DISSERTATIO CVM NVNCIO SIDEREO III

1

PRAGAE — MMVI 12. VIII. — SERIES TERTIA

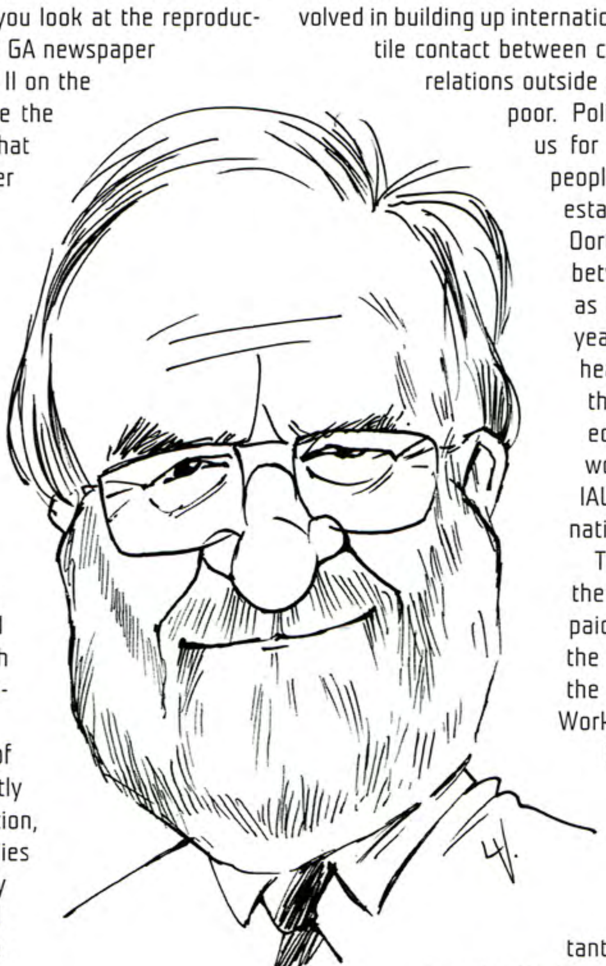
Message From The IAU President

After 39 years the IAU returns to Prague and it is my great pleasure to invite you to attend this XXVI General Assembly which will be taking place from August 14 to 25, 2006. Thirty nine years is only a brief moment in Prague's great astronomical history which reaches back more than 400 years to Tycho Brahe and Johannes Kepler and the era of the Copernican revolution, but it's half the lifetime of the IAU. If you look at the reproductions of stories in the 1967 IAU GA newspaper Dissertatio cum Nuncio Sidereo II on the GA web site you can appreciate the extraordinary developments that have occurred in astronomy over this short period.

Following the now established pattern we will have an extensive scientific programme of Symposia, Joint Discussions and six Special Sessions as well as four Invited Discourses, on essentially all topics of contemporary Astronomy. New features in the Prague GA will be the "hot topics" sessions to capture the excitement of the most recent astronomical activities, and a number of lunch meetings to debate topics of social and cultural importance.

There are now a plethora of astronomical meetings, mostly with international participation, but the IAU General Assemblies are unique in offering not only a large variety of specialised scientific meetings but also the freedom to attend meetings in other fields to gain new perspectives on our science. The General Assembly will also give you the opportunity to meet with astronomers and colleagues from around the world to discuss common interests, to organise cooperative ventures and to renew old friendships.

The IAU was founded in 1919 by the International Research Council, (now ICSU). Its mission "to promote and safeguard the science of astronomy in all its aspects through international cooperation" is little changed since 1919. The language of science binds IAU members, strengthened by a shared vision to better understand the Universe and a love of astronomy. This transcends where you were born and to where you migrate. A few years after the last Prague General Assembly at the IAU 50^{th} anniversary, J. H. Oort said: „Looking over the entire time of my relations with the Union the most important aspects have been in the first place the many personal relations and often friendships which came about through these relations, and, in the second place, having become involved in building up international understanding and fertile contact between countries where sometimes relations outside astronomy were extremely poor. Politicians have rightly envied us for the natural ties between peoples we have been able to establish and conserve." Sadly Oort's comment on relations between countries remains as true today as it was forty years ago but I am greatly heartened by the success of the IAU groups working on education and development world wide as well as the IAU's role in promoting international collaborations.



The IAU depends totally on the contributions (mostly unpaid) of the many people in the Executive, the Divisions, the Commissions and in the Working Groups which are the foundation of all our work.

I wish to thank all my IAU colleagues, and in particular the General Secretary, Oddbjørn Engvold, the Assistant General Secretary, Karel van der Hucht, and our secretarial staff in the Paris Office, Monique Orine who maintains the IAU corporate memory and Claire Vidonne who has designed and brought to fruition much of the new IAU membership data base and website.

An IAU General Assembly makes particularly onerous demands on the astronomers in the host country. We owe a great debt to Jan Palouš and the rest of his team who have invited us to share their historical Prague for this General Assembly of astronomers.

Ron Ekers, IAU President

EDITORIAL

Dissertatio cum Nuncio Sidereo, Series Tertia

When Galileo Galilei published the report about his pioneering astronomical observations in the famous book "Sidereus Nuncius" (Venice, 1610), probably no one was more excited than Johannes Kepler. In the same year he reacted vigorously to Galilei's findings by writing a reply "Dissertatio cum Nuncio Sidereo" (Prague, 1610). Although Kepler was rather poorly treated by his sponsor, Emperor Rudolph II, his stay in the magnificent town of Prague (1600–1612) was extremely fruitful from the astronomical point of view. Thus when Czechoslovakian astronomers were honored to organise the XIIIth IAU General Assembly in Prague in 1967, it was most natural that they choose the title of Kepler's document as the name of the congress newspaper. Eleven issues of Series Secunda of the Dissertatio were published on August 20–31, 1967, and those of our readers who are interested in this 39-year old history are invited to read the scanned copies at the address: ***http://astro.cas.cz/nuncius/***

In #7 of Dissertatio II, I published a note "Longest-Published Periodical Discovered", in which I argued that the journal with the periodicity of 357 years was easily the periodical with the longest period in the world. At the end of the note I wrote "At this moment we cannot say with certainty whether the periodicity of the intervening 357 years is constant or not. More numerous observations of the Dissertatio appearance are urgently needed. Another series of observations should be established circa 2324 A.D."

It never occurred to me that another series of observations in Prague would be a reality after mere 39 years. Thus, I am very pleased to introduce the Series Tertia of Dissertatio to all participants of the $XXVI^{th}$ IAU General Assembly, held again in Prague. Although 39 years seems to be a short time in astronomical time-scales, the changes in our country and in the world are simply amazing. Instead of splicing carbon copies of the manuscripts, we have electronic desktop publishing, we communicate among the editors by WiFi internet and cell phones, and, by the way, we now live in the Czech Republic instead of Czechoslovakia. For the first time in the history of IAU General Assemblies you will be able to read the electronic version of the congress newspaper on the internet (see the web address above) as soon as it is cleared to the printers. Our editorial staff of 16 includes 9 astronomers and 4 journalists, and you are invited to contact any of us when you wish to publish announcements, notes or articles that will be of interest to congress participants. Suggestions, remarks and critique are welcome as well, because this is the only way to have a good and perhaps even at times amusing newspaper.

I am also glad that I can already now answer my own question I posed in August 1967: the period of the Dissertatio is certainly not constant. Actually it is dramatically shrinking, and a simple linear extrapolation shows it would be zero in a few years. Such singularity is artificial, of course, because I neglected relativistic corrections. Obviously, the final period of the Dissertatio cannot be shorter than the period of its circulation on the last stable orbit around the fully degenerate object. However, this solution brings – as is usual in any good science – a new puzzle: what might be the physical nature of the degenerate object that causes such easily observable effect? Of course, one can speculate that this object has something in common with rather stable position of Aurea Praga Astronomica on the globe and high volume density of astronomers during the General Assemblies, moving around the globe on highly eccentric orbit with respect to the Prague standard of rest. Thus, it is very well possible that during close encounters of these massive bodies the total mass of the binary is supercritical with inevitable consequences. However, I am afraid that the physically (and politically) correct answer to this mystery I have to leave to the Editor of Series Quarta of the Dissertatio in too distant future.

Jiří 'George' Grygar

Today's programme: (monday 14/8)

- symposia S235, S236, S237

Memories of IAU

I believe that I am quite a rather peculiar case of IAU craze. I have been attending all General Assemblies since Rome 1952; I am the most ancient survivor of the Executive Committee, having been the first elected Assistant General Secretary, in 1961, at Berkeley, assistant to our dear Donald Sadler, whose imprint on the IAU has been so decisive.

Jean-Claude Pecker

In spite of such a long acquaintance, I have no desire to divorce! The IAU is indeed my second family. And it is a family indeed. The past General Secretaries have been accustomed, since Edith Müller introduced that concept, to be the "son" of their predecessor, the "father" of their successor. So, I am the son of Donald, the father of Luboš, the grand-father of Kees ...(himself father of George, himself father of Edith, mother of Patrick, father of Richard, father of Jean-Pierre, and Derek, and Jacqueline, and Immo, and Johannes, and Hans) and now, the g-g-g-...g father of Oddbjorn, the g-g-g-...g grand-father of Karel... It sounds like the first Book of the Bible!

During the last forty years, the IAU had deeply evolved. The introduction of divisions, in face of the increasing number of members was a factor of coherence. But the meetings of the old commissions, often attended by only a few of their members, keep a perfume of traditional solidity, and devotion to astronomy. The number of adhering national organisations has indeed increased also; and the importance of regional organisations (such as the European ESO) have gained in visibility and efficiency. The multiplication of fascinating symposia on the hot topics of our rapidly evolving science has attracted excellent contributions, and an opening to the whole community on the frontiers of astronomy. I expect still more from the Prague 2006 GA, which has not started yet, at the moment when I write this contribution.

My own memories of the many IAU meetings is, may I say, rather fuzzy. Am I too old? Or were they too rich? I do remember the time when Marteen Schmidt spoke to us about the newly discovered quasars.

I do remember the day when Victor Ambartsumian displayed his broad views on the explosive evolution of everything in the Universe. I do remember the day when I (sorry for putting myself in this list) spoke quite convincingly of the circum-stellar physics, after having been throwing all my slides, in a complete disorder, on the floor of the Grenoble skating rink, and gathering them with the help of Charles (Fehrenbach). I do remember the day when Bob (Williams) spoke to us about the new and fascinating results from the Hubble telescope, and I do remember the fine disputes between one angry Lawrence (Aller) and one still angrier Dick (Thomas) about the departures from LTE.

Unique photo of 9 General Secretaries, courtesy of A. Blaauw: *from left to right the names, and the years in the office in parentheses: Immo Appenzeller (1994–1997), Jean-Claude Pecker (1964–67), Richard West (1982–1985), the late Edith Muller (1976–79), the late Patrick Wayman (1979–1982), Jacqueline Bergeron (1991–1994), Johannes Andersen (1997–2000), Jean-Pierre Swings (1985–1988), Derek McNally (1988-1991), kneeling in the front Adriaan Blaauw (president in 1976–1979).*

Yes, all that and many other memorable events, in a complete disorder, just like my beautiful mesh of circum-stellar slides.

Not all memories are purely scientific! I do remember the day, in Rome 1952, when H. H. Pius the XIIth told us that the Big Bang is indeed nothing but the fiat lux of the Scriptures. After that memorable pontifical speech, Fred Hoyle, Dick Thomas, Evry Schatzman and myself had a fine conversation under the olive trees of the Castel Gandolfo Vatican Observatory, and we reconstructed the Universe. I do remember (1958) the hours we spent dragging Marcel Minnaert out from the Soviet prisons (he was put in jail when taken painting the Moscow landscape, with its ...strategic (!) bridges)! I do remember shaking hands with Mr Eamon de Valera, the charismatic strong man of Ireland (Dublin 1955). I do remember...

I do remember the EC meetings, and the nasty remarks of Martin (Schwarzschild), and the difficult peacemaking achieved by Pol (Swings). I even do remember the EC meetings when I was not any more member of it; the EC met actually twice in my home, on the Atlantic island of Yeu. Instead of the astronomical cooking, which I let my distinguished friends deal with, I had limited myself to the cooking of the chicken! Then, Bengt (Strömgren) of Kees (de Jager) found the ocean water rather warm, but George (Contopoulos) was not of the same advice, nor was Livio (Gratton). And Vaïnu (Bappu) stood very strict, on the coast, looking at these crazy north-Europeans swimming in the freezing water.

I do remember, between and during the GA, the smile of the successive misses IAU. The sweet Nell Splinter, the first Miss IAU, since the time of Piet (Oosterhoff), the charming Dorothy (then Bell) who left IAU to marry Jack Brandt; the spectacles on the forehead of the ironic Arnošt Jappel (the only male miss IAU), the boiling activity of Brigitte (Manning), the quiet efficiency of Monique (Orine). And I should not forget my own devoted secretary for years, notably in Prague 1967, our Geneviève (Drouin).

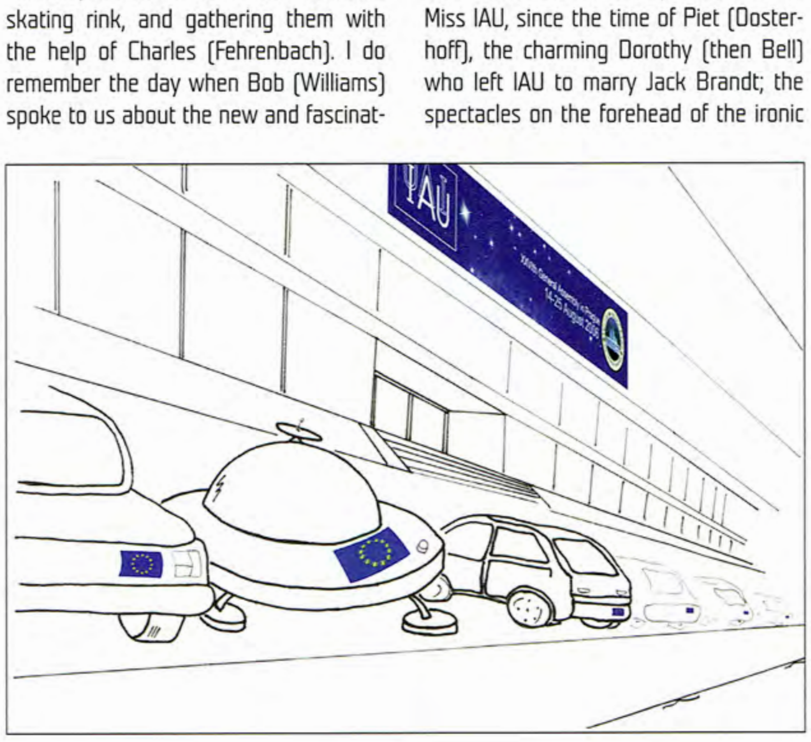
It happened also that I was General Secretary during the first General Assembly held in Prague in 1967.

What a meeting it was! I could not (of course! True, Oddbjorn?) pay too much attention to the science: I had to see that the Resolutions Committee work in a reasonable atmosphere of constructive peace, to see that all commissions have been allocated proper room, to take care of the depressive moods of the girls and boys in the office (please read my contribution to the Nuncius Sidereus II, published then in Prague), to book a table at the "Three Ostriches" restaurant, on the other side of the Charles bridge, to be sure not to miss the splendid show of the "Laterna Magica", to organise the agenda of the Executive Committee, including its "post-agenda", which was to be implemented by Luboš. Etc..., etc...! I do remember the splendid meeting, hosted and addressed by Bohumil Šternberk at Ondřejov at the occasion of the inauguration of the telescope. I do remember the subtle invited discourse by Paul Ledoux, on the internal structure of stars. I do remember the ballroom of place Wenceslas, with its flamboyant Grande Époque decorum, its golden attires, its large mirrors, and its very slippery floor. I danced, I danced, I danced, with the joy of having finished my task... During this wild exercise, Mrs Chalonge, my dancer, lost her diamond ring. It took hours, crawling on the floor, to retrieve this jewel. During that time, my white waistcoat (it was so hot that I had to get rid of it and to put it on some chair) has travelled from one astronomer to another; and it came back with a hundred signatures of old and new friends. I still treasure it!

Altogether 1967 Prague was for me a fruitful meeting and a splendid occasion to collect new friends. It started excellent relations with my Czech colleagues, often also with their family. I am now eager to meet them in every meeting that I can attend to, or at some other occasion. But the best occasion is, undoubtedly, the Prague 2006 GA! Many thanks for organizing it, my friends, and good luck!

My "father" Donald Sadler used to end his letters by the traditional: "With all good wishes, Yours sincerely". I had introduced a pronounceable abbreviation: WAGWYS!

Thus, my friends, WAGWYS!



Why to organize the General Assembly of the IAU?

Jan Palouš
Chair of the National Organizing Committee

The General Assembly of the IAU is a complex event gathering a few thousands of specialists in astronomy, astrophysics and related fields. It might be easier to organize a more topical and smaller meetings, which are frequently also cheaper and more convenient to attend. I do see the following main reasons, why sometimes, in the case of the Czech Republic it is every 39 years that we should decide for such adventurous action.

Why it is adventurous: it needs dedicated people that have to change their way of life for a few years. Also it needs some financial background, since all the financial risk is taken by the local organizers, and, after some rather early instants, it is impossible to stop the action. But, I can confess that I had a good experience with it, since I encountered good friends, who were all the time very helpful, able to solve all the problems. In a way, I can compare this experience to another one with the floods in Prague in 2002. I do remember this heavy struggle with the disaster coming from the river Vltava, however, it was a very nice period in my life, since I encountered such effective help from all the friends.

Why organize the GA IAU? First, it builds our community and enables to meet colleagues and friends from other disciplines in today's very specialized branches. The trends for fragmentation and isolation into small circles of separate disciplines are always working. This is the easy way and we are obliged to try to surpass our own limits to resort to broader contexts. The GA IAU may be the opportunity for such excursions to larger spaces of nearby disciplines. We are offered an opportunity of listening to excellent talks of other disciplines, through which we may try to understand their vocabulary and import their wisdom to our fields. In this way, we build a broader community, which is also stronger and has more inertia compared to very specific and smaller fields.

Another reason is the outreach and relation to the broader public. Astronomy and astrophysics are not suffering from isolation, but certainly we are obliged to broadcast the new discoveries to the rest of the society and to provide to the public our knowledge. Being astronomers, we are in a rather privileged position, like ambassadors for the Universe, having the duty to transmit the space coordinates to others, who are with us floating in space.

The next reason for the conference is that we need to address the politicians and important individuals and convince them that a very important change in our perception of the Universe is coming. This golden age of astronomy is coming back after more than 400 years since Tycho and Kepler here in Prague changed the view on the Solar system. Today, we are addressing that broader volume covering the space between us and the big bang.

Finally, the GA IAU influences the local development of the discipline. It is a meeting of the world-wide astronomy and astrophysics with the local fields. We hope that the Czech astronomers will benefit from this encounter and become a valuable part of the field. Here, I can mention that the move of the Czech Republic to enter ESO already started and I hope it will soon successfully finish.

Finally, I can recommend to everyone to organize the General Assembly of the IAU. It is a very nice experience, which you would never forget.

Does global climate change have an astronomical cause?

Sami K. Solanki, Natalie A. Krivova and M. Schüssler
Max-Planck-Institut für Sonnensystemforschung, Katlenburg-Lindau, Germany

Since the end of the last ice age around 11,500 years ago, i.e. during the Holocene, the global temperature has shown fluctuations that are smaller than the strong and steep rise over the last century. It is generally agreed that the recent warming is mainly driven by the release of greenhouse gases, foremost among them carbon dioxide, into the Earth's atmosphere by the burning of fossil fuels. However, determining the exact level of warming due to man-made greenhouse gases requires a good understanding of the natural causes of climate change and the magnitude of their influence. These natural causes are partly to be found in the climate system itself (which includes the oceans and the land surfaces, including the vegetation, which undergo complicated interactions with the atmosphere and the climate), partly they are produced by the release of aerosols and dust from the Earth's interior through volcanoes, and partly they lie outside the Earth and are thus astronomical in nature.

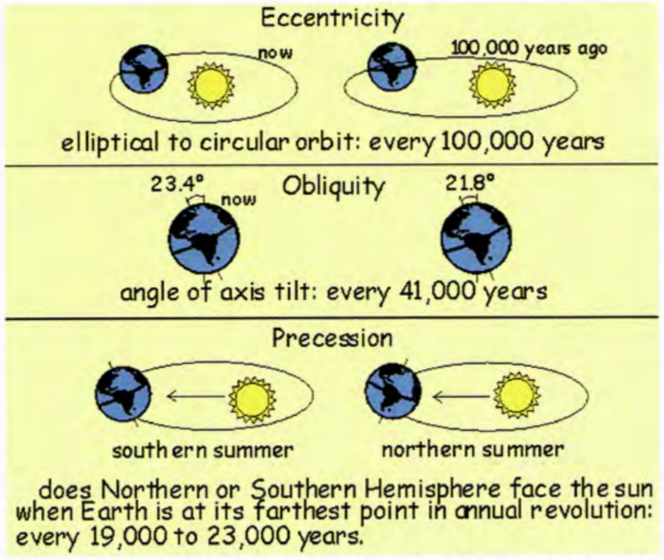


Figure 1: There are three parameters of Earth's orbit that change with time and cause climate variations in Milankovitch cycles: eccentricity, tilt and precession.
Credit: Instructional Technology Group, University of Nebraska-Lincoln

There are a variety of astronomical effects that can influence the Earth's climate. The most obvious are related to the Sun, which is the source of practically all external energy input into the climate system. The solar influence can be threefold:

1) through changes in the Earth's orbital parameters and in the obliquity of its rotations axis, which modulate the amount of solar energy reaching different parts of the Earth,
2) through changes in the Sun's radiative output itself,
3) through the solar influence on galactic cosmic rays.

The first of these is considered to be the prime cause of the pattern of the ice ages and the interglacial warm periods, which has dominated longer term climate variations over the past few million years. Different parameters of the Earth's orbit vary at periods ranging from about 20,000 years to roughly 100,000 years.

Although the precession of the Earth's rotation axis and the evolution of the obliquity and orbital eccentricity can cause large climate changes, all these processes run so slowly that they are unlikely to play a role on a time scale of centuries.

The second is generally considered to be the main cause of the contribution of the Sun to global climate change and will be described in greater detail below.

The third refers to the fact that the flux of galactic cosmic rays varies roughly inversely with the level of solar magnetic activity. The fraction of the Sun's magnetic field spreading out to the edge of the solar system and the solar wind impede the propagation of the charged galactic cosmic ray particles into the inner solar system. The more active the Sun, i. e. the stronger its interplanetary magnetic field, the smaller is the cosmic ray flux reaching the Earth. The connection with climate was drawn by Danish colleagues from the correlation between the cosmic ray flux and global cloud cover.

The variable Sun

Ever since sunspots were discovered around 1611, they have been a subject of intense study. One of the properties of particular fascination was the change in the number of sunspots with time. The number of sunspots rises and falls over a solar cycle of roughly an 11-year duration. Along with the sunspots almost every observable feature on the Sun changes. For example, the X-ray brightness and structure of the corona change dramatically, as does the frequency of flares and coronal mass ejections (CMEs), which influence the upper atmosphere and the Earth's space environment and adversely affect sensitive technical systems exposed to them. All these changes are driven by a single entity, the magnetic field. The large-scale magnetic field of the Sun is produced by a dynamo mechanism acting deep within the solar convection zone. At the surface of the Sun the magnetic field shows up as dark sunspots and bright faculae, composed of many small bright points. It is reasonable to suppose that these features of different brightness all affect the solar irradiance (i. e. the Sun's radiative flux).

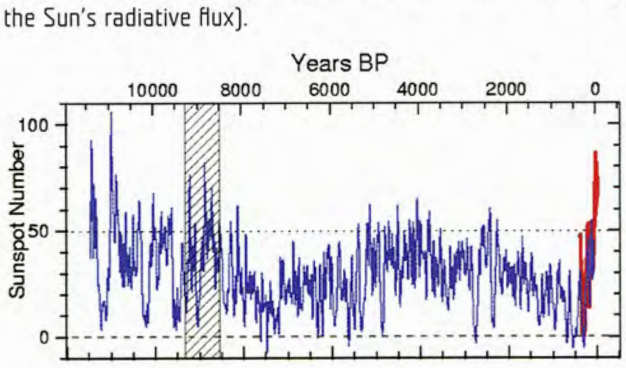


Figure 2: Cycle-averaged sunspot number reconstructed from ^{14}C over the last 11,400 years (blue line), combined with the directly observed sunspot number since 1610 (red line).

The Sun's varying irradiance

Since 1978 we know that the Sun is a variable star. From that time on, spacecraft carrying radiometers have recorded the solar irradiance almost without interruption. Besides the strong short-term variability there is also a clear solar cycle variation. The Sun is brightest at times of high solar activity (many dark sunspots, many bright faculae, bright and complex corona), but the variation in the total irradiance over the solar cycle is only 0.1 %. Hence, although the Sun is a variable star, it is changing only very slightly on the timescales on which direct measurements exist.

What causes the irradiance variations? In the layers immediately below the solar surface, the outward energy flux is carried almost completely by convection. A strong vertical magnetic field hinders the development of overturning convection and hence strongly impedes the convective energy transport. As a result, sunspots appear dark. An important finding was that the energy blocked from reaching the surface does not emerge in a bright ring around that sunspot, but rather is distributed over the whole convection convection zone and emerges only over a Kelvin-Helmholtz timescale of 10^5 years, which is very long compared to the lifetime of the sunspot. Consequently, while a sunspot is present on the solar surface, the Sun should be slightly darker.

For the smaller and numerous magnetic features forming faculae the suppression of convection by the field is more than offset by the influx of radiative energy from the sides. Faculae are places where the solar surface level is depressed (due to the pressure of the magnetic field), so that the solar surface area is increased. Hence more radiation escapes than through the normal "quiet" parts of the solar surface. Again, a significant part of this excess energy flux comes from throughout the solar convection zone and not just from the immediate vicinity of the magnetic element.

In summary, the irradiance change over the solar cycle should be explained by the energy blocked by sunspots and the excess energy released by faculae. Models based on this assumption have been very successful in reproducing the measured irradiance variations.

The Sun in time: past solar activity and irradiance

The solar rotation period of 27–30 days and the solar activity cycle period of roughly 11 years have dominated the temporal behaviour of solar activity in recent decades. If we consider the 17th century, however, we find that the number of sunspots was extremely low for nearly 70 years and a cyclic behaviour was far from clear. This Maunder minimum period is the best studied example of a "Grand Minimum" of solar activity, the only one detected in directly observed solar data. It is particularly intriguing because it falls together with the climax of the 'little ice age', a time of bitter cold and suffering in Europe. This gives rise to the question whether further such periods of low solar activity occur and what do they mean for the Sun's irradiance?

This question can be addressed by using proxies of solar activity that allow us to reach further back in time than sunspot observations. The most widely used such proxies are cosmogenic isotopes, in particular ^{14}C and ^{10}Be. These isotopes are formed in the Earth's atmosphere when high-energy galactic cosmic rays (mainly protons) interact with constituents of the Earth's atmosphere, in particular with nitrogen atoms. After their formation the isotopes are transported in the Earth's atmosphere (and in the case of ^{14}C through the carbon cycle, which includes the oceans and the biosphere) until they are deposited in a natural archive (tree trunks in the case of ^{14}C and the Greenland or Antarctic ice sheets in the case of ^{10}Be).

With the help of physical models, it has become possible to reconstruct the sunspot number from such data. Fig. 2 shows a reconstruction covering the last 11,400 years (blue curve), based upon a ^{14}C record obtained from (reliably dated) tree rings. The red curve represents the sunspot number obtained from telescopic observations. Note that the plotted data are averaged over 10 years. Multiple Grand Minima, extended intervals of negligible sunspot number, are visible in this period of time. Another striking feature is that we are currently in a period of exceptionally high solar activity. Over the past 11,400 years (i.e. throughout the Holocene) the Sun spent only 2–3 % of the time in a high state of activity similar to the present one.

A critical quantity is the amount by which the Sun's irradiance changes between a Grand Minimum (such as the Maunder minimum) and a Grand Maximum, i.e. a time of very strong cycles, such as the last 50 years. Initially, this estimate was made using the emission in the Ca II, H and K lines from cool stars. Early results suggested that field stars in a Grand Minimum had considerably lower emission than stars in a cycling state, such as the present-day Sun. However, recent investigations have not supported this result, so that the difference between the Ca, H and K emission between the Sun and other stars cannot be used to estimate the difference in the irradiance level.

The more recent estimates of the change in the level of irradiance have been based on simple models of the evolution of the magnetic field. These suggest that the Sun has brightened by roughly 0.1 % (cycle avgd.) since the Maunder minimum. It is important to note, however, that the brightening is not homogeneous over the spectrum, with the relative brightening increasing rapidly towards shorter wavelengths.

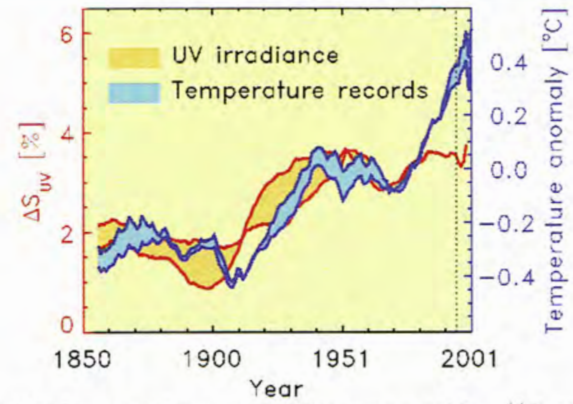


Figure 3: Cycle-averaged sunspot number reconstructed from ^{14}C over the last 11,400 years (blue line), combined with the directly observed sunspot number since 1610 (red line).

Comparison with climate

When attempting to determine the impact of solar variability on climate we need to first compare the trends in solar irradiance with trends in the global temperature on Earth. Fig. 3 shows two reconstructions of the UV irradiance of the Sun vs. time over approximately the last 150 year (red curves). They are compared with the temperature on Earth (global average and average over the northern hemisphere; blue curves). All curves have been smoothed over 11 years in order to remove the influence of individual solar cycles and the often large year-to-year excursions in atmospheric temperatures. Prior to approximately 1980 the curves run roughly in parallel, with solar irradiance showing a tendency to run slightly ahead of climate. After 1980, however, a clear divergence between the two quantities is seen. Whereas Earth has continued to warm at a rapid rate, solar radiative output has remained nearly constant when averaged over the solar cycle.

The processes by which the variable solar input affects climate change are not yet well understood. Since solar radiation is the principal source of energy for the Earth, it appears natural to expect that any variation in the solar net radiative output will affect the energy balance of the Earth's surface and atmosphere. On the other hand, the solar UV irradiance varies by a far larger relative amount (10 to 1000 times depending on the wavelength) than the solar total irradiance, and such variations have a pronounced effect on the chemistry of the Earth's upper atmosphere, in particular the balance between ozone production and destruction.

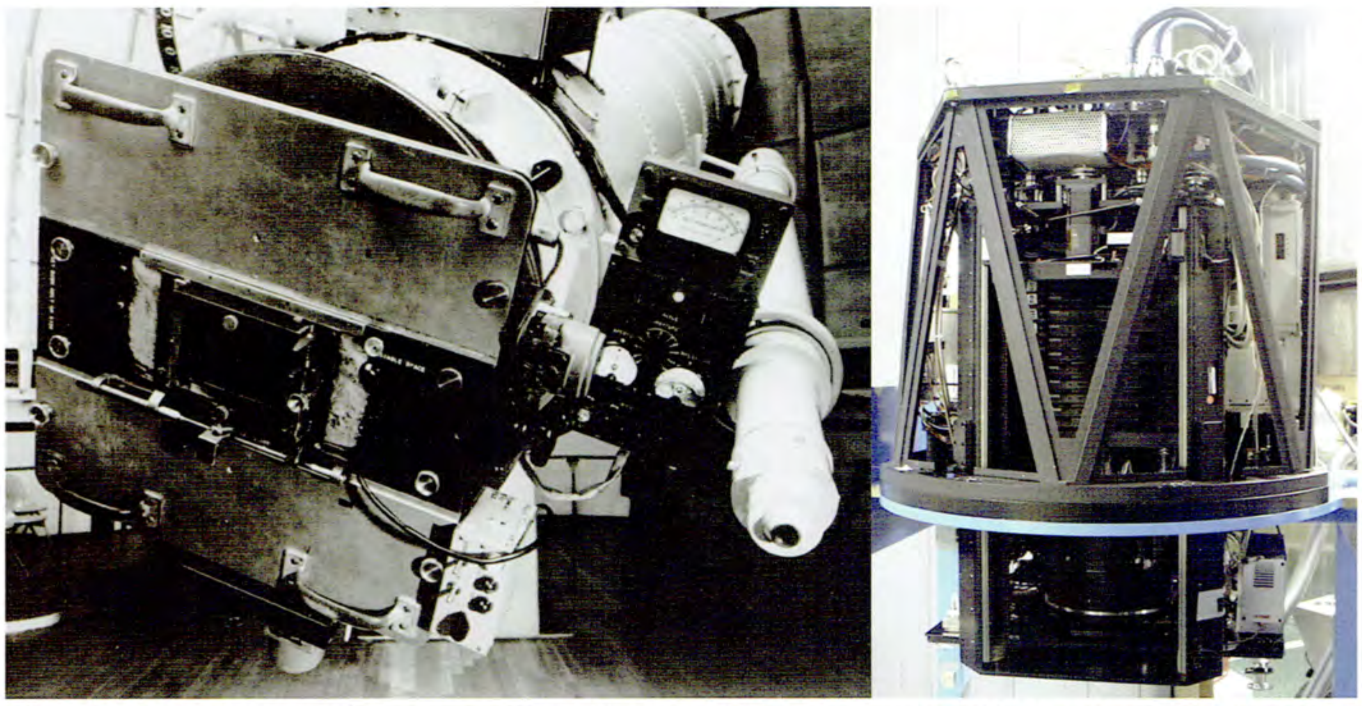
The difficulty is that the solar signal is not just a fluctuation entering a passive system. The complex interrelated system of the Earth's atmosphere, land and oceans can transfer, smooth off, amplify or depress this signal. Solar energy is deposited and redistributed from the thermosphere down to the troposphere and the Earth's surface, and a number of different mechanisms are involved in the process: direct absorption of solar radiation, generation and modification of chemically active substances and planetary waves. This all makes the solar-climate relationship highly nonlinear, such that the dynamic and physical feedbacks of the Earth's system need to be considered, in order to reliably assess the magnitude and mechanisms of solar influence on climate.

Conclusions

The Sun is now recognized to be a (weakly) variable star. Since it is the major source of external energy input, this clearly has implications for the climate on Earth. Correlation analyses suggest that prior to the most recent very rapid rise in temperature the Sun likely had a discernable influence on climate. The magnitude of the influence of the Sun's variability is not clearly known, however, and considerable further work needs to be done both in order to improve the reconstruction of the Sun's brightness in the past and to work out the most promising mechanisms for transferring fluctuations in the Sun's output into the climate system and producing climate changes. It is completely clear, however, that in the past 25 years the rapid rise in global temperatures has not been driven by solar variability. ❒

Did you know that the year 2007 was announced as the International Heliophysical Year (IHY)?

In 1957 a program of international research, inspired by the International Polar Years of 1882 and 1932, was organized as the International Geophysical Year (IGY) to study global phenomena of the Earth and geospace. The IGY involved about 60,000 scientists from 66 nations, working at thousands of stations, from pole to pole to obtain simultaneous, global observations on Earth and in space. The IHY continues the tradition of this project, it has three primary objectives: The advance of our understanding of the fundamental heliophysical processes that connect the Sun, the Earth, and a heliosphere, continuing the tradition of international research as the legacy of the International Geophysical Year and the demonstration of the relevance and significance of space and earth science to the world and the mankind. There are many events and scientific projects coming from the IHY. Do you want to be involved? Just visit **http://ihy2007.org**.



Left: *camera for photographic plates formerly used on U.S. Naval Observatory for double-star observations (Credit: F. J. Josties),* ***right:*** *Suprime-Cam, one of the world's biggest CCDs residing in the primary focus of the Subaru telescope (Credit: National Astronomical Observatory of Japan)*

O'Brave New World

The IAU has very rarely repeated a venue for the General Assembly and the event invites a moment of reflection to consider, as in our lives, what has changed. Our world, as astrophysicists, is now so different – it's a striking demonstration of the vitality of our science that so many of the joint discussions and symposia this year will be dealing with almost normal science in entire areas of astronomical research that had not yet begun forty years ago.

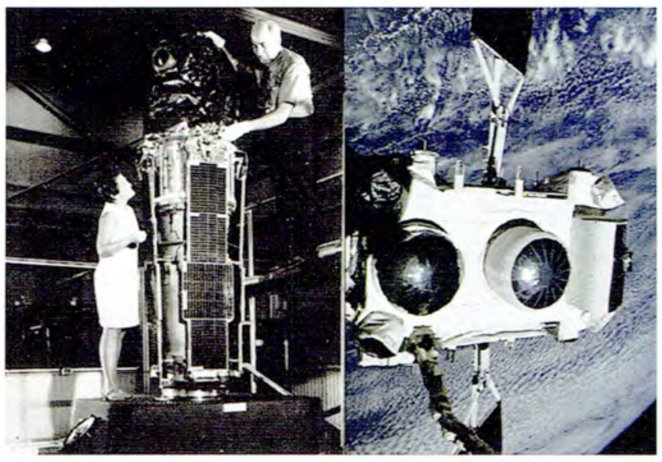
Steve Shore, Università di Pisa, Italy

We were then in the era of photographic plates and photomultipliers. Now we have mosaicked CCD arrays and MAMA detectors. At optical wavelengths the deepest surveys are more than two orders of magnitude fainter now than 40 years ago. Multiwavelength approaches to the study of cosmic objects had barely started. At the time of the last Prague GA, there were still only glimpses of the spectrum beyond the terrestrial optical and near infrared windows. Sounding rockets and small orbital packages had been used, but there were still no high resolution images in any wavelength band and few high resolution spectra. This changed dramatically almost immediately after the meeting. By 1968, all-sky survey satellites had been launched and in the UV (OAO-2) and X-ray (Uhuru) a new era had started. The catalog of subsequent missions is well known. It's always striking to see the number of coincidences that happened in discoveries within a short time. In the same year, γ-ray bursts and pulsars were first observed, neither sought for specifically by the instruments with which they were discovered. We have now improved the spectral and spatial resolution throughout the electromagnetic spectrum, even at TeV energies sources can be located using Cerenkov telescopes to within 0.1° and imaging arrays are also available for the particle spectrum at the highest (PeV and above) energies. The span of energy routinely studied by astronomers now spans the range 0.1 meV to >PeV and coordinated multiwavelength campaigns have become routine. This is reflected in changes in the sociology of the field. In the 1960s, archives of data were hard to access, groups were more closed, and consortia were smaller. We are now completely immersed in the age of *big science*, which in astrophysics had not yet begun in the late 1960s.

In 1967 the largest aperture optical telescope was 5 meters, now there are realistic plans for instruments more than six times as large and 4-meter telescopes are thought of as relatively small. We've moved from photographic plates and photomultipliers to massive arrays of CCDs. Neutrino astronomy was just starting in the attempt to detect emission from the Sun the current and future instruments now use the Earth as a converter to detect cosmic sources.

We astronomers left the Earth soon after the meeting, the age of space astrophysics really began immediately after the last Prague GA with an amazing series of satellites such as Uhuru (1968), OAO-2 (1968), OAO-3 *Copernicus* (1973), *Einstein* (1973), IUE (1978), COBE (1989), HST and CGRO (1990); the list should be much longer and, let us hope, will continue to grow for future meetings. The infrared sky was just beginning to be explored, the first surveys were just starting. Now we're in the third generation of satellites. Solar monitoring satellites cover the particle as well as electromagnetic spectrum providing synoptic coverage of solar activity. At this moment, high resolution imaging and spectroscopic instruments are available completely across the electromagnetic spectrum, and the archives these satellites are generating will remain our permanent heritage. We have gone from data starvation to data saturation!

At centimeter wavelengths, there were no aperture synthesis arrays; VLBI hadn't been tried. Now all this is almost routine. Consider the difference now that the VLA has been operating for almost three decades, the Australia Array is nearly a decade old, and intermediate and intercontinental VLBI is almost routine. There are long-operating millimeter arrays and more under construction, and large scale low frequency interferometry is beginning. Michelson had pioneered optical interferometry for high resolution stellar observations in the 1920s for extreme objects (e.g. α Ori). But a few years after the Prague GA, new instruments for intensity and speckle interferometry were introduced that have now flowered into, for instance, the VLT, Keck, Mark III, CHARA, Iota, and other arrays that almost routinely study the surface structure of relatively normal stars. Gravitatinal waves were an interesting



Left: *Engineers checking the UHURU satelite (1968),* ***right:*** *deployment of the CGRO (1990). Credit: NASA*

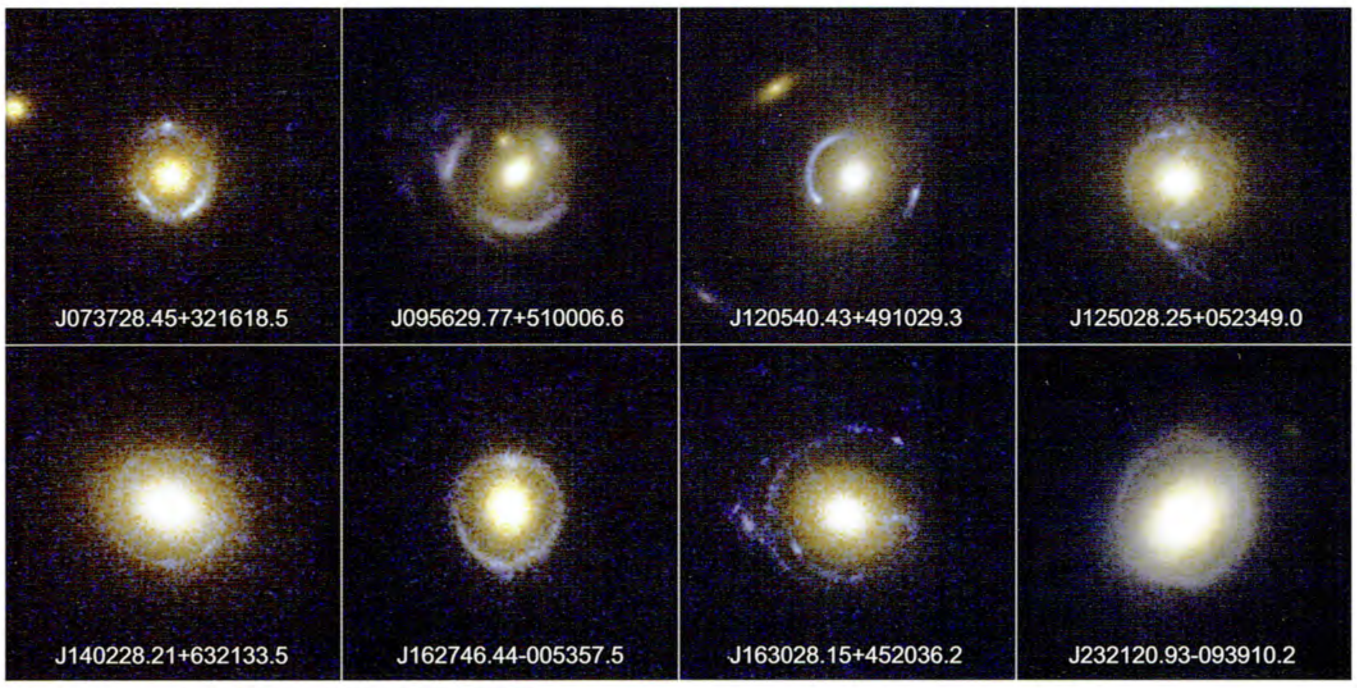
possibility, now multiple interferometric detectors are operating simultaneously in the northern and southern hemispheres and on four continents. Neutrino observatories of all kinds are either operating or under construction.

Try, those of you who were there, to remember the world without the ADS and arXiv, without SIMBAD and the Virtual Observatory, without access to archival data centers from your desk. We have passed from the era of pigeon-hole delivered computer output in centralized computing facilities and from punch cards to the era of massively parallel calculations with well tested and widely used publicly available codes. Hydrodynamical and radiative transfer simulations employ a broad spectrum of algorithms, virtually none of which existed 40 years ago, for instance smooth particle hydrodynamics, the workhorse of large scale cosmological simulations. Even

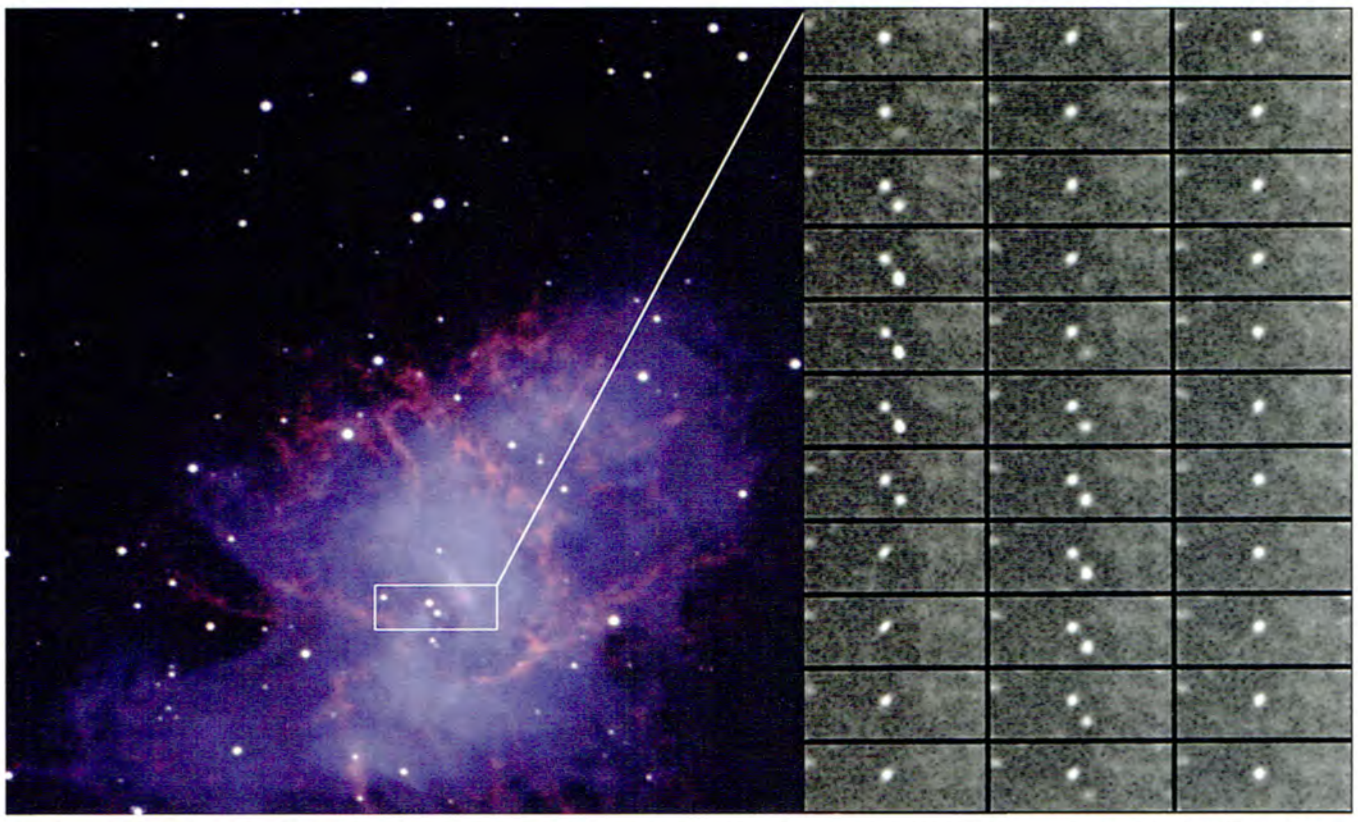
Aerial view of the Very Large Array. Credit: Dave Finley, National Radio Astronomy Observatory and Associated Universities, Inc.

the first N-body calculations were just starting and then for relatively few objects. A quick glance at IAU Colloquium 10 shows how difficult progress was in the computing environment of the late '60s and yet how much progress was made using clever approximations.

Extragalactic astronomy and cosmology were just beginning as modern fields of study. Quasars had been discovered but their association with galaxies was far from clear, and they were still thought to be only radio sources. The general class of active galaxies was yet unrecognized, the link between nuclear activity and relativistic objects was still merely hypothetical, and nothing was known about the origin of the core-halo structure that was an emerging phenomenon among these sources. Gravitational lenses were theoretical curiosities, now they constrain the mass of clusters. The cosmic background



A gallery of Einstein rings, the most elegant manifestations of gravitational lensing, when two galaxies are almost perfectly aligned, one behind the other. Credit: NASA, ESA, and the SLACS Survey team: A. Bolton (Harvard/ Smithsonian), S. Burles (MIT), L. Koopmans (Kapteyn), T. Treu (UCSB), and L. Moustakas (JPL/Caltech)



Visual variability of the Crab pulsar is shown on a series of pictures, taken accumulatively during many cycles of the pulsar. Credit: NOAO/AURA/NSF.

radiation had been observed and its temperature measured but no structure information would be available for a long time and it was far from certain that the spectrum was truly Planckian. There were still debates about the initial conditions for the universe (cold vs. hot start), no clear connection with star formation and still a shaky – though very hard-won – grasp of the basic cosmic parameters. The importance of evolutionary corrections for galactic properties had not been well explored; stellar evolutionary calculations were just emerging from large scale numerical investigations. It is significant to note that the meeting had discussions about whether the universe had a cold or hot start, the Big Bang was still only an alternative among several choices for cosmology.

During the meeting, the antenna array that detected the first pulsar signals was still under construction. A mere three months after the GA, CP 1919+21 was discovered – announced a year after the Prague GA – and the era of pulsar astronomy began. Soon afterward pulsars were found in association with supernova remnants, closing the theoretical circle after thirty years, and their spindown and glitching behavior, optical emission, and pulse stability and variability were all soon identified. But in 1967, these were still theoretical. It is one of the triumphs of astrophysical theory that so many of their observed properties were either predicted or quickly understood in general terms.

In stellar physics, dynamo cycles had not yet been detected although there were many indications of magnetic processes on late-type stars. Stellar atmospheres computations were difficult with only continuum opacities; now they routinely include line opacities for millions of transitions. The first compilations of stellar abundances were just beginning at the last Prague meeting. It had only been a decade since the B^2FH paper established the vocabulary of the field. Now pre-solar grains have been separated in meteoritic samples and constrain stellar and explosive nucleosynthesis models. The chemical history of the Galaxy, and extragalactic systems, are boundary conditions for theoretical modeling. Radiation hydrodynamic computations span scales from planetary atmospheres and accretion disks to cosmological simulations. Protostars could only be hypothesized, now we are debating the origin of their disks and outflows and their effects of the molecular clouds in which they are born.

Supernovae have become "standard candles" for cosmological measurements – like 1994D in NGC 4526 on this Hubble image. Credit: NASA, ESA, The Hubble Key Project Team, and The High-Z Supernova Search Team

Barnard's star was debated as a possible planetary system at the last Prague meeting but we knew with certainty only one planetary system, our own, and that relatively inadequately. The interplanetary medium in the near Earth environment was being explored, orbiting solar observatories had begun to study the Sun and the interplanetary medium, the origin of the solar wind and its dynamics had been clarified. Crash-landers and orbital probes had reached the Moon, providing the first high resolution imaging of the surface and brief glimpses

Martian surface as seen from Mariner 6. Credit: NASA

from near encounters of Mars and Venus were available but planetary orbital missions were still to come. We now know more than 200 *extrasolar* planets, many better than we knew our own in 1967, and planetary science is no longer provincial – astrobiology is an expanding, vital, multi-disciplinary field of research and no longer the stuff of science fiction.

High energy gamma ray phenomena meant observations from sounding rockets, Cerenkov observatories were an as yet unexploited technique. Cosmic ray physics was not a central area for the meeting. How this has changed, with even a new subdiscipline, *astroparticle physics*, having emerged to integrate the very diverse phenomena and techniques developed by astrophysicists and the high energy particle physics community, who have begun using the universe as a grand scale accelerator to move beyond *their* energy window. The Vela series had not yet detected the first Gamma Ray Bursts, SNe Ia were not yet standard candles. Most of the cosmological distance calibrators had yet to be discovered. There was a missing mass problem for the Galactic disk and for clusters of galaxies but there was as yet no evidence from direct dynamic measurements of galactic rotation curves that dark halos must exist.

The interstellar medium became a much more complex, interesting place immediately after the last GA in Prague. Although OH masers had been detected before 1967, they were still few in number and poorly characterized. A theory was lacking. Formaldehyde was detected in absorption a couple of years later, providing a view of the coldest material, and interstellar masers were a new phenomenon that ultimately would provide mass determinations for the central engines in AGNs. Not yet detected in *our* interstellar medium at the last GA, carbon monoxide emission is now routinely observable from lensed galaxies at high redshift. Indeed lensing itself was not yet known, now it constrains theoretical cosmological models and probes the mass distributions of galaxy clusters.

And finally, a frightening statistic: in 1967, there were about 4000 published refereed papers in all astronomical journals, last year there were over 5 times that number. *Astronomy and Astrophysics* was founded as a European journal.

This list is far from complete and I'm certain everyone at this meeting will have areas to include, discoveries to highlight, memories to relate, and projects to anticipate. That's what such meetings as this are for. With the state of research budgets, of the world political situation, it may be tempting to "compare the age in which their lot has fallen with a golden age which exists only in imagination..." (Lord MacCaulay). But I suspect we will feel after this meeting far more in agreement with Aldous Huxley who, just 50 years ago, wrote "We may not appreciate the fact; but a fact nevertheless it remains: we are living in a Golden Age." ❐

An Astronomers' Data Manifesto

Ray Norris, CSIRO ATNF, Australia

When you look up an object in NED or Simbad, you're probably seeing only about half the data published in the journals. That's not the fault of the data centres, who do a magnificent job under enormous pressure. Nor is it the fault of the journals, most of whom would happily support a system to overcome this. It's because we, the astronomical community, have not got together to agree on what we want, or how to achieve it.

And did you know that a few years ago a war was fought on our behalf to oppose some daft international legislation which would have wrapped all our existing public-domain databases (like ADS, CDS, and NED) in a morass of legal red tape, making them illegal or inoperative? Neither did I. But because of a few effective and public-spirited individuals in ICSU and CODATA, we got to keep our databases. But let that be a warning – we'd better raise our game in data management, or we might lose what we've got.

Hence the following "Astronomers' Data Manifesto":

We, the global community of astronomy, aspire to the following guidelines for managing astronomical data, believing that they would maximise the rate and cost-effectiveness of scientific discovery. We do not underestimate the challenge, but believe that these goals are achievable if astronomers, observatories, journals, data centres, and the Virtual Observatory Alliance work together to overcome the hurdles.

1. All significant tables, images, and spectra published in journals should appear in astronomical data centres.
2. All data obtained with publicly-funded observatories should, after appropriate proprietary periods, be placed in the public domain.
3. In any new major astronomical construction project, the data processing, storage, migration, and management requirements should be built in at an early stage of the project plan, and costed along with other parts of the project.
4. Astronomers in all countries should have the same access to astronomical data and information.
5. Legacy astronomical data can be valuable, and high-priority legacy data should be preserved and stored in digital form in the data centres.
6. The IAU should work with other international organisations to achieve our common goals and learn from our colleagues in other fields.

Is this a pipe-dream? I think not: technical and funding issues are ever-present, but can be overcome, provided we have the agreement and will of the astronomical community. Join us at Special Session SPS6: "Astronomical Data Management" on the afternoon of Tuesday August 22, right after the Virtual Observatory Special Session. And you can join in more specialised discussion at the meetings of the Working Group for Astronomical Data (WGAD) on the afternoon of Wednesday 16 August. See you there! ❐

Proposals to change the IAU statutes and bye-laws

The IAU Executive Committee is submitting some changes to the IAU Statutes and Bye-Laws for the vote of the National Member Representatives at the first session of the XXVIth IAU General Assembly. Compared to the current Statutes and Bye-Laws the changes are shown (below) in bold italic letters, either underlined (for additions) or striked out (for deletion).

Oddbjørn Engvold, IAU General Secretary

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Proposal For Modification Of Statutes

For consideration at GA XXVI

I. Objective

1. The International Astronomical Union (referred to as the Union) is an international non-governmental organisation. Its objective is to promote the science of astronomy in all its aspects.

II. Domicile And International Relations

2. The legal domicile of the Union is Paris.

3. The Union adheres to, and co-operates with the body of international scientific organisations through ICSU: The International Council for Science. It supports and applies the policies on the Freedom, Responsibility, and Ethics in the Conduct of Science defined by ICSU.

III. Composition Of The Union

4. The Union is composed of:
a. National Members (adhering organisations)
b. Individual Members (adhering persons)

IV. National Members

5. An organisation representing a national professional astronomical community, desiring to promote its participation in international astronomy and supporting the objective of the Union, may adhere to the Union as a National Member. Exceptionally, a National Member may represent the community in the territory of more than one nation, provided that no part of that community is represented by another National Member.

6. An organisation desiring to join the Union as a National Member while developing professional astronomy in the community it represents may do so on an interim basis, on the same conditions as above, for a period of up to nine years. After that time, it will either become a National Member on a permanent basis, or its membership in the Union will terminate.

7. A National Member is admitted to the Union on a permanent or interim basis by the General Assembly. It may resign from the Union by so informing the General Secretary, in writing.

8. A National Member may be either:
a. the organisation by which scientists of the corresponding nation or territory adhere to ICSU or:
b. an appropriate National Society or Committee for Astronomy, or:
c. an appropriate institution of higher learning.

9. The adherence of a National Member is suspended if its dues have not been paid for five years; it resumes, upon the approval of the Executive Committee, when the arrears have been paid. After five years of suspension of a National Member, the Executive Committee may recommend to the General Assembly to terminate the membership.

10. A National Member is admitted to the Union in one of the categories specified in the Bye-Laws.

V. Individual Members

11. A professional scientist who is active in some branch of astronomy may be admitted to the Union by the Executive Committee as an Individual Member. An Individual Member may resign from the Union by so informing the General Secretary, in writing.

VI. Governance

12 The governing bodies of the Union are:
a. The General Assembly;
b. The Executive Committee; and
c. The Officers.

VII. General Assembly

13. The General Assembly consists of the National Members and of Individual Members. The General Assembly determines the overall policy of the Union.

13.a. The General Assembly approves the Statutes of the Union, including any changes therein.

13.b. The General Assembly approves Bye-Laws specifying the Rules of Procedure to be used in applying the Statutes.

13.c. The General Assembly elects an Executive Committee to implement its decisions and to direct the affairs of the Union between successive ordinary meetings of the General Assembly. The Executive Committee reports to the General Assembly.

13.d. The General Assembly appoints a Finance Committee, consisting of one representative of each National Member having the right to vote on budgetary matters according to Article 14.a., to advise it on the approval of the budget and accounts of the Union. The General Assembly also appoints a Finance Sub-Committee to advise the Executive Committee on its behalf on budgetary matters between General Assemblies.

13.e. The General Assembly appoints a Special Nominating Committee to prepare a suitable slate of candidates for election to the incoming Executive Committee.

13.f. The General Assembly appoints a Nominating Committee to advise the Executive Committee on the admission of Individual Members.

14. Voting at the General Assembly ***on issues of a primarily scientific nature, as determined by the Executive Committee, is by Individual Members. Voting on all other matters*** is by National Member. Each National Member authorises a representative to vote on its behalf.

14.a. On questions involving the budget of the Union, the number of votes for each National Member is one greater than the number of its category, referred to in article 10. National Members with interim status, or which have not paid their dues for years preceding that of the General Assembly, may not participate in the voting.

14.b. On questions concerning the administration of the Union, but not involving its budget, each National Member has one vote, under the same condition of payment of dues as in 14.a.

14.c. National Members may vote by correspondence on questions concerning the agenda for the General Assembly.

14.d. A vote is valid only if at least two thirds of the National Members having the right to vote by virtue of article 14.a. participate in it.

15. The decisions of the General Assembly are taken by an absolute majority of the votes cast. However, a decision to change the Statutes can only be taken with the approval of at least two thirds of the votes of all National Members having the right to vote by virtue of article 14.a. Where there is an equal division of votes, the President determines the issue.

16. Changes in the Statutes or Bye-Laws can only be considered by the General Assembly if a specific proposal has been duly submitted to the National Members and placed on the Agenda of the General Assembly by the procedure and deadlines specified in the Bye-Laws.

VIII. Executive Committee

17. The Executive Committee consists of the President of the Union, the President-Elect, six Vice- Presidents, the General Secretary, and the Assistant General Secretary, elected by the General Assembly on the proposal of the Special Nominating Committee.

IX. Officers

18. The Officers of the Union are the President, the General Secretary, the President-Elect, and the Assistant General Secretary. The Officers decide short-term policy issues within the general policies of the Union as decided by the General Assembly and interpreted by the Executive Committee.

X. Scientific Divisions

19. As an effective means to promote progress in the main areas of astronomy, the scientific work of the Union is structured through its Scientific Divisions. Each Division covers a broad, well-defined area of astronomical science, or deals with international matters of an interdisciplinary nature. As far as practicable, Divisions should include comparable fractions of the Individual Members of the Union.

20. Divisions are created or terminated by the General Assembly on the recommendation of the Executive Committee. The activities of a Division are organised by an Organising Committee chaired by a Division President. The Division President and a Vice-President are elected by the General Assembly on the proposal of the Executive Committee, and are ex officio members of the Organising Committee.

XI. Scientific Commissions

21. Within Divisions, the scientific activities in well-defined disciplines within the subject matter of the Division may be organised through scientific Commissions. In special cases, a Commission may cover a subject common to two or more Divisions and then becomes a Commission of all these Divisions.

22. Commissions are created or terminated by the Executive Committee upon the recommendation of the Organising Committee(s) of the Division(s) desiring to create or terminate them. The activities of a Commission are organised by an Organising Committee chaired by a Commission President. The Commission President and a Vice-President are appointed by the Organising Committee(s) of the corresponding Division(s) upon the proposal of the Organising Committee of the Commission.

XII. Budget And Dues

23.a. For each ordinary General Assembly the Executive Committee prepares a budget proposal covering the period to the next ordinary General Assembly, together with the accounts of the Union for the preceding period. It submits these, with the advice of the Finance Sub-Committee, to the Finance Committee for consideration before their submission to the vote of the General Assembly.

23.b. The Finance Committee examines the accounts of the Union from the point of view of responsible expenditure within the intent of the previous General Assembly, as interpreted by the Executive Committee. It also considers whether the proposed budget is adequate to implement the policy of the General Assembly. It submits reports on these matters to the General Assembly before its decisions concerning the approval of the accounts and of the budget.

23.c. The amount of the unit of contribution is decided by the General Assembly as part of the budget approval process.

23.d. Each National Member pays annually a number of units of contribution corresponding to its category. The number of units of contribution for each category shall be specified in the Bye-Laws.

23.e. National Members having interim status pay annually one half unit of contribution.

23.f. The payment of contributions is the responsibility of the National Members. The liability of each National Member in respect of the Union is limited to the amount of contributions due through the current year.

XIII. Emergency Powers

24. If, through events outside the control of the Union, circumstances arise in which it is impracticable to comply fully with the provisions of the Statutes and Bye-Laws of the Union, the Executive Committee and Officers, in the order specified below, shall take such actions as they deem necessary for the continued operation of the Union. Such action shall be reported to all National Members as soon as this becomes practicable, until an ordinary or extraordinary General Assembly can be convened. The following is the order of authority: The Executive Committee in meeting or by correspondence; the President of the Union; the General Secretary; or failing the practicability or availability of any of the above, one of the Vice-Presidents.

XIV. Dissolution Of The Union

25. A decision to dissolve the Union is only valid if taken by the General Assembly with the approval of three quarters of the National Members having the right to vote by virtue of article 14.a. Such a decision shall specify a procedure for settling any debts and disposing of any assets of the Union.

XV. Final Clauses

26. These Statutes enter into force on 15 July 2003.

27. The present Statutes are published in French and English versions. In case of doubt, the French version is the only authority.

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Proposal For Modification Of Bye-Laws

For consideration at GA XXVI

I. Membership

1. An application for admission to the Union as a National Member shall be submitted to the General Secretary by the proposing organisation at least eighteen months before the next ordinary General Assembly.

2. The Executive Committee shall examine the application and resolve any outstanding issues concerning the nature of the proposed National Member and the category of membership. Subsequently, the Executive Committee shall forward the application to the General Assembly for decision, with its recommendation as to its approval or rejection.

3. The Executive Committee shall examine any proposal by a National Member to change its category of adherence to a more appropriate level. If the Executive Committee is unable to approve the request, either party may refer the matter to the next General Assembly.

4. Individual Members are admitted by the Executive Committee upon the nomination of a National Member or, ~~***if the individual in question is not represented by a National Member, by***~~ the President of a Division. The Executive Committee shall publish the criteria and procedures for membership, and shall consult the Nominating Committee before approving applications for admission as Individual Members.

II. General Assembly

5. The ordinary General Assembly meets, as a rule, once every three years. Unless determined by the previous General Assembly, the place and date of the ordinary General Assembly shall be fixed by the Executive Committee and be communicated to the National Members at least one year in advance.

6. The President may summon an extraordinary General Assembly with the consent of the Executive Committee, and must do so at the request of at least one third of the National Members. The date, place, and agenda of business of an extraordinary General Assembly must be communicated to all National Members at least two months before the first day of the Assembly.

7. Matters to be decided upon by the General Assembly shall be submitted for consideration by those concerned as follows, counting from the first day of the General Assembly:

7.a. A motion to amend the Statutes or Bye-Laws may be submitted by a National Member or by the Executive Committee. Any such motion shall be submitted to the General Secretary at least nine months in advance and be forwarded, with the recommendation of the Executive Committee as to its adoption or rejection, to the National Members at least six months in advance.

7.b. The General Secretary shall distribute the budget prepared by the Executive Committee to the National Members at least eight months in advance. Any motion to modify this budget, or any other matters pertaining to it, shall be submitted to the General Secretary at least six months in advance. Any such motion shall be submitted, with the advice of the Executive Committee as to its adoption or rejection, to the National Members at least four months in advance.

7.c. Any motion or proposal concerning the administration of the Union, and not affecting the budget, by a National Member, or by the Organising Committee of a Scientific Division of the Union, shall be placed on the Agenda of the General Assembly, provided it is submitted to the General Secretary, in specific terms, at least six months in advance.

7.d. Any motion of a scientific character submitted by a National Member, a Scientific Division of the Union, or by an ICSU Scientific Committee or Programme on which the Union is formally represented, shall be placed on the Agenda of the General Assembly, provided it is submitted to the General Secretary, in specific terms, at least six months in advance.

7.e. The complete agenda, including all such motions or proposals, shall be prepared by the Executive Committee and submitted to the National Members at least four months in advance.

8. The President may invite representatives of other organisations, scientists in related fields, and young astronomers to participate in the General Assembly. Subject to the agreement of the Executive Committee, the President may authorise the General Secretary to invite representatives of other organisations, and the National Members or other appropriate IAU bodies to invite scientists in related fields and young astronomers.

III. Special Nominating Committee

9. The Special Nominating Committee consists of the President and past President of the Union, a member proposed by the retiring Executive Committee, and four members selected by the Nominating Committee from among twelve Members proposed by Presidents of Divisions, with due regard to an appropriate distribution over the major branches of astronomy.

9.a. Except for the President and immediate past President, present and former members of the Executive Committee shall not serve on the Special Nominating Committee. No two members of the Special Nominating Committee shall belong to the same nation or National Member.

9.b. The General Secretary and the Assistant General Secretary participate in the work of the Special Nominating Committee in an advisory capacity.

10. The Special Nominating Committee is appointed by the General Assembly, to which it reports directly. It assumes its duties immediately after the end of the General Assembly and remains in office until the end of the ordinary General Assembly next following that of its appointment, and it may fill any vacancy occurring among its members.

IV. Officers And Executive Committee

11.a. The President of the Union remains in office until the end of the ordinary General Assembly next following that of election. The President-Elect succeeds the President at that moment.

11.b. The General Secretary and the Assistant General Secretary remain in office until the end of the ordinary General Assembly next following that of their election. Normally the Assistant General Secretary succeeds the General Secretary, but both officers may be re-elected for another term.

11.c. The Vice-Presidents remain in office until the end of the ordinary General Assembly following that of their election. They may be immediately re-elected once to the same office.

11.d. The elections take place at the last session of the General Assembly, the names of the candidates proposed having been announced at a previous session.

12. The Executive Committee may fill any vacancy occurring among its members. Any person so appointed remains in office until the end of the next ordinary General Assembly.

13. The past President and General Secretary become advisers to the Executive Committee until the end of the next ordinary General Assembly. They participate in the work of the Executive Committee and attend its meetings without voting rights.

14. The Executive Committee shall formulate Working Rules to clarify the application of the Statutes and Bye-Laws. Such Working Rules shall include the criteria and procedures by which the Executive Committee will review applications for Individual Membership; standard Terms of Reference for the Scientific Commissions of the Union; rules for the administration of the Union's financial affairs by the General Secretary; and procedures by which the Executive Committee may conduct business by electronic or other means of correspondence. The Working Rules shall be published electronically and in the Transactions of the Union.

15. The Executive Committee appoints the Union's official representatives to other scientific organisations.

16. The Officers and members of the Executive Committee cannot be held individually or personally liable for any legal claims or charges that might be brought against the Union.

V. Scientific Divisions

17. The Divisions of the Union shall pursue the scientific objects of the Union within their respective fields of astronomy. Activities by which they do so include the encouragement and organisation of collective investigations, and the discussion of questions relating to international agreements, cooperation, or standardization. They shall report to each General Assembly on the work they have accomplished and such new initiatives as they are undertaking.

18. Each Scientific Division shall consist of:

18.a. An Organising Committee, *normally* of 6-12 persons, including the Division President and Vice-President, and a Division Secretary appointed by the Organising Committee from among its members.

18.b. Members of the Union appointed by the Organising Committee in recognition of their special experience and interests. The Committee is responsible for conducting the business of the Division.

19. Normally, the Division President is succeeded by the Vice-President at the end of the General Assembly following their election, but both may be re-elected for a second term. Before each General Assembly, the Organising Committee shall organise an election from among the membership, by electronic or other means suited to the Commission structure of the Division, of a new Organising Committee to take office for the following term. Election procedures should, as far as possible, be similar among the Divisions and require the approval of the Executive Committee.

20. Each Scientific Division may structure its scientific activities by creating a number of Commissions. In order to monitor and further the progress of its field of astronomy, the Division shall consider, before each General Assembly, whether its Commission structure serves its purpose in an optimum manner. It shall subsequently present its proposals for the creation, continuation or discontinuation of Commissions to the Executive Committee for approval.

21. With the approval of the Executive Committee, a Division may appoint Working Groups to study well-defined scientific issues and report to the Division. Unless specifically re-appointed by the same procedure, such Working Groups cease to exist at the next following General Assembly.

VI. Scientific Commissions

22. A Scientific Commission shall consist of:

22.a. President and an Organising Committee consisting normally of 4-8 persons elected by the Commission membership, subject to the approval of the Organising Committee of the Division;

22.b. Members of the Union, appointed by the Organising Committee, in recognition of their special experience and interests, subject to confirmation by the Organising Committee of the Division.

23. A Commission is initially created for a period of six years. The parent Division may recommend its continuation for additional periods of three years at a time, if sufficient justification for its continued activity is presented to the Division and the Executive Committee. The activities of a Commission is governed by Terms of Reference, which are based on a standard model published by the Executive Committee and are approved by the Division.

24. With the approval of the Division, a Commission may appoint Working Groups to study well-defined scientific issues and report to the Commission. Unless specifically re-appointed by the same procedure, such Working Groups cease to exist at the next following General Assembly.

VII. Administration And Finances

25. Each National Member pays annually to the Union a number of units of contribution corresponding to its category as specified below; National Members with interim status pay annually one half unit of contribution:

Categories as defined in article 10 of the Statutes:

I	II	III	IV	V	VI	VII	VIII	IX	X
1	2	4	6	10	14	20	27	35	45

Number of units of contribution

If further Categories of Adherence are required in the future, the step in the number of units shall be 10 units/category.

26. The income of the Union is to be devoted to its objectives, including:

26.a. the promotion of scientific initiatives requiring international co-operation;

26.b. the promotion of the education and development of astronomy world-wide;

26.c. the costs of the publications and administration of the Union.

27. Funds derived from donations are reserved for use in accordance with the instructions of the donor(s). Such donations and associated conditions require the approval of the Executive Committee.

28. The General Secretary is the legal representative of the Union. The General Secretary is responsible to the Executive Committee for not incurring expenditure in excess of the amount specified in the budget as approved by the General Assembly.

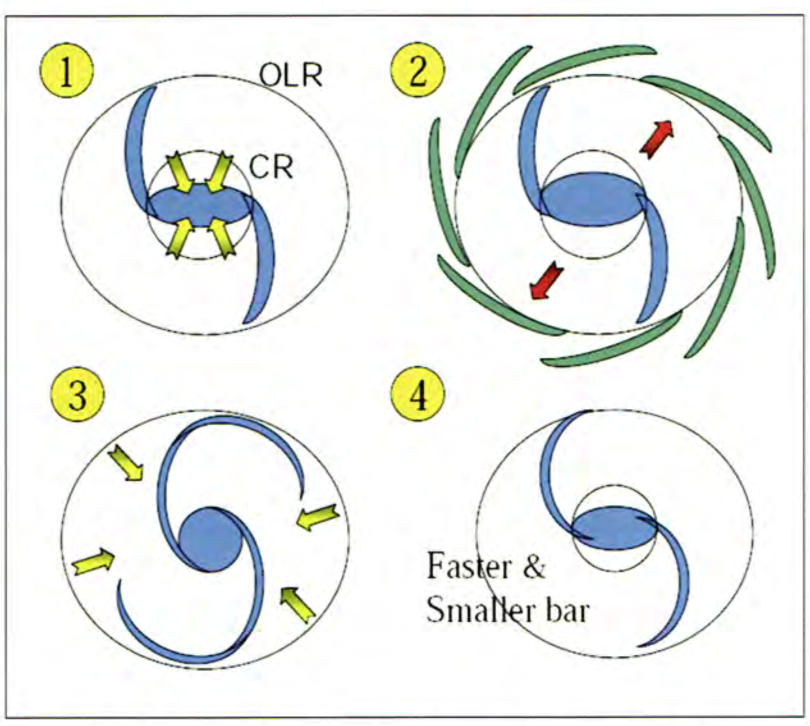
29. The General Secretary shall consult with the Finance Sub-Committee (Statutes 13d) in preparing the accounts and budget proposals of the Union, and on any other matters of major importance for the financial health of the Union. The comments and advice of the Finance Sub-Committee shall be made available to the Officers and Executive Committee as specified in the Working Rules.

30. An Administrative office, under the direction of the General Secretary, conducts the correspondence, administers the funds, and preserves the archives of the Union.

31. The Union has copyright to all materials printed in its publications, unless otherwise arranged.

VIII. Final Clauses

32. These Bye-Laws enter into force on 15 July, 2003.



1 - A stellar bar forms in a cold gaseous disk, and the bar gravity torques drive the gas inwards from corotation (CR) at the outer end of the bar. 2 - As long as the bar is there, gas between CR and OLR (outer Lindblad resonance) is driven outwards. The gas accreted from cosmic filaments is stalled outside OLR. 3 - The bar is destroyed by the angular momentum accepted from the gas inflow. Now bar torques are suppressed, and the external gas can inflow and replenish the disk of this unbarred galaxy. 4 - A new bar instability develops in the new cold disk. Its pattern speed is slightly higher, and the bar smaller with respect to the disk scalelength.

Galaxies are no longer isolated

In the recent past, astronomers used to consider galaxies as isolated systems, with respect to their dynamics and chemical enrichment. This is no longer the case today! Sometimes galaxies interact with their neighbours, and most of the time the collision leads to a coalescence, but even more important, galaxies continue to accrete a lot of matter from their surroundings.

Françoise Combes, Observatorie de Paris, France

Galaxies are supposed to form hierarchically, from mergers of small entities. However, minor mergers and major mergers of galaxies are very destructive of galaxy disks. Minor mergers heat a stellar disk considerably, form a thick disk, and progressively a spheroidal component. Major mergers end up generally as elliptical galaxies. The mass assembly to form galaxies cannot only be hierarchical, from small building blocks, since the majority of galaxies in the field are spiral galaxies with young and thin stellar disks.

How can these disks be formed and maintained? This can be done only through gas accretion, since the formation of thin disks requires dissipation. Perhaps after all, simple diffuse and more regular accretion dominates the formation of galaxies.

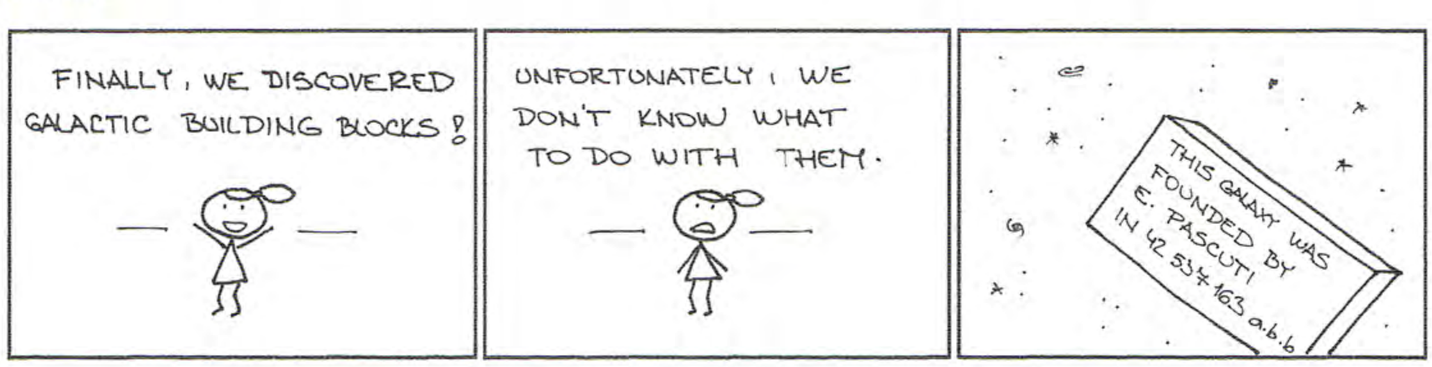
Galaxies are part of a gigantic network of filaments, that are clearly seen in large scale surveys, like the SDSS. Cosmological simulations show that galaxies are assembling mass through matter accretion from cosmic filaments. These filaments are composed of dark matter and baryonic gas, which continuously inflow onto galaxies.

Gas accreted from cosmic filaments progressively settles in a disk through dissipation. But the disk is fragile. Not only it is heated and destroyed by mergers, but also non-axisymmetric instabilities form in a cold disk like a bar, spiral arms or lopsidedness, and these features produce torques that drive the gas towards the center, in a dynamical time-scale.

The formation of bars in galaxies turns out to be a way to shed light on the accretion process. In fact, a bar is not a permanent feature, but can be destroyed by only a few percent of mass in gas in spiral disks. Through gravity torques, angular momentum is exchanged between the gas and the stars in the bar, and while the gas is driven inward, the bar is weakened or destroyed, by the absorption of the angular momentum lost by the gas. Bars in a gaseous spiral galaxy are therefore self-regulating features. The stronger they grow, the quicker they commit suicide, by driving the gas inflow.

The recent infrared surveys have confirmed that the majority (more than 3/4th) of spiral galaxies are barred at some level, and certainly more than 1/3rd are strongly barred. How is this possible, if all bars are weakened or destroyed by gas inflows?

The extensive frequency of bars today can only be explained through a large external gas accretion rate, that can revive galaxy disks, in replenishing their gas content. This observation may tell us that the dominant mechanism in baryonic mass assembly of spiral galaxies is gas accretion more than mergers. ❐



Vyšehrad

Alena Šolcová, Jana Olivová

We would like to invite you to take a walk to one of the most memorable places in Prague that is precious to the whole Czech nation. It is called Vyšehrad and it takes literally a couple of minutes to walk there from the Congress Centre, the venue of the General Assembly of the IAU.

Ancient legends say that this place was the original seat of the legendary princess Libuše or Libussa [minor planet *(264) Libussa*] and of the first of the Přemyslide princes. Johannes Kepler was acquainted with the legend of princess Libuše. He was impressed by it while writing his "Dream or Astronomy of the Moon" about a fantastic journey to the Moon.

The first fortified Přemyslide settlement is, however, supported by historical evidence dating back "only" to the mid-10th century. In the latter half of the 11th and in the 12th centuries Vyšehrad became the main seat of Přemyslide princes and stone fortifications, palaces and several churches were built there. One of the rulers, Vratislav II, established the Church of Saints Peter and Paul in the late 11th century, which was later reconstructed and which has been the heart of Vyšehrad up to now.

When leaving the Congress Centre, you will see a part of the Baroque fortification and the towers of the Vyšehrad Church. Walk along the city walls to the first of the three Vyšehrad gates – the Tábor Gate built in 1655. You will pass through the Leopold Gate, which forms the inner entrance to the Vyšehrad fortress, and then one of the most revered buildings at Vyšehrad – the Romanesque rotunda of St. Martin. It was built in the latter half of the 11th century and it is the oldest church in Prague. If you turn to the right of the rotunda, you will come to the St. Leopold bastion – and a beautiful view of the city will open before your eyes. You will be able to see all the most noteworthy places in Prague, including Hradčany (Prague Castle), the dominant green dome and the belfry of the highly admired Baroque St. Nicholas Church at Prague´s Lesser Town (Chrám sv. Mikuláše, Malá Strana), as well as the Petřín View Tower, which is a 1:5 replica of the Eiffel Tower in Paris.

Walk along the Vyšehrad walls, through the park and all the way to the Church of Sts. Peter and Paul and enter the cemetery. Since 1869, it has been national cemetery where numerous outstanding personalities of the Czech nation – artists, scientists, politicians, and so on – have been buried. The most prominent of them were laid to rest in the monumental common tomb called Slavín (Pantheon).

It may surprise you that the Vyšehrad Cemetery with Slavín is also interesting from an astronomical point of view. Thanks to the fact that as many as 19 (!) personalities buried there have their names in the universe – these are minor planets dedicated to them. The names of some of them may be familiar to you – and you may even wish to visit their tombs.

Zdeněk Kopal – Czech astronomer, expert in close binaries; minor planet *(2628) Kopal*, tomb 5/132 (i. e. section/number of the tomb)
Jaroslav Heyrovský – discoverer of polarography, Nobel Prize winner, minor planet *(3069) Heyrovský*, tomb 13/48
Jan Evangelista Purkyně – professor of physiology; minor planet *(3701) Purkyně*; tomb 5/59
František Křižík – electrical engineer and inventor, minor planet *(5719) Křižík*, in Pantheon
Jan Neruda – poet, novelist and journalist; his collections of poems include "Cosmic Songs", minor planet *(1875) Neruda*, tomb 3/25
Josef Čapek – painter, graphic artist and writer, he invented the word "robot" for his brother Karel´s famous 1920 play R.U.R.; minor planet *(14976) Josefčapek*
The word "robot" also has its minor planet – *(15907) Robot*
Karel Čapek – writer, author of the play R.U.R. and the novel "Krakatit"; minor planet *(1931) Čapek*, tomb 12/47
Božena Němcová – acclaimed Czech author, her most renowned book is "Babička" (Grandmother); minor planet *(3628) Božněmcová*, her name has also been given to a crater on Venus, tomb 2/12
Antonín Dvořák – composer, author of the famous "Symphony No. 9, From the New World"; minor planet *(2055) Dvořák*; tomb 14/35
Bedřich Smetana – composer, author of a cycle of six symphonic poems entitled "My Fatherland", the opera "The Bartered Bride"; minor planet *(2047) Smetana*; tomb 5/40
Ema Destinnová – opera singer, minor planet *(6583) Destinn*; in Pantheon

Other personalities whose name has been given to minor planets include:
Karel Ančerl – chief conductor of the Czech Philharmonic orchestra; *(21801) Ančerl*
Josef Bican – soccer player, *(10634) Pepibican*
Josef Jan Frič – one of the brothers who founded the Ondřejov Observatory; *(7849) Janjosefrič*, tomb 3/24
Alfons Mucha – painter, *(5122) Mucha*
Josef Myslbek – sculptor; *(29490) Myslbek*
Oskar Nedbal – composer and conductor, *(3592) Nedbal*
Vladimír Neff – author, *(9087) Neff*
Antonín Svojsík – founder of a Czech boy-scouts´ organization *(16706) Svojsík*

Brief information

❍ Selected contributions will be translated for the Czech public. Contributors, who do not agree with the translation, should announce this to the Nuncius editorial board (Rooms No. 222, 223, **nuncius@ig.cas.cz**)

Secret diary of secret agent F.R.Og

July 1: Only three months after I arrived on this planet and I already mastered the Earthlings' Galactic coordinates. For some strange reason they don't use the simple linear carthesian coordinate system like we do, but have angles, velocities, galactocentric distances and such stuff. Phew.
July 15: Insult, insult! I came across a paper describing the discovery of SIRGO G061-01 which must be my lovely home planet, rybníček. Sirgog! A stinking sink! What a name for my beautiful home. Naturally I looked what hateful and spitful journal published an insult like this. It was Astrophysical and Astronomical Science that claims that all nomenclature is in agreement with IAU resolutions. Is the aim of IAU to insult races far more intelligent than Earthlings?
July 20: I cooled down a little bit. Maybe the name was an unintentional though very unhappy coincidence. The author claims it stands for Strange Infrared Galactic Object. Ahem. Must find out what he knows about it (luckily not much judging from the paper).
August 1: I wanted to deal with the author but he left to Prague. There's a big conference there about SIRGOGs and such. I must go there. All IAU people will be there, so I will find them and they must apologize. Hooray for Prague!

Nomenclature Filler

1. From Confusion to Clarity: Quips and Quotes from "IAU Recommendations for Nomenclature"

Hélène R. Dickel, University of New Mexico, USA

The creation of clear and unambiguous designations for astronomical sources of radiation is becoming increasing important in this era of multi-wavelength comparisons, such as envisioned with the Virtual Observatory, and associated Data Management. Special Session (SPS) 3 on the Virtual Observatory is being held on the following days: Thursday August 17 (p.m.), Friday August 18 (full day), Monday August 21 (full day) and Tuesday August 22 (a.m.), followed that afternoon by SPS 6 on Data Management. The short fillers or quips that follow in succeeding issues of the Nuncius Sidereus are intended to help the reader refer to and create designations that conform to IAU standards and thus facilitate the inter-comparison of different source lists and data by the Virtual Observatory and others with a minimum of errors.

Courtesy of the IAU WG Designations and WG Astronomical Data

Day	Morning minimum	Afternoon maximum	Sky	Wind
Saturday 12/8	7 °C / 46 °F	18 °C / 66 °F	Overcast and very rainy	WSW winds 3 m/s (7 mph)
Sunday 13/8	10 °C / 50 °F	21 °C / 70 °F	Overcast and very rainy	N winds 3 m/s (7 mph)
Monday 14/8	11 °C / 52 °F	22 °C / 72 °F	Cloudy with possible rain	WSW winds 4 m/s (10 mph)
Tuesday 15/8	12 °C / 54 °F	22 °C / 72 °F	Sunny with scattered clouds	SW winds 5 m/s (13 mph)

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DISSERTATIO CVM NVNCIO SIDEREO III | 2

PRAGAE — MMVI 15. VIII. — SERIES TERTIA

Centenary of Czech astronomer František Link

** 15. 8. 1906, Brno – † 28. 9. 1984, Paris*

Zdeněk Ceplecha, Václav Bumba, Jiří Grygar, Jana Olivová

František Link is one of the pioneers of Czech astronomy. As far back as World War II he founded the Calculation Section of the Czech Astronomical Society, which accomplished a huge amount of irreplaceable work in the pre-computer era. In 1948, after the war, he became the director of the observatory in Ondřejov. He initiated research of the Sun and the Sun-Earth relations, meteors and the upper atmosphere of the Earth. He also pioneered the space research.

Thanks to his scientific activities and good social contacts, he played an important role in founding the Central Astronomical Institute in 1951. It was incorporated in the Centre of Research and Technological Development, which integrated a small group of scientific institutions and became later the basis of the Czechoslovak Academy of Sciences.

His lectures given at Charles University captured the attention of many students. He proposed the themes for their future scientific works, guided them and supervised their doctoral theses.

In 1947, he founded and became the first editor-in-chief of the scientific journal called "Bulletin of the Astronomical Institutes of Czechoslovakia" (BAC), which had also its Czech version. In 1992, BAC was incorporated into the European journal "Astronomy and Astrophysics".

Thanks to František Link´s efforts, a new building of the solar laboratory with a third, eastern dome was built at the Ondřejov Observatory in the years 1952–1955. In 1953, after a dispute with the upcoming young generation, Link was removed from the post as the director. Then he concentrated on the research of the upper atmosphere of the Earth, often with very unconventional methods, including photometric studies of lunar eclipses, in particular the density of their darkening and colour. In this way he improved his theory of lunar eclipses which he worked out in France as early as 1933. He drew attention to the possibility of the luminescence of the lunar surface caused by corpuscular solar radiation. Link was also one of the first to determine the amount of atmospheric ozone and he developed the method of sunset measurements from satellites.

In 1951 František Link, then the director of the Central Astronomical Institute of Czechoslovakia, invited a young university student, Zdeněk Ceplecha, to undertake a post-doc work at the Ondřejov Observatory to work at new project using meteoroids as probes for determining air densities at the altitudes between 130 and 60 km. Link's project opened a new era in meteoroid research in Ondřejov, which from its very beginning was aimed to improve the understanding of the interactions of meteoroids with the middle atmosphere. Systematic photographing of meteors every clear and moonless night was carried out at two different stations. For many years Ondřejov has been the basic station, while the second one was successively located at different sites of about 40 km from Ondřejov (Mezivraty, Vysoký Chlumec and Prčice). Link soon realized that the direct photographing of meteors should be complemented with high resolution spectral cameras equipped with objective gratings. Finally, the whole system was created, comprising 30 direct cameras with a large field of view and focal distance of 180 mm, covering slightly more than a half of the visible sky hemisphere and equipped with rotating shutters of about 50 breaks of the image per second. Recordings were made with the use of photographic glass plates, which were the most precise detectors for astrographic measurements at that time. Over the 27 years of operation, the modern programme of photographing meteors from two stations, which was originated by František Link, has provided data about 1200 meteors. Thanks to this basis, Z. Ceplecha, J. Rajchl and others scored a historical success: they became the first in history to record with scientific means the Příbram fireball and meteorite fall, which has therefore become the first meteorite with a precisely defined orbit.

Link was convinced that the focus on research programmes in the fields of astrophysics, geophysics and atmospheric sciences at the Ondřejov Observatory would bring the most fruitful results. He guessed right and the study of relations between the Sun and the atmosphere of the Earth, as well as the research of the penetration of meteoroids through the Earth's atmosphere have won him international recognition and resulted in many discoveries. That has been achieved thanks to the complex structure of observational programs covering different aspects of the same phenomenon at the same time. Nowadays those scientific specializations continue to form a substantial part of observational and theoretical projects at the Ondřejov Observatory.

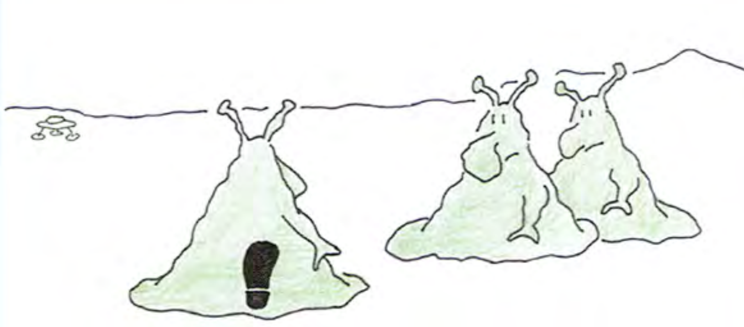
Throughout his whole career, František Link maintained close relations with French astronomers. He worked at observatories in Lyon and Pic du Midi and pushed through the cooperation with French experts who began to use stratospheric balloons for research of the atmosphere in the 1960s. He also collected meteoric dust from jet fighters.

After the Soviet invasion to Czechoslovakia in 1968, he emigrated to France in 1970 where he was active at the Observatoire de Paris till his death in 1984. ❐

An Astronomers' Data Manifesto: Journal Data

Ray Norris

When I publish data in a journal, I'd like it to be widely used and cited, and when I look up a redshift in NED or Simbad, I'd like to see all published redshifts. At present, data centres have to go through published tables by hand, and so many never make it. How to fix this? We need to define formats and metadata that are author-friendly, journal-friendly, and datacentre-friendly. Then when you submit your tables, spectra, and images to ApJ, they will automatically be transferred to the data centres, resulting both in greater punch from your science, and more citations. Impossible? Find out at Special Session SPS6: "Astronomical Data Management" on Tuesday afternoon, August 22.



They're still not prepared for a close encounter with us.

Important erratum of changes of IAU statuses and Bye-laws:

1. The beginning of the section VII. of Bye-laws should read:

VII. Administration And Finances

25. Each National Member pays annually to the Union a number of units of contribution corresponding to its category as specified below; National Members with interim status pay annually one half unit of contribution:

Categories as defined in article 10 of the Statutes:

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1	2	4	6	10	14	20	27	35	45	60	80

Number of units of contribution

~~If further Categories of Adherence are required in the future, the step in the number of units shall be 10 units/category.~~

2. Both modifications enter into force on August 15th, 2006 (not July 15th, 2003).

Pluto the Ninth, Xena (2003 UB_{313}) the Tenth, and brighter than Pluto after that

Tom Gehrels, University of Arizona, USA

The regular asteroid observers, including amateur astronomers, are doing well with their CCDs in faint follow-up astrometry. However, large wide-angle telescopes and special equipment are needed to explore the outer solar system, including the rare objects that might qualify as planets. The searching is done with expensive telescopes by experts who are not always asteroid observers. The greatest encouragement for exploration of the outer solar system is the excitement that a new Planet might be found. Observatory directors and funding agencies are well aware of that.

This proposal is therefore to stay with the 75 years of popularly considering Pluto the Ninth, as the IAU agreed to in Manchester, and to adopt Xena as the Tenth Planet because it is intrinsically brighter than Pluto. The proposal is further that the same accurate and convenient criterion be used for naming an Eleventh Planet and so forth, namely that they be intrinsically brighter than Pluto, measured in "absolute V-magnitude." Pluto's absolute visual magnitude is −0.76, Xena's −1.2. The present proposal is written on behalf of people who are doing the observing and discovering, who see the need for prompt recognition and the fastest return in naming. This has been explained before, in Nature 436, 1088, 2005 and Sky & Tel. 111, No. 1, 14, 2006, and this Letter has been circulated in draft form, but there has been no response from the two naming committees of the IAU. Considering roundness due to gravitational stability is complex, time consuming, subject to change, and impossible due to faintness at great distance.

A compromise for proper study and distinction of the various objects and populations is to attach to Pluto and to any new Planets also the usual comet or asteroid designation. Xena already has 2003 UB_{313}, which eventually will be a 6-digit catalog number. The dual assignment, as Planet and comet or asteroid, will also stimulate discussion in schools and colleges of the rich variety of solar-system objects.

Today's programme: (tuesday 15/8)

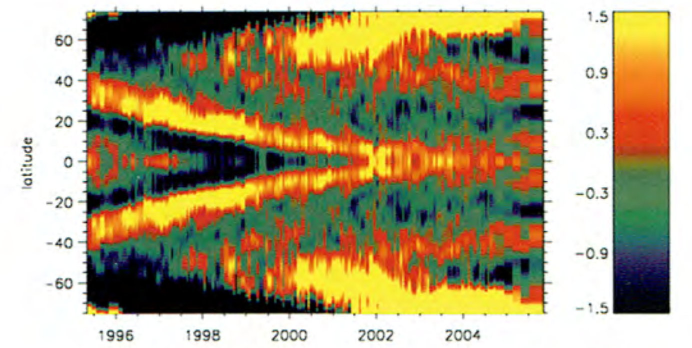
- Symposia S235, S236, S237
- Opening (inaugural) Ceremony
- General Assembly, Session 1
- Youth Astronomer Lunch-Debate

Helioseismology

"At first sight it would seem that the deep interior of the sun and stars is less accessible to scientific investigation than any other region of the universe. Our telescopes may probe farther and farther into the depths of space; but how can we ever obtain certain knowledge of that which is hidden behind substantial barriers? What appliance can pierce through the outer layers of a star and test the conditions within?"

Arthur Eddington "The Internal Constitution of the Stars", 1926, p. 1

Alexander G. Kosovichev, Stanford University, USA



This diagram shows migration of the zonal flows ("torsional oscillations") from high to low latitudes during the current solar cycle. The color scale shows the speed of the zonal flows in m/s. The weak red branches started after 2002 at about 45 degrees latitude are the torsional oscillations of the next solar cycle, probably, indicating that the magnetic field which will form sunspots in the next cycle is already being generated inside the Sun.

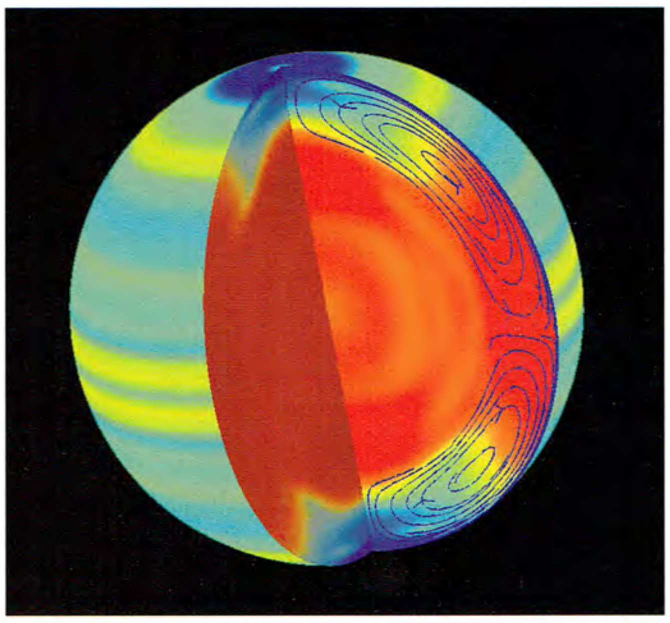
Helioseismic observations

Helioseismology is the study of the Sun's interior by the observation and analysis of oscillations at its surface. Investigation of the internal structure and dynamics of the Sun is one of the fundamental problems of astrophysics. The processes of the nuclear energy release and generation of magnetic fields occur below the visible surface of the Sun, and thus are not accessible by direct astronomical observations.

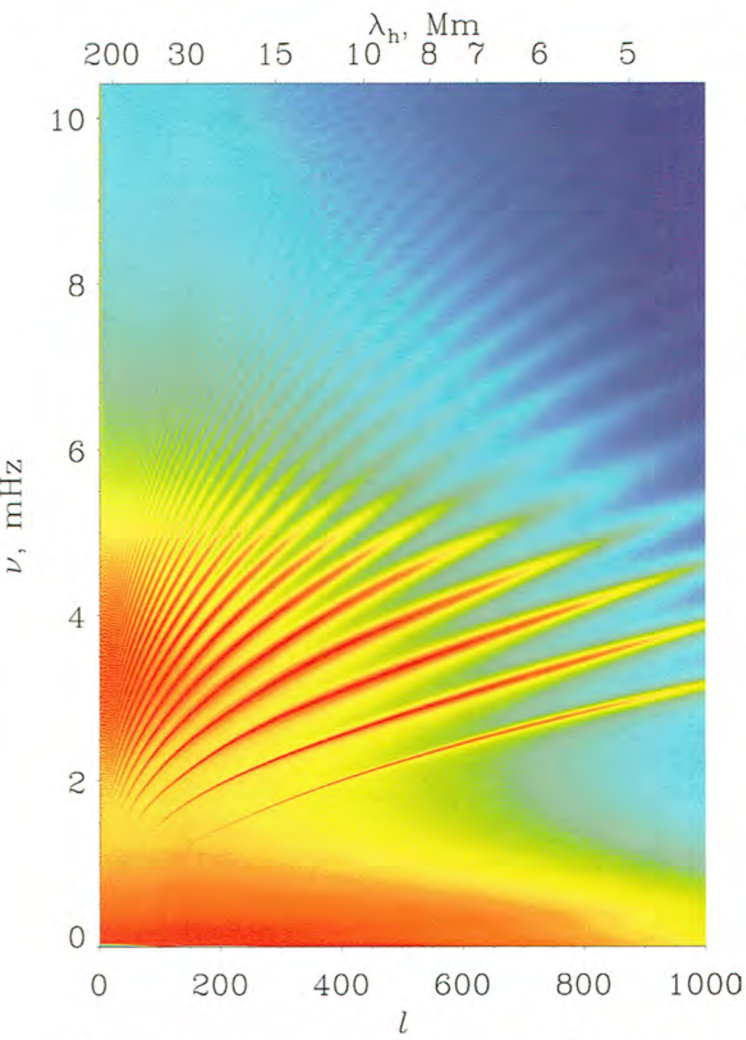
The answers to Eddington's questions are given by helioseismology. The internal layers of the Sun are not transparent to electromagnetic radiation, but they are transparent to acoustic waves. Thus, observations of acoustic waves on the Sun allow us to investigate the interior structure and dynamics. Acoustic oscillations with a characteristic period of 5 minutes were discovered in 1963 by Leighton, Noyers and Simon. Initially it was believed that these oscillations represent a local surface phenomenon related to propagation in the solar atmosphere of acoustic waves excited by granules.

Further observations by Frantz-Ludwig Deubner revealed that the power spectrum of these oscillations is concentrated in "ridges" formed by subsurface resonances. The oscillation frequencies of the resonant modes depend directly or indirectly on various properties of the solar interior such as the sound speed, angular velocity and others.

During the last 10 years, continuous observations of solar oscillations from the Solar and Helioseismic Observatory (SOHO) space mission and from the ground-based Global Oscillation Network Group (GONG) project allowed us to make high-precision measurements of about 2,000 multiplets of acoustic (p) and surface gravity (f) modes of solar oscillations, and investigate their variations with the solar cycle. The oscillations are observed from the Doppler shift of photospheric lines, measured over the whole disk every minute. The Doppler-shift images, typically of 1024×1024 pixels, record displacement velocities of the solar surface, due to the oscillations of a wide range of wavelength or spherical harmonic degree, *l*, from 0 to 1000.



This image shows three most important global motions on the Sun: zonal flows ("torsional oscillations") obtained by difference between observed surface rotation and a smooth fit, differential rotation changing with latitude and depth (in the cut into the Sun), and streamlines showing observed poleward flow near the surface and the expected return flow at the base of the convection zone.



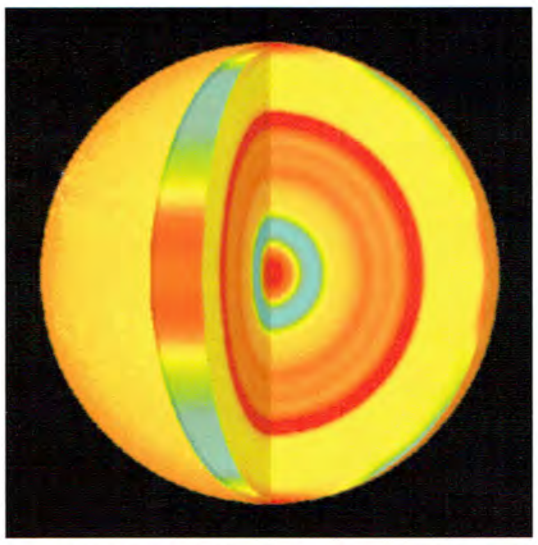
Power spectrum of solar oscillations as a function of spherical harmonic degree, l, and frequency, ν. The ridges are formed by resonant oscillation modes. The lowest ridge corresponds to surface gravity (f) mode; the higher ridges are acoustic (p) modes. The top axis shows the horizontal wavelength in Mm.

Global helioseismology

These data provided new accurate measurements of the differential rotation inside the Sun, and determine the narrow transition zone at the base of the convection zone (so-called tachocline) in which the rotation law changes from an almost solid-body rotation in the radiative core to differential rotation of the convection zone. It is believed that the strong gradient of the angular velocity in the tachocline plays an important role in the process of generation of solar magnetic fields – solar dynamo.

The helioseismology data also revealed the deep structure of zonal flows – "torsional oscillations", migrating from mid-latitudes to the equator during the solar cycles. These observations are important for understanding the dynamo mechanism of solar activity. In addition, the high-precision measurements of solar oscillation frequencies are used to determine the internal stratification and chemical composition of the Sun.

These investigations based on analysis of oscillation frequencies of resonant modes on the whole Sun are called "global helioseismology". They provide information about the axisymmetric structure of the Sun and rotation. However, the mode frequencies are not sensitive to the more complex 3D structures and flows inside the Sun. Also, they cannot be used for measuring the north-south asymmetry.



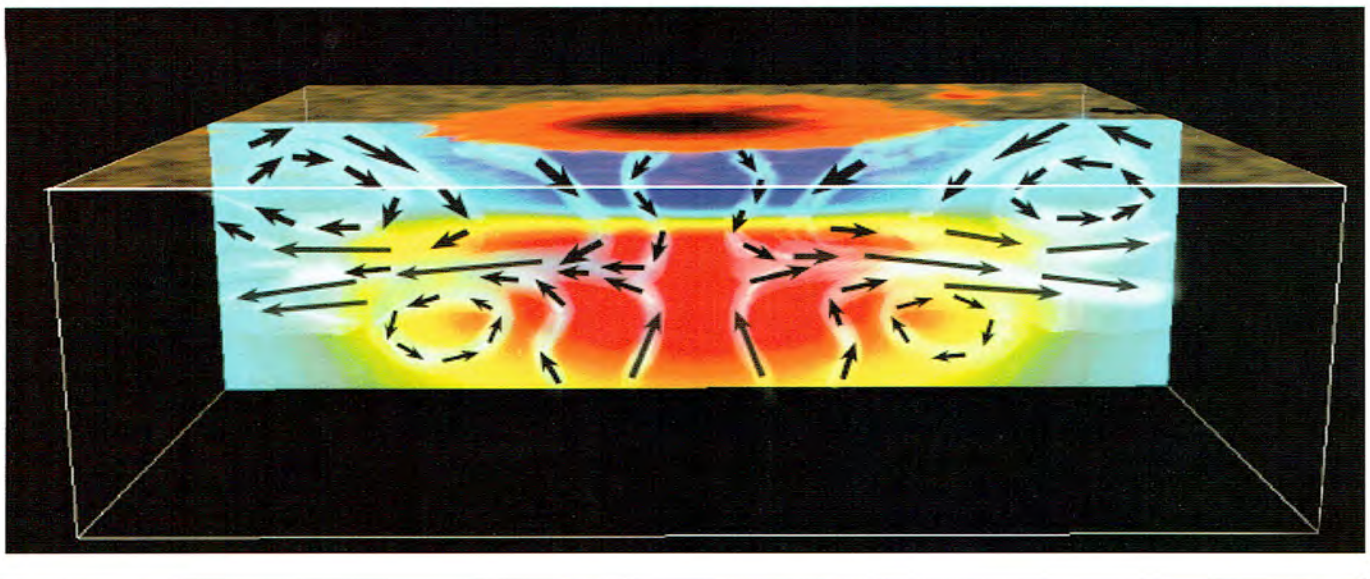
The radial and latitudinal variations of the sound speed in the Sun, relative to a standard solar model. Red color corresponds to the positive variations ('hotter' regions), and blue color corresponds to negative variations ('cooler' regions).

Local helioseismology

These limitations are overcome, however by new "local helioseismology" techniques (time-distance helioseismology, ring-diagram analysis and acoustic holography), which substantially expand our ability to probe the structure and dynamics inside the Sun. In particular, they allow us to obtain 3D flow maps and sound-speed images of connective cells, sunspots and active regions, determine a large-scale flow pattern, measure the meridional circulation, and detect sunspots on the far side of the Sun. The main problems of local helioseismology are related to the forecast of solar activity and space weather.

While "global helioseismology" measures the resonant oscillation frequencies of the whole Sun the local methods utilize local properties of solar oscillations such as travel times, phase shifts or dispersion relation. For instance, time-distance helioseismology is based on measurements of travel times of acoustic and surface gravity waves between different points on the solar surface. These travel times are used to estimate properties of solar plasma along the wave paths. Because the paths of acoustic wawes go through the interior, this method provides three-dimensional maps of plasma flows and perturbations below the visible surface. So far, methods of local helioseismology have been successfully used to obtain detailed maps of mass flows 20–30 Mm deep, covering 10–15 % of the depth of the convection zone. However, these methods are developed intensively, and we can expect that they will become one of the main tools for investigation of the dynamo processes in the Sun.

This image shows the sound-speed structure and the axisymmetrical component of plasma flows below a sunspot. The red color shows where the sound speed is higher than average and blue color shows where the sound speed is lower. The depth of the box is about 12 Mm. The transition from lower to higher sound speed occurs at a depth of 4–5 Mm. The characteristic flow speed is about 1–2 km/s.



Structure and dynamics of sunspots and active regions

Time-distance helioseismology has led to a clue that may help to solve the mystery of sunspots. Measurements of acoustic wave travel times indicate that in the subsurface layer, 4–5 Mm (4,000–5,000 km) deep, there are plasma flows with velocities of 1–2 km/s, converging around sunspots. In the deeper interior, the flow pattern is reversed. These measurements also show that the sound-speed in the subsurface layer is reduced by 10–20 %, but becomes higher in deeper layers. This means the cool area of sunspots, caused by suppression of convective energy flux by magnetic field, is only about 4 Mm deep, rather shallow compared to the diameter of sunspots, which is typically, 10–20 Mm. The deep region of enhanced sound speed (higher temperature) is probably caused by partial accumulation of the heat flux. The heat flux excess is then redistributed in the convection zone by horizontal convective motions, which can be also seen at the depth 4-5 Mm.

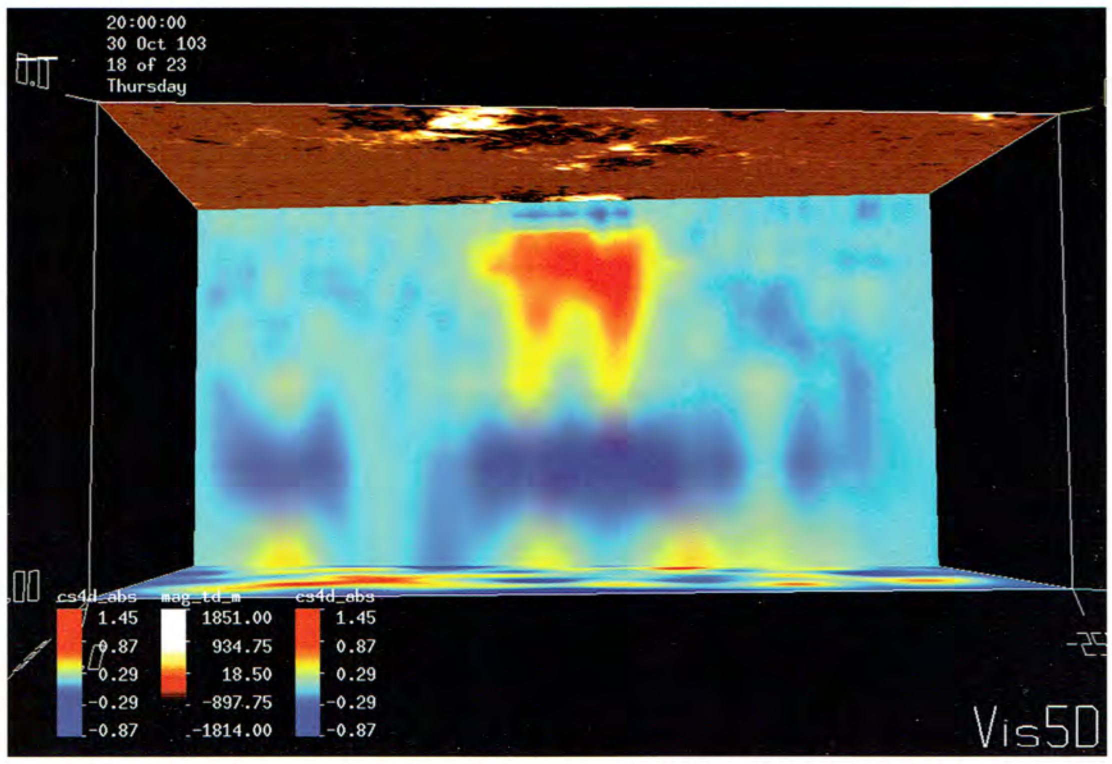
These results suggest that the magnetic field in sunspots can be confined by strong converging plasma flows below the solar surface, and that the general structure of sunspots corresponds to the cluster model of Severny-Parker, in which sunspots represent clusters of magnetic flux tubes pushed toward each other by the converging flows.

The two-layer structure seems to be very typical also for large active regions. The time-distance analysis of emerging and developing active regions shows that the active regions develop as a result of repeated flux emergence in the same place during extended periods of time, over several days and weeks. So far, there is no indication in the subsurface flow maps and sound-speed images that active regions are formed by large-scale omega-shaped loops, as suggested by some models. Nevertheless, the resulting sub-surface images in some cases reveal a loop-like structure extended to at least 40 Mm below the surface. However, the depth of the roots is still unknown. Detection of new emerging active regions and forecast of their evolution is one the most important task of local helioseismo-logy.

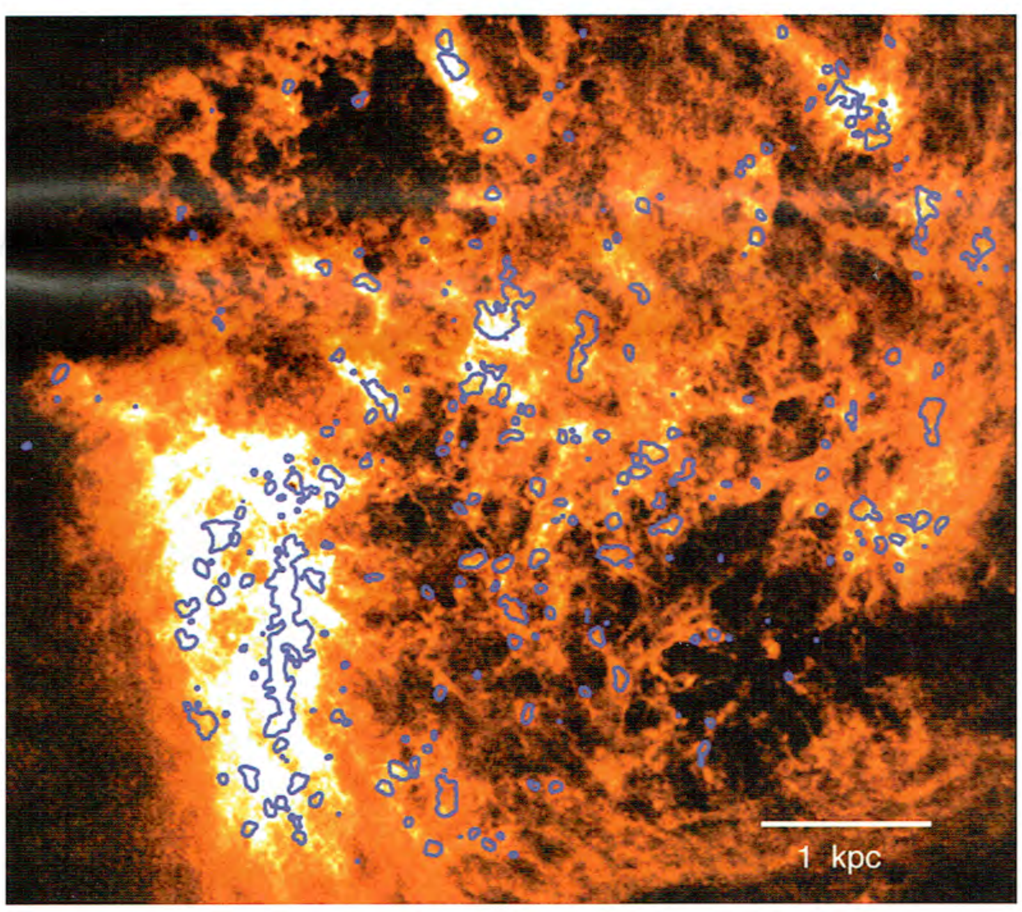
Perspectives of helioseismology

Helioseismology has provided an unprecedented view of the Sun's interior, revealing complicated structures and dynamics. Many results of helioseismology are unexpected, counter intuitive and are not explained by current theoretical models. For understanding the basic mechanisms of the Sun's magnetic activity, magnetic energy storage and release, it is very important to investigate in more details the internal processes associated with the 11-year cycle; variations of the differential rotation and meridional circulation, particularly, in the solar tachocline; the processes of formation of sunspots and active regions; fast streaming flows below active regions, which can shear and twist magnetic fields in the atmosphere and corona, and lead to solar flares.

New high-resolution observational data for helioseismology will be obtained from space missions: Solar-B, scheduled for launch in September 2006, and Solar Dynamics Observatory, planned for 2008. For future progress in helioseismology, also it is necessary to develop realistic 3D simulations of magneto-convection, dynamo and sunspots, in order to test and refine the helioseismic diagnostics, and interpretation of helioseismic inferences. The main direction in helioseismology is further development of the local methods to obtain 3D maps of the whole convection zone and high-resolution images of subsurface magnetic structures. ❐



Sound-speed variations associated with the large active region NOAA 10488, observed in October 2003, which shows a loop-like structure below the surface. The depth of the box is 48 Mm, the horizontal size is about 540 Mm. The sound-speed scale is from −1 to 1.5 km/s, the scale of the photospheric field shown in the top panel is from −1800 to 1800 Gauss.



Left: An overlay of NANTEN GMCs (contours) on the ATCA HI total intensity distribution (orange) by Kim et al. (2003).

The Large Magellanic Cloud

An ideal laboratory for the study of star formation

Stars form in every galaxy. We need to observe a great number of star forming regions to derive the "star formation law" (if it exists) which drives galactic evolution both on the local and galactic scales. The Milky Way appears to be a reasonable place to do such a study but the heavy extinction and contamination in its disk hampers our scope seriously. Instead, the Large Magellanic Cloud (LMC), the nearest neighbor galaxy to our own, offers an ideal laboratory to study how stars form from molecular clouds.

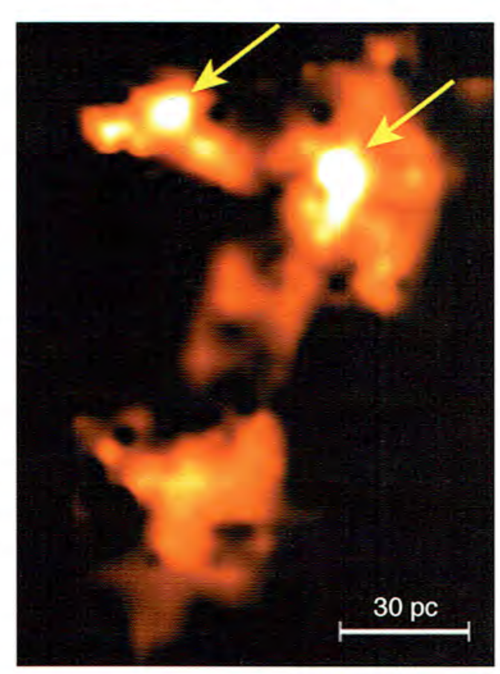
Yasuo Fukui, Nagoya University, Japan

NANTEN, a 4m mm/sub-mm telescope, which has been operated by Nagoya University in Chile since 1996, is providing a comprehensive view of molecular clouds where stars form in the LMC. A recent view of the LMC with NANTEN in 2.6 mm CO emission, reveals some 300 giant molecular clouds (GMCs) whose masses range from a few tens of thousands to several million solar masses, the first complete sample of GMCs at 40pc resolution in a single galaxy (Fukui, Y. et al. 1999 and 2006). More recently, a UC Berkeley team has been finding more resolved GMCs in other nearby galaxies such as M 33 (Blitz, L. et al. 2006).

By comparing the GMCs with young stars, the NANTEN team classified them into three classes; Class I GMCs are starless in the sense that no massive stars are associated. Class II GMCs show association with only tiny HII regions and Class III GMCs exhibit very active formation of rich clusters and giant HII regions. The huge HII region 30 Dor is one of the best examples associated with a Class III GMC. It is likely that GMC Class represents an evolutionary sequence from Class I to III over a few tens of Million years. GMC Class III is perhaps followed by rapid dissipation of molecular material by vast ultraviolet photon fluxes from the O stars in the clusters (Kawamura, A. et al. 2006). Triggering of star formation by the feedback from massive stars is a reasonable scenario but regarding the LMC it seems that supershells may not be the major mode of triggering, as suggested by the poor correlation between supershells and star-forming regions (Yamaguchi, R. et al. 2001).

HI gas is perhaps the reservoir from which molecular clouds are formed on a galactic scale. The overlay of HI ATCA data (Kim et al. 2003) on the CO image, shown in the figure to the left, indicates that GMCs are highly clumped and are embedded in tenuous HI filaments, providing strong support for the scenario that CO clouds are being formed from HI. More details are revealed through a new comparison of HI and CO in a three dimensional space including the velocity axis, consisting of 1 million pixels of 40 pc × 40 pc × 2 km.s^{-1} (Iritani, H., Kawamaura, A., Wong, T. and Fukui, Y. 2006). This new method allows us to pick up the HI gas closely associated with GMCs and to show that the HI mass around GMCs increases from Class I to III, suggesting that GMCs are still growing in mass by the gravitational accumulation of HI. In addition, the SAGE program with the Spitzer space telescope lead by M. Meixner is revealing distribution of cool and warm dust components and will tell us more about the evolution of GMCs including temperature change.

At even shorter wavelengths in the sub-mm regime, we are able to observe proto-cluster dense clumps. The figure below indicates such dense clumps whose masses are 0.1 million solar masses, revealed in 870-micron CO emission by the 10-m sub-mm telescope ASTE in Atacama, Chile, which is operated by the National Astronomical Observatory of Japan (Minamidani, T. et al. 2006). The superclusters in the LMC, like R136 in the center of 30 Dor, include more than 10,000 stars, significantly more massive than the open clusters in the Milky Way. The formation of very massive gas clumps must be connected to the formation of such superclusters. Eventually, the ALMA (Atacama Large Millimeter/submillimeter Array) observatory under construction in Atacama will offer a tremendous opportunity to resolve such clumps down to 1,000 AU in the LMC. More details of this article will be given in a talk by the author in the IAU symposium 237 "Triggered star formation" this week. ❐



The 870 micron CO (J=3–2) distribution in the N159 region obtained with ASTE 10m telescope (by courtesy of T. Minamidani, Nagoya University). Two arrows indicate candidates for proto-cluster clumps.

Meet Tycho Brahe at Benátky near Prague

Jana Olivová

The Museum in the town of Benátky nad Jizerou is currently staging an exhibition entitled **Maps and the Astronomer**. It displays geographical and astronomical maps connected with Tycho Brahe, which were borrowed from private collections.

The exhibition takes place in the Museum situated on the 2nd floor of the Benátky Chateau. Opening hours: Friday to Sunday: 9:00–12:00 and 13:00–17:00.

You can get there by bus from Černý Most (terminus of Metro Line "B"). Distance: 31 km, travel time: 25 minutes

As you may know, the life and work of famous Danish astronomer Tycho Brahe is closely connected with Prague. But you may not know that soon after he arrived at the court of Emperor Rudolf II, he decided to move to a place which he considered more suitable for his astronomic observations and other scientific purposes. That was the chateau at Nové Benátky. Numerous instruments were moved there and Tycho Brahe and his assistants began to observe planets and stars from the rooms on the second floor. Brahe himself is said to have carried out his observations from the room with a high window which has been preserved to the present day. Even the "Benátky meridian" defined by Tycho Brahe is marked on the floor. Tycho Brahe even met Johannes Kepler at Nové Benátky before he moved back to Prague.

Several centuries later, in 1944, Nové Benátky merged with Staré Benátky and other villages and became known as Benátky nad Jizerou.

Meet Mozart in Prague

Jana Olivová

All lovers of classical music are invited to Prague's Ovocný trh, which is currently the venue of the open-air festival; **Mozart for All Music Film Festival – Vienna–Prague**. It is being staged within a wider project called Vienna Mozart Music Film Festivals in Central Europe.

From August 5 to 19, TV and film recordings will be presented of Mozart's operas, concerts as well as other performances concerning the work and life of the famous composer. The programme offers, among other things, such operas as, "The Marriage of Figaro" and "Don Giovanni". The whole event takes place in the close vicinity of the Estates Theatre, where the opera, "Don Giovanni," had its world premiere in 1787.

August 5–19
Performances begin at: 21:00
Admission is free

For details of the programme see: **http://www.mozartfilmfest-prague.cz/**

Brief information

- **Prague Transportation:** All the necessary travel information on the Prague integrated transport (trams, buses and the underground, which is called "Metro" in Prague and marked "M") can be found at: **http://www.dp-praha.cz**. It is in Czech, English and German. The site includes details of tariffs and fares, ticket sale, list of routes of trams, buses and Metro as well as their timetables. You can also search for links from one place to another there.
- **JD03 – Solar active regions and 3D magnetic structure:** The final program (see **http://www.asu.cas.cz/~msobotka/IAU_JD03/programme.html**) is posted at the entrance of Club A and printed copies will be available to the participants at the beginning of the first session.
- The live video stream of the afternoon's General Assembly will be available at the web page **http://astronomy2006.com/tv/**.

Secret diary of secret agent F.R.Og

August 14th: I'm in! It was quite tough, 'cause Earthlings have the wrong skin colour and are much bigger but I am a master of disguise. Nothing much going on at the conference. *A symposium about galaxy evolution:* galaxies grow from cosmeggs, every child knows it. *A symposium about near-Earth asteroids:* a local matter, nothing for me. And *star formation in turbulent medium:* if it were `how to avoid star formation in turbulent traffic situations', that would be different, but as it is... I just strolled around and came across IAU statutes which are going to be changed or what. I've got a genius idea! I will smuggle in some small changes, they'll vote for it (nobody reads such stuff, anyway), and then... No more insults for non-Earthlings, more power for F.R.Og! My proposed changes are:

§ 1: The IAU is an international interplanetary non-governmental organization.

§ 18: The Officers of the Union are the President, the General Secretary, the President-Elect, the Assistant General Secretary, and the General Extraterrestrial Overlord.

§ 24: If ... circumstances arise ... the General Extraterrestrial Overlord shall take such actions as he/she deems necessary....

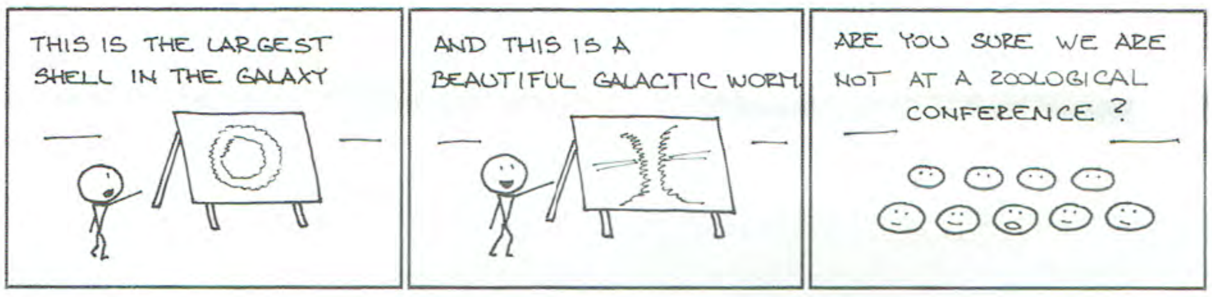
IAU, just wait for F.R.Og!

NOMENCLATURE FILLER

2. From Confusion to Clarity: "How to .. for Dummies" reference for naming sources

Hélène R. Dickel

A short primer on How to refer to a source or designate a new one may be found at **http://cdsweb.u-strasbg.fr/how.html.** Some future From Confusion to Clarity quips will contain direct quotes from the more detailed IAU Recommendations for Nomenclature at **http://cdsweb.u-strasbg.fr/iau-spec.htx**.



New horizons for young astronomers

For young astronomers it's "a hard day's night" to establish and maintain a career in astrophysical research and scholarship. Astronomy today is driven by rapid advances in technology, instrumentation, and theory. Because of this, there has been an overwhelming increase in scientific discovery and information in every subfield of the astronomy and astrophysics. Under these circumstances, how can a young astronomer manage to find a viable PhD thesis topic that makes significant progress in his/her field? And then even if successful in achieving a Doctorate degree, nowadays it's a daunting challenge to find a permanent job to continue and practice the newly acquired research abilities after completing a PhD. For the first time, the IAU General Assembly program is enriched by two specific events that precisely address these problems and questions for young astronomers. These activities aim at providing valuable information to young astronomers on various relevant scientific issues as well as the framework in which to carry out and improve the science. A relevant URL **http://astro.cas.cz/yae/index.html.**

Getting smarter while you eat

The first planned program is the "Young Astronomer Lunch-Debate" and it is scheduled for Tuesday, August 15th, just before the Opening Ceremony of the GA. This luncheon provides a splendid opportunity for young astronomers to meet with members of the IAU Executive Committee, representatives from ESO, ESA, NASA, as well as other top academic, industrial, research institutions and organizations. It will be a chance to get help and friendly advice from people who want to help and who care. The invited "senior" astronomers are from all around the world and have expertise and interest over a large spectrum of work and experience. They will be there to share their expertise, exchange ideas and to discuss research, educational opportunities for post-doctoral positions, as well as possible career and employment opportunities. The luncheon is organized through round tables of about 10 participants (8 young astronomers and 2 invited astronomers), each table discussing one or more topics of interest among lists that have been established according to the suggestions made by the young astronomers through the questionnaires. The questions discussed range from (1) finding important collaborations in astrophysical research in Europe, North and South America, Asia and Australia, (2) how to deal with the exploding number of papers in the literature, (3) discussing general job prospects in the long term and (4) possibilities for tenure-track positions at academic, governmental and international organizations.

Your own experienced consultant for free!

The second initiative is a new orientation program called the "Young Astronomer Consulting Service". The purpose of this is to have a clearly identified office where Young Astronomers meet with experienced astronomers by arranged appointments, to seek advice about their CVs, thesis work, jobs, etc. during one-to-one discussions. And yes, you can arrange to meet with more one than one consultant. This service will be run during the entire General Assembly (16–25 August). The location is Meeting Hall 2.2 located on the second floor of the Congress Centre. This program was initated some weeks ago through dedicated web pages **http://astro.cas.cz/yae/consulting_service.php** where astronomers volunteered to participate in this program and have expressed their areas of expertise and experience, and in which the young astronomers indicated their goals. For all young astronomers: it is still possible to make an appointment and get expert "free" advice and to advance your careers. You will find the link to the questionnaire at the URL at **https://astro.cas.cz/yae/php/questionary_cs.php** Or come and find us at Meeting Hall 2.2, or leave a message at the Young Astronomers Message Box. With these events, the young astronomers' future might not necessarily become brighter, but for most the path to take might be better defined. We, the organizers, hope that the events will give those participating new ideas and some additional useful connections to their collaborative network. It should interesting, worthwhile, and fun for all of us.

T. YAST (The Young Astronomers Supporting Team)

Tuesday 15/8

12 °C / 54 °F morning minimum
21 °C / 70 °F afternoon maximum
Cloudy with possible rain
SW winds 8 m/s (18 mph)

Wednesday 16/8

10 °C / 50 °F morning minimum
23 °C / 74 °F afternoon maximum
Partly sunny and dry
ESE winds 4 m/s (9 mph)

Erratum, 1st issue: The caption of the Figure 3 on page 3 (top right) should read: "Solar UV irradiance (red curves) and terrestrial temperature (blue curves) vs. time. All curves have been smoothed by an 11-year running mean". We apologize for this misprint.

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DISSERTATIO CVM
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PRAGAE — MMVI 16. VIII. — SERIES TERTIA

The Inaugural Ceremony

Petr Lála

The 26th General Assembly was formally opened yesterday, during a well attended Inaugural Ceremony at the main Congress Hall. It was a quite balanced mixture of speeches, performances and lectures, skillfully moderated by Jan Palouš, Chair of the National Organizing Committee.

The Ceremony began with opening words by outgoing IAU President Ronald Ekers and with the Czech Republic anthem performed by Prague Lesser Town Singers.

The official addresses included a message from the president of the Czech Republic Václav Klaus, and speeches delivered by the Counselor of the City Hall of Prague, President of the Academy of Sciences of the Czech Republic Václav Pačes and by Deputy Rectors of the Masaryk University in Brno, Charles University in Prague and Rector of the Czech Technical University also in Prague.

The golden thread all through the speeches was the dedication of local authorities and institutions to provide the best environment for GA deliberations in order to justify the trust of IAU in deciding to convene the GA in Prague for a second time.

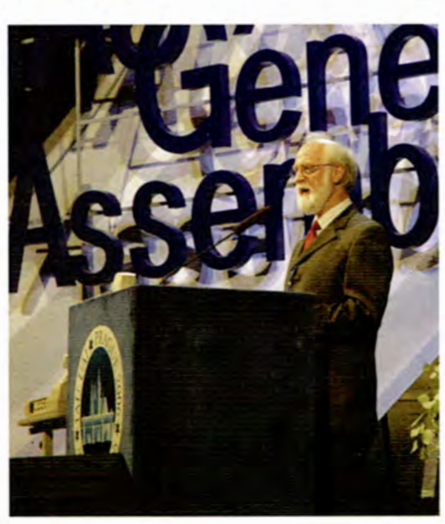
The audience was also welcomed by Luboš Perek, doyen of Czech astronomers. In a nutshell, he shared his recollections on personalities and developments in between the GA in Prague in 1967 and 2006. (The text of his presentation can be found in this issue of Nuncius Sidereus.)

The Children's Traditional Ensemble Rosénka and Prague Lesser Town Singers performed before and after the presentation of the Peter Gruber Foundation Cosmology prize for 2006 to John Mather and the Cosmic Background Explorer (COBE) team and of two fellowships for young astronomers.

Last but not least, Alena Hadravová gave an interesting lecture describing the role of Prague *genius loci* in the development of astronomy from the Middle Ages to the present time.

The Inaugural Ceremony was followed by the first session of the General Assembly and later on by a cocktail welcoming all visiting guests. ❐

"TO PLUTO BE OR NOT UB313, THAT IS THE QUESTION!"



Abstract of today's Invited Discourse

Today's Invited Discourse at 6:15 p.m. in the Congress Hall

The Evolution of Life in the Universe: Are We It?

Jill Tarter, SETI Institute

In his book "Many Worlds", Steven J. Dick has chronicled the millennia of discourse about other inhabited worlds, based upon deeply held religious or philosophical belief systems. The popularity of the idea of extraterrestrial life has waxed and waned and, at its nadir, put proponents at mortal risk. The several generations of scientists now attending this General Assembly of the International Astronomical Union at the beginning of the 21st century have a marvelous opportunity to shed light on this old question of habitable worlds through observation, experimentation, and interpretation, without recourse to belief systems and without risking our lives (though some may experience rather bumpy career paths). The newly-named and -funded, multi-disciplinary field of astrobiology is extremely broad in its scope and is encouraging IAU members to learn and speak the languages of previously disparate disciplines in an attempt to answer the big picture questions: "Where did we come from?" and "Are we alone?" These are questions that the general public (our ultimate paymasters) understand and support, and these are questions that are attracting students of all ages to science and engineering programs. These questions also push the limits of instrumentation to explore the cosmos remotely across space and time, as well as to examine samples of interplanetary space returned to the laboratory and samples of distant time teased from our own Earth.

Within my personal event horizon, the other planetary systems long-predicted by theorists have been revealed, along with many whose structure was not predicted. The 'just-so' conditions requisite for the comfort of astronomers have been understood to be only a very narrow subset of the conditions that nurture extremophilic microbial life. Thus the potentially habitable real estate beyond Earth has been greatly expanded and within the next few decades it may be possible to detect the biosignatures or technosignatures of any inhabitants.

John Downland

What poor astronomers are they

What poor astronomers are they take women's eyes for stars,
and set their thoughts in battle 'ray, to fight such idle wars,
when in the end they shall approve
'tis but a jest drawn out of love.

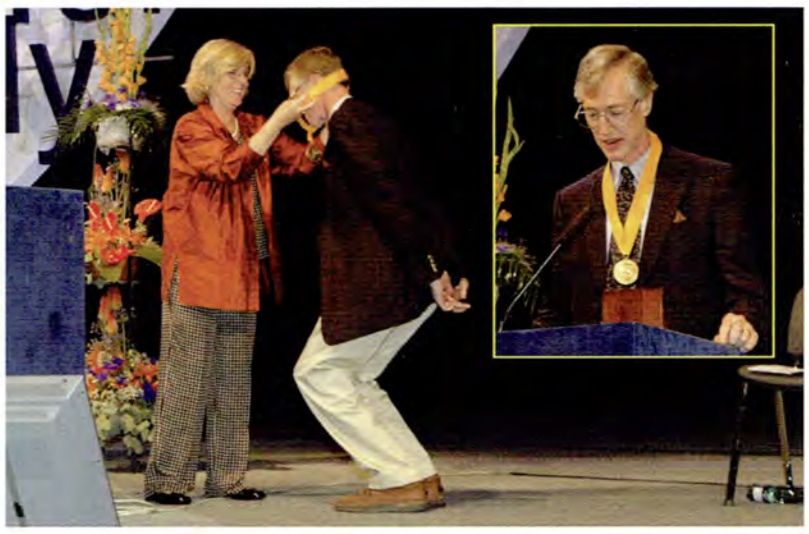
But yet it is a sport to see how wit will run on wheels,
while will cannot persuaded be, with that which reason feels;
that women's eyes and stars are odd,
and Love is but a feigned god.

But such as will run mad with will, I cannot clear their sight,
but leave them to their study still, to look where is no light.
'Till them too late we make them try,
they study false astronomy!

John Downland (1563–1626), was unsurpassed in his day as a lute virtuoso, and the composer of 88 lute songs. Since the early twentieth century, Dowland's excellence as a songwriter has been well established; many of his compositions for lute – long shrouded in obscurity – have become well known.

Today's programme: (wednesday 16/8)

- Symposia S235, S236, S237
- Joint Discussions JD01, JD02, JD03, JD04, JD05
- Special Session SPS1
- Peter Gruber Foundation Cosmology Prize Winner Lecture
- Invited Ddiscourse – Jill Tarter



Interview with John C. Mather

2006 Gruber Cosmology Prize recipient

Michael Prouza

You started your work on the COBE proposal as a post-doc in 1974. The satellite was eventually launched in 1989. Do you consider a 15-year development to be adequate or was it possible to have COBE ready sooner?

As it turned out 15 years was barely enough, though in retrospect it seems to be a long time. We had such a huge number of technical challenges that we were fortunate to get the project done in 15 years. None of the technologies were as mature as we believed, and the scientists and engineers were doing this kind of project for the first time. If you read the book (The Very First Light) you will get a sense of the incredible accomplishment of the team.

When did you actually begin to believe that this mission would go and fly? When did you receive the first real funding dedicated directly for the development of individual instruments?

After the first science team was chosen in 1976, I always believed that this project would fly, because it was unique, the only possible way to answer the critical questions about the Big Bang. Also, Nancy Boggess, my counterpart at NASA HQ, was articulate and determined to make the mission happen. She was responsible for three major missions in the infrared: IRAS, COBE, and Spitzer, and all have been brilliant successes, despite complaints and opposition from other areas of astronomy. We were approved for flight in 1982, I think, after it was clear that our precursor satellite, the IRAS, was past its major difficulties. IRAS was launched successfully on January 25, 1983.

What results did you expect? Did you guess that COBE would find any (and what type of) anisotropy?

I expected about what we found: a nearly-perfect blackbody spectrum, anisotropy at the level we found, and a near and far IR background radiation field. Theorists had agreed shortly before the COBE launch that the anisotropy must exist because of the galaxy correlation functions. Many theorists were surprised that the background spectrum was so perfect, but I wasn't – there are a lot of photons per atom, and there were no plausible energy sources to modify the spectrum after decoupling. I also was expecting the near and far IR background excess found by DIRBE, because I thought a lot of galaxies are dusty and they would convert a lot of starlight into IR and far IR.

What was your favorite cosmological model in 1974 and what is it now?

Good question. I don't remember 1974 well enough but I don't think there was much to think about. We knew the universe must be slowing down because of gravity (that was wrong) and we had no clue about inflation. When inflation was first suggested much later, a common reaction was that it was silly because it was just cooked up to solve a problem, and there would never be a way to test it. Dark Matter was beginning to be discussed but could be argued away as experimental error. Dark Energy and even the Cosmological Constant were not popular. I was an agnostic. My view was and is that Nature doesn't care a bit what we think is "simple" or "elegant", and especially in astronomy, where energy flows from hot to cold favor the development of complexity. The same energy flows favor life, which is pretty complex, and would never have been predicted from basic principles.

How many dimensions has our universe to your opinion?

I don't have a serious opinion about that. I can see only three and I think I remember the fourth. The subatomic ones are not tangible but I would not be surprised at many many.

The precise knowledge of cosmic microwave background (CMB), based on the pioneering work of the COBE team, is the current cornerstone of the observational cosmology. Are you able to name at least one topic in experimental cosmology that can prove to be comparably fruitful in the future? (E.g. as advice to current young postdocs or graduate students, where to look for interesting opportunities.)

Well, the current bandwagons are three: dark energy and dark matter, and the polarization of the CMB. A huge investment is going into astrophysical studies of dark energy, because there's no other way. The dark matter is also exciting but almost as hard to study. The CMB polarization has the potential to tell us about the scalar/tensor nature of the Big Bang forces and inflation, so that's also pretty exciting.

COBE, WMAP and Planck: Which of these satellites will be considered as the most important by future historians of science in 2106? Why?

Darned if I know. WMAP has found out an awful lot more about the anisotropy than COBE did, and I have my doubts that Planck will be as much improvement as its builders hoped. COBE found out that there was something to study, so it opened the field and started an industry, so it's important historically. Which is more important, Christopher Columbus or Albert Einstein? They're not really comparable.

You are currently the Senior Project Scientist for the James Webb Space Telescope (JWST). What will be the most important observation targets of this telescope? What discoveries may we anticipate?

Do you think that June 2013 is the final date of launch, or some further delay is still possible? (Why?)

The JWST will be pointed at every target of interest to astronomy, because it's a general purpose user facility. We think the main topics will be: 1) the first light in the universe, from Population III stars or whatever; 2) the assembly of galaxies, from whatever parts may exist; 3) the formation of stars and planetary systems, and 4) the conditions for life. We anticipate finding out a lot about each topic. We should see galaxies and first stars that are much earlier and farther away than any we have yet seen, we hope to see planets around other stars and have a chance to measure their chemical and physical properties, and we might even see a few Earth-like ones in transit against their home stars. Exoplanet studies were barely dreamed of when JWST was first conceived. Now there's a serious proposal to build an external occulter, flying 25,000 km away from JWST, that would block starlight and reveal Earthlike planets quite well. See "New World Observer" and Webster Cash at the University of Colorado.

June 2013 is definitely the launch date for JWST. My crystal ball is perfect. More seriously, anyone can see that NASA's budget is in crisis, and nobody can predict what that means. We have no technical worries now that would lead to a launch slip, and we have budgeted a prudent and ample reserve of funds to handle things we can't specifically identify late in the program. So 2013 is quite possible.

Will you dare to predict any name of potential future recipients of the Cosmology Gruber Prize?

No, thanks.

I have read in one of your interviews that your first scientific experience was the observation of Mars opposition in 1954, at age eight. Have you also observed the last closest Mars approach last November? What was the telescope used then and what was used now?

In 1954 we had a 2-inch diameter refractor my dad bought at Sears Roebuck. It was a great disappointment for Mars. I didn't try hard to see Mars the last time it came close but now my wife has bought me a nice 8-inch Celestron that works quite well. Mars is still awfully small and suburban Washington is not a great place for private astronomy. Space telescopes are a lot better! ❐

Dr. John C. Mather biography

Dr. John C. Mather, Senior Astrophysicist, Goddard Fellow, and Senior Project Scientist for the James Webb Space Telescope (JWST), is responsible for ensuring the scientific success of the JWST. He has been Goddard's lead scientist for JWST since studies were initiated Oct. 30, 1995. He is a member of the Infrared Astrophysics Branch. Previously, he served as Project Scientist for the Cosmic Background Explorer satellite (COBE), and as Principal Investigator for the Far Infrared Absolute Spectrophotometer (FIRAS) on COBE. He organized the first proposal for the COBE in 1974 and led the scientific effort through the completion of the mission. As FIRAS PI he measured the cosmic microwave background radiation spectrum to the unprecedented precision of a part in 100,000, showing that it matches the spectrum of a perfect blackbody and must have originated in the primordial Big Bang of the universe. He served as Head of the Infrared Astrophysics Branch from 1988–1989 and from 1990–1993.

Dr. Mather began his career at NASA's Goddard Institute for Space Studies as a Research Associate of the National Academy of Sciences. He received a Bachelor of Arts degree in Physics from Swarthmore College in Swarthmore, Pennsylvania, and a PhD in Physics from the University of California at Berkeley.

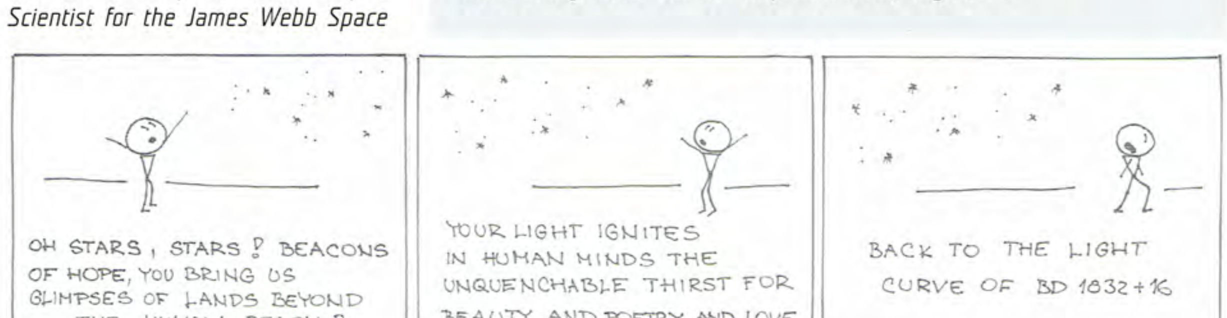
Gruber Cosmology Prize

The Cosmology Prize of the Peter Gruber Foundation was established in 2000. The prize, consisting of gold medal and $250,000 cash prize is awarded annually to an outstanding astronomer, cosmologist, physicist, mathematician, or philosopher of science, selected from an international pool of candidates by a board of distinguished peers in their fields. Since 2001, the Cosmology Prize is co-sponsored by the International Astronomical Union. The list of previous recipients of the prize is following: 2000 – Phillip James E. Peebles & Allan R. Sandage, 2001 – Sir Martin Rees, 2002 – Vera Rubin, 2003 – Rashid Alievich Sunyaev, 2004 – Alan Guth & Andrei Linde, and 2005 – James E. Gunn.

An Astronomers' Data Manifesto: Mining science from Archives

Ray Norris

Did you know that three times as many papers (and citations) result from data retrieved from the Hubble archive as those based on the original data? So, in principle, observatories can quadruple their science by making their archive data public. Try telling that to a politician concerned with bangs-per-buck. It may not be news. All OECD science ministers have signed a principle, which says that all publicly-funded data should be placed in the public domain. And at the last IAU GA in Sydney, we all voted to support a resolution urging our publicly--funded observatories to do so. So why are most archive data (with some notable exceptions) still hidden from the bright light of the internet? Funding? Or poor systems to access them cost-effectively? If we want to maximise our science per dollar, we need to find better ways of doing this. Join the search at Special Session SPS6: "Astronomical Data Management" on Tuesday afternoon, August 22.



First science with SALT:

Observations of an eclipsing polar

Accreting gas onto compact stars is a common occurrence in astronomy; it's one of the indirect ways in which we detect black holes, especially through their X-ray emission by the accreting gas. It's also believed to be the fundamental cause of the Type Ia supernova explosions by which we have recently measured the acceleration of the universe. The study to be described below is of a polar, an example of a compact object accreting gas from a nearby companion. Polars have the added feature that the compact object has a very strong magnetic field. They are the most readily accessible objects we know for studying gas accretion in strong magnetic fields.

Darragh O'Donoghue, South African Astronomical Observatory

The Southern African Large Telescope (SALT) was inaugurated in November 2005. One of the capabilities which SALT and its instruments has, and which very few large telescopes have, is the ability to take very rapid pictures of stars. This is intended to enable us to study the rapid brightness changes in exotic stars. One such class of stars are called "polars". These are binary stars: two stars orbiting each other. Polars are amongst the closest binaries we know: the orbit of the two stars would fit inside the Sun! The polar which SALT has studied takes only one and a half hours to complete an orbit. Despite being a pair of stars, they are so close, you would see them as only one star in a telescope.

In the binary system which SALT has studied, one of the stars is like the Sun, only cooler, redder and about 1/3 of the mass and radius of the Sun. The other star is a very dense white dwarf star: its mass is similar to the Sun's, but it is squeezed into the size of the Earth (whose diameter is about 1 per cent that of the Sun). The white dwarf's gravity is very large: white dwarf gas the size of a dice would weigh as much as a small truck.

The amazing thing about these binaries is that the white dwarf is gravitationally sucking the outer layers off its companion. The white dwarf also has a huge magnetic field (30 million times the Earth's magnetic field) which channels the gas coming off the cool star down to its magnetic poles. Figure 1 is an artist's impression of what a typical such binary system might look like: the cool, red star is in the background with the stream of gas being sucked off it (shown in white) and finding its way down to the white dwarf shown at lower right.

Figure 1. The artist Bob Watson's painting of a "polar".

Imagine now looking at a binary system like this from "behind" the cool, red star with your viewing angle such that the red star, once in orbit, eclipses the white dwarf and cuts off your view of it. If you had a telescope like SALT, and a camera on it like its camera SALTICAM, which can make brightness measurements every 100 milliseconds, you would see the brightness of the system dim because the light from the gas crashing on to the magnetic poles of the white dwarf completely outshines the light from everything else. Figure 2 illustrates of your view of the system at the start of eclipse (left) when the red star is just about to eclipse the one magnetic pole, labeled Spot 2, and at the end of the eclipse (right) when the red star has just uncovered Spot 2.

Figure 3 is a sequence of brightness measurements and the evidence for what has just been described can be seen there sequence. If you look closely at Figure 3, you will see it has a first sudden brightness drop (Spot 2 disappearing), followed about 25 s later by a second sudden brightness drop (Spot 1 disappearing). Towards the end of the sequence there are sudden rises in brightness corresponding to the earlier sudden drops as the spots are uncovered. The gas stream between the stars also gives some light, and this accounts for the rounded shape of the bottom of the eclipse.

This sequence of measurements is better than anything that has been obtained before, and has been described in full scientific detail in the first scientific paper (or report) on the science from SALT.

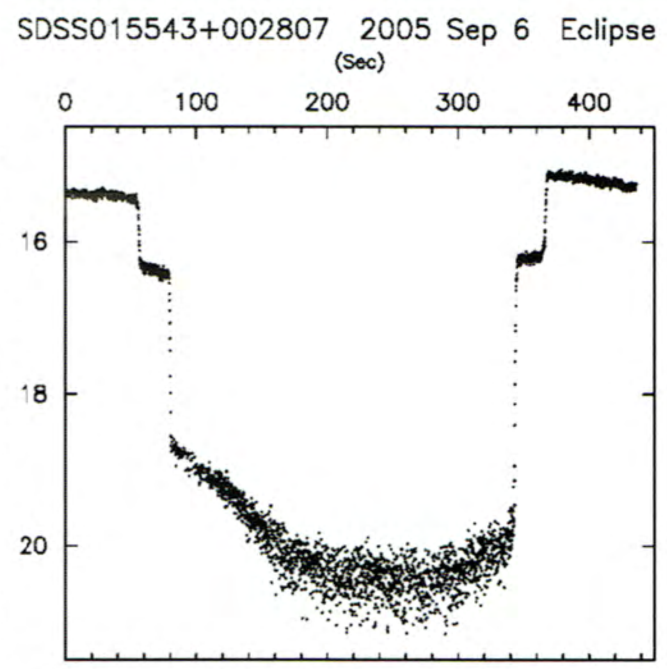


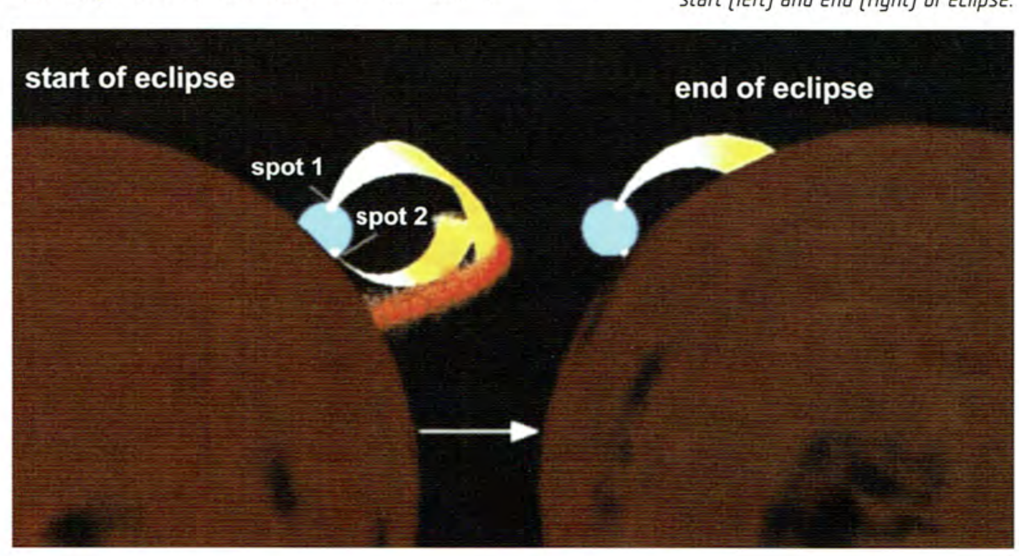
Figure 3. Sequence of brightness measurements of the polar. Each point is a 112 millisecond exposure.

These results have been accepted for publication in the scientific peer-reviewed journal Monthly Notices of the Royal Astronomical Society. An electronic preprint of the article is available online at **http://xxx.lanl.gov/archive/astro-ph**, entry number *0607266*.

SALT is especially suited to studying objects of the kind just described. Amongst the world's currently largest telescopes, it has a significant advantage over all the others for this kind of research, which will undoubtedly enable its astronomers to probe the mysteries of this kind of star.

For further information, contact Dr. Darragh O'Donoghue: +27 214 470 025, dod@saao.ac.za At the IAU General Assembly in Prague, contact Prof. Phil Charles or Dr. David Buckley. ❐

Figure 2. Earth observer's view of a polar at the start (left) and end (right) of eclipse.



Address at the Inaugural ceremony

Welcome after 39 Years

Luboš Perek

Ladies and Gentlemen,

at the thirteenth General Assembly of the IAU, held 39 years ago, I had the privilege to invite the audience to meet again soon in Prague. Thirty nine years is a short time in astronomy but in human life it means two generations. Many things have changed in that time. All branches of astronomy made substantial advances thanks to space research, to computer technology, and, in first place thanks to a larger number of human brains working in the field. It is impossible to give an account of all new discoveries and of new understanding of old problems. Be referred to 200 volumes of IAU Symposia and 200 volumes of IAU Colloquia which appeared in those 39 years.

There are things, however, which have not changed. Among them is the individual membership in the IAU, an important support of personal contacts across space and time. As regards space, we greet astronomers from 75 countries. As regards time, connecting past with the present, we have in Prague four former presidents of the IAU. The youngest, in terms of service, is Franco Pacini, whose name is closely connected with rotating neutron stars. He was preceded by Lodewijk Woltjer, a supporter of the Very Large Telescope at Mount Paranal. Yoshihide Kozai stands for lunisolar perturbations of satellite orbits. The oldest in service is Adriaan Blaauw. He put all runaway stars into their place in an improved cosmic distance scale. More than half a century ago, I had the honor and pleasure to share an office with Adriaan at the Leiden Observatory, where the atmosphere consisted not of air or oxygen but of pure astronomy.

Seven former General Secretaries, who devoted part of their lives to the IAU, are among us, starting with my predecessor, Jean-Claude Pecker, my lifelong friend, who attended more IAU congresses than anybody else. My successor, Kees de Jager, made the Sun his permanent residence. Further Jean-Paul Swings, supporter of Mars exploration. Derek Mc Nally, fighter against adverse environmental impacts, Johannes Andersen, director of the Nordic Optical Telescope, and Hans Rickman, observer of the comet impact on Jupiter.Names of all former presidents of commissions, professors, and colleagues who connect the past with the present are too many to be listed here and now. They are all welcome, as well as all those who will become friends and colleagues at this Assembly.

Ladies and Gentlemen, next time, please, do not wait 39 years. You are welcome any time.

IAU Planet Definition Committee

The IAU has been the arbiter of planetary and satellite nomenclature since its inception in 1919. The various IAU Working Groups normally handle this process, and their decisions primarily affect the professional astronomers. But from time to time the IAU takes decisions and makes recommendations on issues concerning astronomical matters affecting other sciences or the public. Such decisions and recommendations are not enforceable by any national or international law; rather they establish conventions that are meant to help our understanding of astronomical objects and processes. Hence, IAU recommendations should rest on well-established scientific facts and have a broad consensus in the community concerned.

Ron Ekers, President of the IAU

The boundary between (major) planet and minor planet has never been defined and the recent discovery of other "Trans-Neptunian Objects" (TNOs), including some larger than Pluto, triggered the IAU to form a working group on "Definition of a Planet" from its Division III members. While there was general agreement on all the scientific issues related to Solar System dynamics and physical properties of planets, the IAU Division III Working Group could not agree on aspects that were related to social and cultural issues, such as the status of Pluto. In order to include these broader aspects, the IAU Executive Committee (EC) formed a new committee whose membership had backgrounds in history, science publishing, writing and education as well as in planetary science.

Terms of Reference

The Planet Definition Committee of the IAU Executive Committee was charged with:

(i) discussing the broader social implications of any new definition of a planet and recommending a course of action that balances the scientific facts with the need for social acceptance of any change;
(ii) addressing the status of Pluto, and of the newly discovered TNOs in the light of recommendation (i);
(iii) considering whether the current naming procedures for planets and minor planets have exacerbated the problem of defining a planet and recommending whether revisions are needed; and
(iv) attempting to frame these recommendations as a resolution, or resolutions, that could be put before the Prague GA in August 2006 for possible adoption.

The Path to Defining Planets

Owen Gingerich, Harvard-Smithsonian Center for Astrophysics/IAU EC "Planet Definition" Committee chair

Celestial nomenclature has long been fraught with controversy. Galileo proposed to name the large satellites of Jupiter the "Medicean planets"; William Herschel named his new planet after the English monarch, George III; Hevelius honoured the defender of Vienna with "Scutum Sobieski"; and Bode named a northern constellation after the comet hunter Charles Messier. None of these appellations have stood the test of time except for the fragment "Scutum".

At its inaugural meeting in 1922, the IAU standardized the constellation names and abbreviations. More recently IAU Committees or Working Groups have certified the names of asteroids, satellites, and planetary and satellite features. Until now, however, the IAU has never named a planet, and it has been unclear whether there are potential planets to be named.

How, in fact, should the word "planet" be defined?

This was the controversial question facing the committee established by the IAU Executive Committee with the charge to recommend a definition for an IAU resolution. The seven members represented a spectrum of opinion and expertise. We all knew that modern scientific advances have taught us that the Solar System is a far more complicated place than William Herschel and his contemporaries ever imagined, not only containing an assortment of planets, asteroids, and comets, but rocks, gravel, dust, and ions. We met in Paris for a vigorous discussion of both the scientific and the cultural/historical issues, and on the second morning several members admitted that they had not slept well, worrying that we would not be able to reach a consensus. But by the end of a long day, the miracle had happened: we had reached a unanimous agreement.

On the scientific side, we wanted to avoid arbitrary cut-offs simply based on distances, periods, magnitudes, or neighbouring objects. One physical criterion seemed pre-eminent: was the object shaped by hydrostatic equilibrium, that is, was it basically a round object? This criterion became the basis of our proposed definition. Objects with mass above 5×10^{20} kg and diameter greater than 800 km would normally be considered to be in hydrostatic equilibrium, but borderline cases would have to be established by observation. Even among these round Solar System objects there is a distinct difference between the major planets, whose orbits lie near the ecliptic plane, and those smaller objects with more eccentric, tilted orbits. Had astronomers realized in 1930 that Pluto was smaller than our Moon and with a mass well under 1 % that of the Earth, perhaps some special designation would have been devised for it. On the cultural/historical side, combined with contemporary science, our committee felt that the time was ripe to recognize Pluto as the prototype of a different sort of planet. Consequently, we propose to distinguish between the eight classical planets discovered before 1900, and a new class of Trans-Neptunian Objects, for which we recommend the name "plutons."

The question immediately arises about the status of Pluto. Although Pluto remains a planet by the proposed definition, it will generally be preferable to call it a pluton to emphasise its role as the prototype for a physically distinct category of planetary bodies.

Specialists will at once recall that there are over a hundred so-called "plutinos," Trans-Neptunian lumps of rock, ice, and snow, each with the period 248 years (thus in a 3/2 resonance with the period of Neptune). These faint objects are in general not plutons. Plutons are at present very rare objects: Pluto, Charon, 2003 UB_{313}, and perhaps several more, and anyone who finds a new pluton should be appropriately celebrated.

Savvy astronomers will notice that our definition also makes Ceres a planet, and if Pallas, Vesta, and Hygeia are found to be in hydrostatic equilibrium, they will also have to be considered planets. Without making a formal definition, we suggest that it might be convenient simply to refer to these small round members of our inner Solar System as "dwarf planets."

Did our committee think of everything, including extra-solar system planets? Definitely not! Science is an active enterprise, constantly bringing new surprises. Undoubtedly some future IAU committee will have to revisit this question and define the upper limit for "planet", probably well before 2106! ❐

The Process of making a Resolution on the Definition of a Planet

Robert Williams, Space Telescope Science Institute, Vice President of the IAU

Statements of scientific importance are expressed by the IAU in resolutions of the General Assembly. Although resolutions are non-binding they do represent the consensus scientific judgment of the members, and are arrived at by a process that involves member input and debate. As explained in the accompanying articles the question of the definition of a planet is of great interest within the Union and among the public, and Division III and the Executive Committee are attempting to set forth criteria that define planets and provide for a nomenclature for the different Solar System objects.

A Working Group under Division III was established to formulate a recommendation on the definition of a planet that could be put before the Executive Committee. Although that Working Group did not achieve a clear consensus, it did succeed in defining the important criteria and framing the discussion of issues to be considered. The EC studied the Division III Working Group report and decided to form its own advisory group, the Planet Definition Committee, to attempt to resolve the issue in a manner that had a solid scientific basis and which might achieve consensus support among members of the Union. Prof. Gingerich has described the work of the Planet Definition Committee, whose report has been received by the EC and used as a basis for framing the draft resolution that is now being put before the General Assembly. The current draft of the resolution "The Definition of a Planet" that has been approved by the EC and the Resolutions Committee appears with these articles.

The process by which resolutions are considered by the IAU is set forth in the Working Rules. It involves consideration by the Resolutions Committee and the Executive Committee, and discussion by the General Assembly before a vote taken in the second business meeting of the GA. Because of the potential impact of this resolution the EC is undertaking extra measures to assure full discussion of the draft during the General Assembly that will allow for possible revisions to the current version before it is presented to the GA at the closing business meeting. They include a discussion and debate of the resolution by Division III-Planetary Sciences at its scheduled meeting this Friday, 18 August. In addition, the EC is convening an extraordinary plenary session of the General Assembly to take place next Tuesday, 22 August, during the lunch break, which will be devoted entirely to a discussion of the draft resolution, and after which a "sense of the meeting" vote will be taken on the resolution as presented. We are fully aware of the potential

Members of the Planet Definition Committee

Dr. Richard Binzel is Professor of Earth, Atmospheric and Planetary Science at MIT and a specialist in asteroids and outer Solar System small bodies, and is also a well known and respected educator and science writer.

Dr. André Brahic is Professor at Université Denis Diderot (Paris VII) and is Director of the Laboratory Gamma-gravitation of the Commissariat a l'Energie Atomique. He specializes in planetary rings, and has co-discovered the rings and arcs of Neptune. For the French-speaking public, André Brahic is one of the best known popularisers of science and astronomy, having authored a number of books.

Dr. Owen Gingerich (chair), Professor of Astronomy and History of Science Emeritus at the Harvard-Smithsonian Center for Astrophysics, is an esteemed historian of astronomy with a broad perspective, and a prize-winning educator.

Dava Sobel is the author of the very successful books *Longitude*, *The Planets*, and *Galileo's Daughter*. She has a solid background in, and knowledge of, the history of science, astronomy in particular.

Dr. Junichi Watanabe is an Associate Professor and also Director of the Outreach Division of NAOJ. He is a Solar System astronomer and highly appreciated in Japan as interpreter and writer of astronomy for the public and students. He has strong connections with amateur astronomers, science editors, school teachers and journalists.

Dr. Iwan Williams, Queen Mary University of London, is an expert on the dynamics and physical properties of Solar System objects. He is the current President of IAU Division III (Planetary Systems Sciences).

Dr Catherine Cesarsky, Director General of ESO and President-Elect of the IAU, took part in the work of the committee, bringing in the perspective of the IAU Executive as well as that of an astronomer at large.

difficulty in achieving a consensus on this complex issue, and we wish to provide ample opportunity for input from members in the formulation of the final resolution to be considered next week.

The key events that bear on the substance of the final resolution to be presented at the closing business meeting, and in which all IAU members are encouraged to participate, are (1) the discussion at the meeting of Division III on Friday, 18 August at 11:00 am in Club B, and (2) the Plenary Session on the Definition of a Planet on Tuesday, 22 August at 12:45 pm in Forum Hall. The Closing Session of the GA will be held Thursday 24 August at 14:00 in the Congress Hall and here the final resolution will be presented, discussed, and voted upon.

The EC reiterates our desire to benefit from members' input into this issue by your participation in these events, which are an important part of the IAU's mission to communicate the discoveries of astronomy to the public. ❐

Resolution 5 for GA-XXVI: Definition of a Planet

Contemporary observations are changing our understanding of the Solar System, and it is important that our nomenclature for objects reflect our current understanding. This applies, in particular, to the designation "planets". The word "planet" originally described "wanderers" that were known only as moving lights in the sky. Recent discoveries force us to create a new definition, which we can make using currently available scientific information. (Here we are not concerned with the upper boundary between "planet" and "star".)

The IAU therefore resolves that planets and other Solar System bodies be defined in the following way:

(1) A planet is a celestial body that (a) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape[1], and (b) is in orbit around a star, and is neither a star nor a satellite of a planet.[2]

(2) We distinguish between the eight classical planets discovered before 1900, which move in nearly circular orbits close to the ecliptic plane, and other planetary objects in orbit around the Sun. All of these other objects are smaller than Mercury. We recognize that Ceres is a planet by the above scientific definition. For historical reasons, one may choose to distinguish Ceres from the classical planets by referring to it as a "dwarf planet."[3]

(3) We recognize Pluto to be a planet by the above scientific definition, as are one or more recently discovered large Trans-Neptunian Objects. In contrast to the classical planets, these objects typically have highly inclined orbits with large eccentricities and orbital periods in excess of 200 years. We designate this category of planetary objects, of which Pluto is the prototype, as a new class that we call "plutons".

(4) All non-planet objects orbiting the Sun shall be referred to collectively as "Small Solar System Bodies".[4]

[1] This generally applies to objects with mass above 5×10^{20} kg and diameter greater than 800 km. An IAU process will be established to evaluate planet candidates near this boundary.

[2] For two or more objects comprising a multiple object system, the primary object is designated a planet if it independently satisfies the conditions above. A secondary object satisfying these conditions is also designated a planet if the system barycentre resides outside the primary. Secondary objects not satisfying these criteria are "satellites". Under this definition, Pluto's companion Charon is a planet, making Pluto-Charon a double planet.

[3] If Pallas, Vesta, and/or Hygeia are found to be in hydrostatic equilibrium, they are also planets, and may be referred to as "dwarf planets".

[4] This class currently includes most of the Solar System asteroids, near-Earth objects (NEOs), Mars-, Jupiter- and Neptune-Trojan asteroids, most Centaurs, most Trans-Neptunian Objects (TNOs), and comets. In the new nomenclature the concept "minor planet" is not used.

Planet Definition Q & A Factsheet

The following Question and Answer sheet may help readers to interpret the "IAU Resolution 5 for GA-XXVI".

Q: What new terms are proposed as official IAU definitions?

A: There are two new terms being proposed for use as official definitions of the IAU. The terms are: "planet" and "pluton".

Q: What is the proposed new definition of "planet"?

A: An object is thus defined as a planet based on its intrinsic physical nature. Two conditions must be satisfied for an object to be called a "planet." First, the object must be in orbit around a star, while not being itself a star. Second, the object must be large enough (or more technically correct, massive enough) for its own gravity to pull it into a nearly spherical shape. The shape of objects with mass above 5×10^{20} kg and diameter greater than 800 km would normally be determined by self-gravity, but all borderline cases would have to be established by observation.

Q: Does an object have to be in orbit around a star in order to be called a "planet"?

A: Yes.

Q: Based on this new definition, how many planets are there in our Solar System?

A: There are currently 12. Eight are the classical planets Mercury through Neptune. Three (Pluto, Charon, and 2003 UB_{313}) are in a newly defined (and growing in number) category called "plutons", for which Pluto is the prototype. One is Ceres, which may be described as a dwarf planet.

Q: What is a dwarf planet?

A: A dwarf planet is a term generally used to describe any planet that is smaller than Mercury. Note that the term "dwarf planet" is simply a descriptive category and not an IAU definition. Terms such as "terrestrial planets" and "giant planets" are additional examples of descriptive categories that are not IAU definitions.

Q: What is a "pluton"?

A: A pluton is a new category of planet now being defined by the IAU. A "pluton" is an object satisfying the technical (hydrostatic equilibrium shape in the presence of self-gravity) definition of "planet." Plutons are distinguished from classical planets in that they reside in orbits around the Sun that take longer than 200 years to complete (i.e. they orbit beyond Neptune). Plutons typically have orbits with a large orbital inclination and a large eccentricity.

Q: Is Ceres a planet?

A: Yes. Ceres is found to have a shape that is in a state of hydrostatic equilibrium under self-gravity. Therefore Ceres is a planet because it satisfies the IAU definition of "planet." [Published reference for shape of Ceres: P. Thomas *et* al. (2005), Nature **437**, 224–227. Dr. Peter Thomas is at Cornell University. Historically, Ceres was called a "planet" when it was first discovered (in 1801).

Q: Is Ceres a "pluton"?

A: No.

Q: Why is 2003 UB_{313} a planet?

A: Recent Hubble Space Telescope images have resolved the size of 2003 UB_{313} showing it to be as large as, or larger than Pluto. Any object having this size, and any reasonable estimate of density, is understood to have sufficient mass that its own gravity will pull it into a nearly spherical shape determined by hydrostatic equilibrium. Therefore, 2003 UB_{313} is a planet because it satisfies the IAU definition of "planet."

Q: Is 2003 UB_{313} a "pluton"?

A: Yes.

Q: What is an object called that is too small to be a "planet"?

A: All objects that orbit the Sun, which are too small (not massive enough) for their own gravity to pull them into a nearly spherical shape are now collectively referred to as "small Solar System bodies." This collection includes the category of objects we continue to call asteroids and comets. This collection also currently includes, near-Earth objects (NEOs), Mars- and Jupiter-Trojan asteroids, most Centaurs and most Trans-Neptunian Objects (TNOs). In the new system of IAU definitions, the term "minor planet" is no longer used.

Table 2: Planet candidates as per 24 August 2006 to be given future consideration if "Resolution 5 for GA-XXVI" is passed.

Object	Unofficial diameter estimate
2003 EL_{61}	2000×1000×1200 km
2005 FY_9	1500±300 km
(90377) Sedna	1200-1800 km
(90482) Orcus	1000±200 km
(50000) Quaoar	~1000 km
(20000) Varuna	600±150 km
(55636) 2002 TX_{300}	<700 km
(28978) Ixion	500±100 km
(55565) 2002 AW_{197}	700±100 km
(4) Vesta	578×560×458 km
(2) Pallas	570×525×500 km
(10) Hygiea	500×400×350 km

Q: Is the term "minor planet" still to be used?

A: No. The term "minor planet" is no longer to be used for official IAU purposes. Under the new definition of "planet", nearly all objects currently called "minor planets" are not planets. For IAU purposes, a definition and name is needed that clearly distinguishes between objects that are officially recognized as planets and those that are not.

Q: When is an object too large to be called a "planet"?

A: The new definitions proposed by the IAU seek only to define the lower boundary between an object that is a "planet" or a "small Solar System body." At this time there is no official IAU definition in place or proposed that defines the upper limit for when an object is, for example a "planet" or a "brown dwarf." This limit is generally thought to be about 13 times more massive than Jupiter, but is subject to discussion.

Q: Is the new definition for "planet" intended to apply also to objects discovered in orbit around other stars?

A: Yes.

Q: Are objects that have planetary sizes and masses, but which are free floating in space (and not orbit a star) officially "planets" by the IAU definition?

A: No. At this time there is no official IAU definition in place that addresses this class of objects. ❐

Table 1: Overview of the planets in the Solar System as per 24 August 2006 if "Resolution 5 for GA-XXVI" is passed.

Object	IAU definition	IAU planet category	Descriptive category	Unofficial mean diameter estimate
Mercury	Planet		Classical	4,879 km
Venus	Planet		Classical	12,104 km
Earth	Planet		Classical	12,746 km
Mars	Planet		Classical	6,780 km
Jupiter	Planet		Classical	138,346 km
Saturn	Planet		Classical	114,632 km
Uranus	Planet		Classical	50,532 km
Neptune	Planet		Classical	49,105 km
Ceres	Planet		Dwarf	952 km
Pluto	Planet	Pluton	Dwarf	2,306±20 km
Charon	Planet	Pluton	Dwarf	1,205±2 km
2003 UB_{313}	Planet	Pluton	Dwarf	2,400±100 km

Other objects that appear large enough so that their shape satisfies the definition of "planet" will be further considered on a case by case basis.

Proposals for IAU Resolutions

Traditionally, the decisions and recommendations of the Union on scientific and organizational matters of general and significant importance are expressed in the Resolutions of the General Assembly. Resolutions should address astronomical matters of significant importance for the international astronomical community as a whole. The following Resolutions will be submitted for consideration at the second session of the IAU General Assembly on Thursday August 24, 2006.

Oddbjørn Engvold, IAU General Secretary

Resolution 1

Adoption of the P03 Precession Theory and Definition of the Ecliptic

Proposed by: IAU Division I WG on "Precession and the Ecliptic"
Supported by: Division I

The following persons will be available for consultations and, if necessary, to speak on the above resolution at the General Assembly on August 24, 2006:

Proposer:	James L. Hilton (USA)	Email: jhilton@aa.usno.navy.mil
Substitute:	Nicole Capitaine (France)	Email: nicole.capitaine@obspm.fr
Seconder:	Patrick Wallace (UK)	Email: ptw@star.rl.ac.uk
Substitute:	Jan Vondrak (Czech Republic)	Email: vondrak@ig.cas.cz

The XXVIth International Astronomical Union General Assembly,

Noting

1. the need for a precession theory consistent with dynamical theory,
2. that, while the precession portion of the IAU 2000A precession-nutation model, recommended for use beginning on 1 January 2003 by resolution B1.6 of the XXIVth IAU General Assembly, is based on improved precession rates with respect to the IAU 1976 precession, it is not consistent with dynamical theory, and
3. that resolution B1.6 of the XXIVth General Assembly also encourages the development of new expressions for precession consistent with the IAU 2000A precession-nutation model, and

Recognizing

1. that the gravitational attraction of the planets make a significant contribution to the motion of the Earth's equator, making the terms *lunisolar precession* and *planetary precession* misleading,
2. the need for a definition of the ecliptic for both astronomical and civil purposes, and
3. that in the past, the ecliptic has been defined both with respect to an observer situated in inertial space (inertial definition) and an observer co-moving with the ecliptic (rotating definition),

Accepts

The conclusion of the IAU Division I Working Group on Precession and the Ecliptic published in Hilton *et* al. 2006, *Celest.Mech.* **94**, 351, and

Recommends

1. that the terms *lunisolar precession* and *planetary precession* be replaced by *precession of the equator* and *precession of the ecliptic*, respectively,
2. that, beginning on 1 January 2009, the precession component of the IAU 2000A precession nutation model be replaced by the P03 precession theory, of Capitaine *et* al. (2003, *A&A*, **412**, 567-586) for the precession of the equator (Eqs. 37) and the precession of the ecliptic (Eqs. 38); the same paper provides the polynomial developments for the P03 primary angles and a number of derived quantities for use in both the equinox based and CIO based paradigms,
3. that the choice of precession parameters be left to the user, and
4. that the ecliptic pole should be explicitly defined by the mean orbital angular momentum vector of the Earth-Moon barycenter in an inertial reference frame, and this definition should be explicitly stated to avoid confusion with other, older definitions.

Note

Formulae for constructing the precession matrix using various parameterizations are given in Eqs. 1, 6, 7, 11, 12 and 22 of Hilton *et* al. (2006). The recommended polynomial developments for the various parameters are given in Table 1 of the same paper, including the P03 expressions set out in expressions (37) to (41) of Capitaine *et* al. (2003) and Tables 3–5 of Capitaine *et* al. (2005).

References

Capitaine, N. Wallace, P.T., & Chapront, J. 2003, *A&A*, **412**, 567
Capitaine, N. Wallace, P.T., & Chapront, J. 2005, *A&A*, **432**, 355
Hilton, J.L., Capitaine, N., Chapront, J., Ferrandiz, J.M., Fienga, A., Fukushima, T., Getino, J., Mathews, P., Simon, J.-L., Soffel, M., Vondrak, J., Wallace, P., & Williams, J. 2006, Celest. Mech. **94**, 351.

Action to be taken by the General Secretary upon adoption of the Resolution

Adoption of the P03 Precession Theory and Definition of the Ecliptic

The following institutions should receive formal notification of the action:

Her Majesty's Nautical Almanac Office, Institut de mécanique céleste et de calcul des éphémérides, Institute of Applied Astronomy of the Russian Academy of Sciences, International Association of Geodesy (IAG), International Earth Rotation and Reference Systems Service (IERS), International Union of Geodesy and Geophysics (IUGG), International VLBI Service for Geodesy and Astrometry (IVS), Japanese Maritime Safty Agency (JMSA), Nautical Astronomical Observatory of Japan (NAOJ), Nautical Almanac Office of the United States Naval Observatory

Resolution 2

Supplement to the IAU 2000 Resolutions on reference systems

Proposed by: IAU Division I WG on "Nomenclature for Fundamental Astronomy"
Supported by: IAU Division I

The following persons will be available for consultations and, if necessary, to speak on the above resolution at the General Assembly on August 24, 2006:

Proposer:	Nicole Capitaine (France)	Email: nicole.capitaine@obspm.fr
Substitute:	Patrick Wallace (UK)	Email: ptw@star.rl.ac.uk
Seconder:	Dennis D. McCarthy (USA)	Email: mccarthy.dennis@usno.navy.mil
Substitute:	Sergei Klioner (Germany)	Email: klioner@rcs.urz.tu-dresden.de

Recommendation 1:

Harmonizing the name of the pole and origin to "intermediate"

The XXVIth International Astronomical Union General Assembly,

Noting

1. the adoption of resolutions IAU B1.1 through B1.9 by the IAU General Assembly of 2000,
2. that the International Earth Rotation and Reference Systems Service (IERS) and the Standards Of Fundamental Astronomy (SOFA) activity have made available the models, procedures, data and software to implement these resolutions operationally, and that the Almanac Offices have begun to implement them beginning with their 2006 editions, and
3. the recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIA, 2005), and

Recognizing

1. that using the designation "intermediate" to refer to both the pole and the origin of the new systems linked to the Celestial Intermediate Pole and the Celestial or Terrestrial Ephemeris origins, defined in Resolutions B1.7 and B1.8, respectively would improve the consistency of the nomenclature, and
2. that the name "Conventional International Origin" with the potentially conflicting acronym CIO is no longer commonly used to refer to the reference pole for measuring polar motion as it was in the past by the International Latitude Service,

Recommends

1. that, the designation "intermediate" be used to describe the moving celestial and terrestrial reference systems defined in the 2000 IAU Resolutions and the various related entities, and
2. that the terminology "Celestial Intermediate Origin" (CIO) and "Terrestrial Intermediate Origin" (TIO) be used in place of the previously introduced "Celestial Ephemeris Origin" (CEO) and "Terrestrial Ephemeris Origin" (TEO), and
3. that authors carefully define acronyms used to designate entities of astronomical reference systems to avoid possible confusion.

Recommendation 2:

Default orientation of the Barycentric Celestial Reference System (BCRS) and Geocentric Celestial Reference System (GCRS)

The XXVIth International Astronomical Union General Assembly,

Noting

1. the adoption of resolutions IAU B1.1 through B1.9 by the IAU General Assembly of 2000,
2. that the International Earth Rotation and Reference Systems Service (IERS) and the Standards Of Fundamental Astronomy (SOFA) activity have made available the models, procedures, data and software to implement these resolutions operationally, and that the Almanac Offices have begun to implement them beginning with their 2006 editions,
3. that, in particular, the systems of space-time coordinates defined by IAU 2000 Resolution B1.3 for (a) the solar system (called the Barycentric Celestial Reference System, BCRS) and (b) the Earth (called the Geocentric Celestial Reference System, GCRS) have begun to come into use,
4. the recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIA, 2005), and
5. a recommendation from the IAU Working Group on "Relativity in Celestial Mechanics, Astrometry and Metrology",

Recognizing

1. that the BCRS definition does not determine the orientation of the spatial coordinates,
2. that the natural choice of orientation for typical applications is that of the ICRS, and
3. that the GCRS is defined such that its spatial coordinates are kinematically non-rotating with respect to those of the BCRS,

Recommends

that the BCRS definition is completed with the following: "For all practical applications, unless otherwise stated, the BCRS is assumed to be oriented according to the ICRS axes. The orientation of the GCRS is derived from the ICRS-oriented BCRS."

Action to be taken by the General Secretary upon adoption of the Resolution

Supplement to the IAU 2000 resolutions on reference systems

The following institutions should receive formal notification of the action:

International Union of Geodesy and Geophysics (IUGG), International Association of Geodesy (IAG), International Earth Rotation and Reference Systems Service (IERS), International VLBI Service for Geodesy and Astrometry (IVS), International Laser Ranging Service (ILRS), International GNSS Service (IGS), International DORIS Service (IDS)

Resolution 3

Re-definition of Barycentric Dynamical Time, TDB

Proposed by: IAU Division I WG on "Nomenclature for Fundamental Astronomy"
Supported by: IAU Division I

The following persons will be available for consultations and, if necessary, to speak on the above resolution at the General Assembly on August 24, 2006:

Proposer:	Nicole Capitaine (France)	Email: nicole.capitaine@obspm.fr
Substitute:	Patrick Wallace (UK)	Email: ptw@star.rl.ac.uk
Seconder:	Dennis D. McCarthy (USA)	Email: mccarthy.dennis@usno.navy.mil
Substitute:	Sergei Klioner (Germany)	Email: klioner@rcs.urz.tu-dresden.de

The XXVIth International Astronomical Union General Assembly,

Noting

1. that IAU Recommendation 5 of Commissions 4, 8 and 31 (1976) introduced, as a replacement for Ephemeris Time (ET), a family of dynamical time scales for barycentric ephemerides and a unique time scale for apparent geocentric ephemerides,
2. that IAU Resolution 5 of Commissions 4, 19 and 31 (1979) designated these time scales as Barycentric Dynamical Time (TDB) and Terrestrial Dynamical Time (TDT) respectively, the latter subsequently renamed Terrestrial Time (TT), in IAU Resolution A4, 1991,
3. that the difference between TDB and TDT was stipulated to comprise only periodic terms, and
4. that Recommendations III and V of IAU Resolution A4 (1991) (i) introduced the coordinate time scale Barycentric Coordinate Time (TCB) to supersede TDB, (ii) recognized that TDB was a linear transformation of TCB, and (iii) acknowledged that, where discontinuity with previous work was deemed to be undesirable, TDB could be used, and

Recognizing

1. that TCB is the coordinate time scale for use in the Barycentric Celestial Reference System,
2. the possibility of multiple realizations of TDB as defined currently,
3. the practical utility of an unambiguously defined coordinate time scale that has a linear relationship with TCB chosen so that this coordinate time scale remains close to Terrestrial Time (TT) at the geocenter for an extended time span,
4. the desirability for consistency with the T_{eph} time scales used in the Jet Propulsion Laboratory (JPL) solar-system ephemerides and existing TDB implementations such as that of Fairhead & Bretagnon (*A&A* **229**, 240, 1990), and
5. the 2006 recommendations of the IAU Working Group on "Nomenclature for Fundamental Astronomy" (IAU Transactions XXVIB, 2006),

Recommends

that, in situations calling for the use of a coordinate time scale that is linearly related to Barycentric Coordinate Time (TCB) and remains close to Terrestrial Time (TT) at the geocenter for an extended time span, TDB be defined as the following linear transformation of TCB:

$$TDB = TCB - L_B \times (JD_{TCB} - T_0) \times 86400 + TDB_0,$$

where $T_0 = 2443144.5003725$,

and $L_B = 1.550519768 \times 10^{-8}$ and $TDB_0 = -6.55 \times 10^{-5}$ s are defining constants.

Notes

1. JD_{TCB} is the TCB Julian date. Its value is $T_0 = 2443144.5003725$ for the event 1977 January 1 00h 00m 00s TAI at the geocenter, and it increases by one for each 86400 s of TCB.

2. The value L_B is equal to $L_C + L_G - L_C \times L_G$, where L_G is given in IAU Resolution B1.9 (2000) and L_C has been determined (Irwin & Fukushima, 1999, *A&A* **348**, 642) using the JPL ephemeris DE405. When using the JPL Planetary Ephemeris DE405, the defining L_B value effectively eliminates a linear drift between TDB and TT at the geocenter. When realizing TCB using other ephemerides, the difference between TDB and TT at the geocenter may include some linear drift which is not expected to exceed 1 ns per year.

3. The difference between TDB and TT at the surface of the Earth remains under 2 ms for several millennia around the present epoch.

4. The independent time argument of the JPL ephemeris DE405, which is called T_{eph} (Standish, *A&A*, **336**, 381, 1998), is for practical purposes the same as TDB defined in this Resolution.

5. The constant term TDB_0 is chosen to provide reasonable consistency with the widely used TDB – TT formula of Fairhead & Bretagnon (1990).

n.b. The presence of TDB_0 means that TDB is not synchronized with TT, TCG and TCB at 1977 Jan 1.0 TAI at the geocenter.

6. For solar system ephemerides development the use of TCB is encouraged.

Action to be taken by the General Secretary upon adoption of the Resolution

Re-definition of Barycentric Dynamical Time, TDB

The following institutions should receive formal notification of the action:

International Union of Geodesy and Geophysics (IUGG), International Association of Geodesy (IAG), International Earth Rotation and Reference Systems Service (IERS), International VLBI Service for Geodesy and Astrometry (IVS), International Laser Ranging Service (ILRS), International GNSS Service (IGS), International DORIS Service (IDS)

Resolution 4

Endorsement of the Washington Charter for Communicating Astronomy with the Public

Proposed by: Ian Robson (Co-Chair of the IAU WG on "Communicating Astronomy with the Public")

The Washington Charter was one of the outcomes of the 2nd International Conference on Communicating Astronomy with the Public held in Washington DC in October 2003. Council endorsed the Washington Charter in March 2004. Nineteen other societies, organizations and facilities have endorsed the Charter, including the BAA and PPARC. At the Communicating Astronomy with the Public 2005 meeting in Garching last June a revised version of the Charter was proposed. This softened the language and also tidied up some of the phraseology. This was endorsed by the attendees and accepted by the IAU Working Group. The revised version is appended.

The IAU General Assembly is requested to confirm endorsement of the Revised Washington Charter.

The Washington Charter for Communicating Astronomy with the Public

As our world grows ever more complex and the pace of scientific discovery and technological change quickens, the global community of professional astronomers needs to communicate more effectively with the public. Astronomy enriches our culture, nourishes a scientific outlook in society, and addresses important questions about humanity's place in the universe. It contributes to areas of immediate practicality, including industry, medicine, and security, and it introduces young people to quantitative reasoning and attracts them to scientific and technical careers. Sharing what we learn about the universe is an investment in our fellow citizens, our institutions, and our future. Individuals and organizations that conduct astronomical research – especially those receiving public funding for this research – have a responsibility to communicate their results and efforts with the public for the benefit of all.

Recommendations

For Funding Agencies:

Encourage and support public outreach and communication in projects and grant programs.Develop infrastructure and linkages to assist with the organization and dissemination of outreach results. Emphasize the importance of such efforts to project and research managers. Recognize public outreach and communication plans and efforts through proposal selection criteria and decisions and annual performance awards. Encourage international collaboration on public outreach and communication activities.

For Professional Astronomical Societies:

Endorse standards for public outreach and communication. Assemble best practices, formats, and tools to aid effective public outreach and communication. Promote professional respect and recognition of public outreach and communication. Make public outreach and communication a visible and integral part of the activities and operations of the respective societies. Encourage greater linkages with successful ongoing efforts of amateur astronomy groups and others.

For Universities, Laboratories, Research Organizations, and Other Institutions:

Acknowledge the importance of public outreach and communication. Recognize public outreach and communication efforts when making decisions on hiring, tenure, compensation and awards. Provide institutional support to enable and assist with public outreach and communication efforts. Collaborate with funding agencies and other organizations to help ensure that public outreach and communication efforts have the greatest possible impact. Make available formal public outreach and communication training for researchers. Offer communication training in academic courses of study for the next generation of researchers.

For Individual Researchers:

Support efforts to communicate the results and benefits of astronomical research to the public, convey the importance of public outreach and communication to team members. Instill this sense of responsibility in the next generation of researchers

Authored by CCAP, Washington DC, October 2003 - Revised by CAP 2005, Garching bei München, June 2005.

Playing with magnets in the Milky Way

A topic that has been in the background of Galactic astronomy for more than 50 years is now becoming the focus of research efforts for more and more astronomers. The coming decade may finally bring an understanding of the Galactic magnetic field on all scales, from the global field geometry to the smallest fluctuations. This will have ramifications for our understanding of a range of problems, including cosmic ray acceleration and propagation, star formation, the pressure and energy balance of the interstellar medium, and the dynamics of the medium on all scales.

John Dickey, University of Tasmania, Australia

The existence of an interstellar magnetic field was deduced from large scale patterns in the polarization of starlight early in the last century. This led to the pioneering theoretical efforts of Fermi, Chandrasekhar, and Munch, who showed how variations in the position angle of the polarization could be used to deduce the order of magnitude of the field strength. Soon after, Davis and Greenstein formulated a mechanism for grain alignment that has motivated a wide range of theories of grain magnetization. Gradually over the subsequent half century more and more different kinds of observations have given us new pieces of the puzzle. Now this field is gathering momentum for a final push to fit all the pieces into a complete picture. This will be a triumph for Galactic astronomy that will interest a broad spectrum of scientists and the general public as well. Everybody likes to play with magnets, in one way or another.

Optical measurements of starlight polarization are still an important tool for studying the Galactic magnetic field, and the same grains that polarize the starlight by their selective absorption also emit preferentially in linear polarization in the mid- and far-infrared. This has been used to map the fields in dust clouds, and in external galaxies. Optical and infrared polarization trace the fields in the plane of the sky. The line of sight component of the field can be traced in the radio, through the Zeeman effect and by Faraday rotation. Both of these techniques have made great progress in the past decade, with promise of major advances to come.

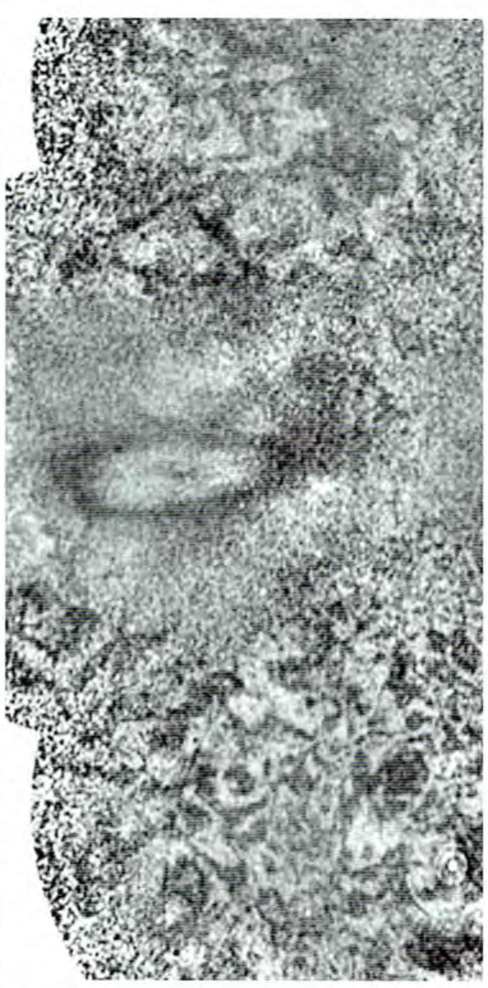
Faraday rotation studies have advanced as many more background sources have become available. The Parkes and Jodrell Bank multibeam surveys for pulsars have been particularly helpful, because for pulsars the dispersion measure and rotation measure can be independently observed, and so the field strength can be separated from the electron density on the line of sight. The pulsar surveys are now sensitive enough to detect pulsars over a large area of the Galactic disk, so our picture of the large scale geometry of the field is improving. Meanwhile, sensitive new surveys of extragalactic continuum sources at low Galactic latitudes have given hundreds of new rotation measures on lines of sight passing entirely through the disk.

A new twist on an old technique for study of the magnetic field is mapping the polarization of the diffuse synchrotron emission by cosmic ray electrons. This was done by radio astronomers in the 1950's and 60's, but in the last decade there has been a renaissance of interest in the Galactic synchrotron polarization through interferometer surveys with resolution of about 1', which show amazing patterns and structures in the diffuse linearly polarized emission. Some of these are intrinsic to the emission, but most of this structure is imposed by changing Faraday rotation in the intervening medium. Studying the rotation measure of this emission gives a way to trace the ordered and disordered spatial structure of the field on a wide range of scale lengths.

On large scales, the ordered component of the field lies in the disk, pointing azimuthally around the Galactic center, or perhaps in a spiral with pitch angle of about ten degrees. Above and below the disk there seems to be a vertical (poloidal) component as well. On smaller scales, the field has some structures related to well understood phenomena, like supernova remnants, and other structures that seem to have no counterparts at any other wavelengths. An example, the Penticton Lens (from Gray *et* al. 1999, Ap. J. **514**, 221), is shown on the figure.

Ever since Fermi, theorists have recognized that the magnetic field could be dynamically significant, even dominant if the energy density in the field exceeds the kinetic energy of the interstellar gas. An application of this is in the cascade of interstellar turbulence, a process that we assume propagates the energy of random motions to progressively smaller scales, where ultimately they are dissipated. A very influential theoretical study of such a turbulence cascade in a magnetized interstellar medium was done some 15 years ago by Ferriere, Zweibel, and Shull. They showed that the energy dissipated on the small scales by the magnetic field could be the dominant heating process for parts of the interstellar medium. Many more recent theoretical studies of this question have advanced our understanding a long way, but there is still no consensus on whether or when the magnetic field dominates interstellar dynamics, or even how it was generated in the first place.

The Square Kilometer Array, a proposed centimeter-wave telescope for the next decade, will reveal cosmic magnetism with unprecedented detail and precision. Various "phase 1" SKA projects are underway for the latter years of this decade. These will go a long way to answering our questions about the Galactic magnetic field. Those answers may cause us to rethink everything from star formation to the evolution of galaxies. ❐



The Penticton Lens, an elliptical structure in the shimmering pattern of linearly polarized Galactic synchrotron emission. Shown is a detail from the Canadian Galactic Plane Survey image published by Gray et al. (1999). The lens has no counterpart in other ISM tracers. Many other structures in the diffuse Stokes Q and U emission have been found in recent years.

Staroměstské náměstí (Old Town Square)

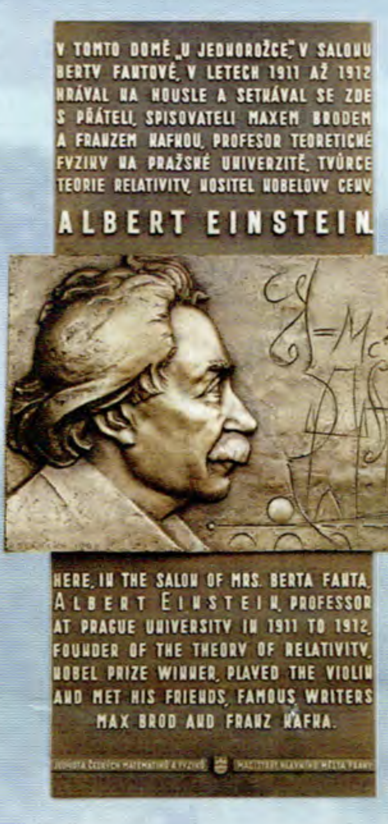
Alena Šolcová, Michal Křížek, Jana Olivová

Today you are invited to see one of the most famous and important places in Prague – **Staroměstské náměstí** or **Old Town Square** in the very historical centre of the city. Since the 11th and the 12th centuries, when it was a crossroad of merchant roads and the main marketplace, the Square has witnessed both the most glorious and the most tragic events in the history of the Czech nation and state.

It is easy to get to Staroměstské náměstí from the Congress Centre Take the underground (called "Metro" in Prague and marked "M") and go to the station "Muzeum". There you can get off and walk a couple of blocks down the Wenceslass Square to Můstek. From there, you can walk to Staroměstské náměstí (Old Town Square) – it takes some ten minutes. You could also change at "Muzeum" to Line "A", get off at "Staroměstská" Metro station and walk directly to Old Town Square.

The most admired and sought-after monument there is obviously the *Astronomical Clock* on the Old-Town Hall, also known as the *Prague Orloj*. It consists of three units: moving statues of the 12 apostles that appear on the hour in two small windows in the upper part of the Clock, the astronomical clock itself and a round calendar with the signs of the zodiac. The mathematical model of the Astronomical Clock was developed by Czech astronomer and mathematician, professor of Prague University **Jan Ondřejův called Šindel** (Iohannes Andreae dictus Sindel – the minor planet *(3847) Šindel*). The astronomical clock was constructed around the year 1410 by clock-maker **Mikuláš of Kadaň** under Šindel´s astronomical supervision. In about 1490, a calendar dial was placed under the astronomical dial. In the centuries which followed, the complex mechanism was further enhanced and new statues – both moving and stationary – were added.

The astronomical dial is an astrolabe on the clock face using a stereographic projection with the centre on the North Pole of the celestial sphere. The dial shows various ways of measuring time over the course of centuries. The outer circles bear gold Arabic numerals showing old Czech hours counted from the sunset of the previous day. Roman numerals mark what is called the German (Italian) time introduced in the reign of Rudolf II. Black Arabic numerals mark uneven planet hours, the length of which changes during the year. Three rotating pointers show the place of the Sun on the ecliptic, the movement and phases of the moon as well as the rising, culmination and setting of individual signs of the Zodiac. The pointer decorated with a small gold star indicates celestial time.



After you get seen enough of the Prague Astronomical Clock, look down at the pavement and you will see the *Prague Meridian* which was formerly used by Prague denizens to determine the time. It was defined by the shadow cast by the column of Our Lady at noon. The column unfortunately was destroyed in 1918 but the place where it was located as well as its shadow are marked with five squares on the pavement. The metal plaque reads: "*Meridianus quo olim tempus Pragense dirigebatur*" (The meridian according to which the time used to be defined). Later time began to be measured more exactly at the Astronomical Tower of Klementinum which you will be invited to visit later.

Staroměstské náměstí (Old Town Square) and the surrounding streets also commemorate a number of outstanding scientists and artists who lived in Prague, including Tycho Brahe, Albert Einstein, Christian Doppler, Ernst Mach and Franz Kafka.

The Church of Our Lady before Týn is the final resting place of great Danish astronomer **Tycho Brahe**. He is buried in front and to the right of the altar. The nearest pillar holds a tombstone made of rose Slivenec marble portraying Tycho Brahe in relief and accompanied with the following inscriptions in Latin:

"*Esse potius, quam haberi*" (Rather to be somebody than only to give such an impression) and "*Nec fasces, nec opes, sola artis sceptra perennant*" (Neither power, nor riches, only the sceptre of knowledge persists).

Tycho Brahe (1546–1601) is probably the best observer of the heavens before the invention of telescope. The minor planet *(1677)* was given his name – *Tycho Brahe*. His activities in Prague where he arrived at the invitation of Emperor Rudolf II in 1599 will be the subject of our next invitation to walks around the city.

A memorial plaque honouring prominent scientist and Nobel Prize holder **Albert Einstein** (minor planet *(2001) Einstein*) can be found at Staroměstské náměstí No. 17/551. That is the house where he used to play the violin and engage in philosophic discussions in the Salon of Berta Fanta between 1911 and 1912.

A Dominican on the next Storch House No. 16/552 recalls the half-a-year long visit paid to Prague by **Giordano Bruno** in 1588. A memorial plaque placed at the Observatory and Planetarium of the Capital of Prague recognizes his work.

Professor of physics **Ernest Mach** (minor planet *(3949) Mach*) lived in the house No. 19/549 situated on the right of the Einstein memorial plaque. ❐

Brief information

❍ **Prague Information Service** provides all sorts of tourist information about Prague, from accommodation and numerous cultural events to foreign language divine services and weather. It outlines the history of Prague, draws attention to its historical monuments, offers sightseeing tours and tips for visits. The information can be found at: **http://www.pis.cz/** in English, German, French, Italian and in Spanish.

❍ **Corrected programme of Comission 45 meeting:**
Wednesday August 16, 14:00–15:30 & 16:00–17:30, Club B
14:00 Scientific Session
Spectral classification in the southern hemisphere: old fashioned technique or the best one for astrophysical insight?
talk by H. Levato
14:30 Business and Discussion on Stellar Classification
Report of President
Presentation of New Organizing Committee
Presentation of New President and Vice President
Discussion on Transforming this Stellar Classification commission to make it more relevant to the great increase in surveys
15:30 Coffee
16:00 Working Group on Standard Stars Meeting
Report of Chairperson and Newsletter Editor
Discussion on Evolving the WG and the Standard Star Newsletter with the times
Appointment of Chairperson and Newsletter Editor

Secret diary of secret agent F.R.Og

August 15th: Life of a secret agent is so hard. Nobody appreciates it. Astronomers didn't vote for my changes in Statutes. The Czech police took a photo of my car in front of the Congress Palace and the picture appeared in the GA newspaper. And moreover, I've got a note from H. Yla (a big boss in the Scientific Board) telling me that I wouldn't recognize a science even if it fell on my head. Imagine this, she expects me to sit at symposia and listen to Earthlings' predendrobitic astrophysics. Astrolabes, epicycles and subluminal velocities. Oh my!

NOMENCLATURE FILLER

3. From Confusion to Clarity: Providing a "paper trail"

Hélène R. Dickel

A designation consists of an *acronym* and a *sequence*.

The *acronym* is an alphanumerical string of characters that specifies the catalog or collection of sources. It may be constructed from catalog names (e.g., NGC, BD), the names of authors (RCW), instruments or observatories used for large surveys (3C, 51W, CXO), etc. Once a paper is published, the acronym will appear in the *Interactive Dictionary of Acronyms* at **http://cdsweb.u-strasbg.fr/viz-bin/Dic** along with the reference, thus providing a paper trail.

The *sequence* (or numbering) is an alphanumeric string of characters, normally only numerical, that uniquely determines the source within a catalog or collection. It may be a sequence number within a catalog (e. g., HD 224801), a combination of fields, or it may be based on coordinates.

Wednesday 16/8
8 °C / 46 °F morning minimum
26 °C / 79 °F afternoon maximum
Some clouds, a shower possible in the afternoon
SE winds 4 m/s (10 mph)

Thursday 17/8
11 °C / 52 °F morning minimum
27 °C / 81 °F afternoon maximum
Partly sunny and nice
S winds 5 m/s (13 mph)

Cause for Celebration – *Mike Dopita*

For one astronomer, the IAU General assembly represents a long-awaited homecoming. Prof. Mike Dopita, at the Australian National University in Canberra, Australia has finally returned to the land of his father, with his Czech passport in pocket. Mike's father, Frantisek Ladislav Dopita, hailed from Olomouc, but fled the German occupation on skis in the winter of 1940 to eventually join the French Foreign legion in Beirut. From there he was shipped to Marseille, where he arrived just in time for the events of June 1940. Fleeing once more he ended up with the Free Czech Army in the UK, where he met Mike's mother. After the war they both returned to a little town called Rotava in Bohemia, where Mike was born on Czech Independence Day, to the sound of brass bands and celebration. The creeping establishment of communist rule meant that, as an ex-Captain in the Free Czech Army, Frantisek was targetted for some "special consideration". Fleeing once more with the whole family, including a one-year old Mike, he returned to the UK. In 1953 he was "naturalized" along with Mike as a British citizen (the English appear to be of the opinion that not to be English is an unnatural state). Many years later, after the fall of communism, Frantisek was finally "re-habilitated" as a Czech citizen, and in celebration Mike also reclaimed his Czech citizenship. So here he is, at the age of 60, in Prague as a Czech / an Englishman / an Australian, finally closing the wheel of history and the tangled fortunes of the twentieth century. ❐

Right: Prof. Mike Dopita

Dissertatio cum Nuncio Sidereo III is the official newspaper of the IAU General Assembly 2006. Contacts: **e-mail** – nuncius@ig.cas.cz, **address** – Nuncius Sidereus III, Kongresové centrum Praha, a.s., 5. května 65, 140 21 Praha 4. **Editor-in-chief**: Jiří Grygar, **deputy editor**: Petr Lála, **secretary**: Pavel Suchan, **assistant secretary:** Kateřina Vaňková **editors**: Soňa Ehlerová, Daniel Fischer, Jana Olivová, Michael Prouza, Petr Scheirich, Michal Sobotka, Michal Švanda, **technical editors**: David Ondřich, Jan Verfl, **English corrector**: John Novotney, **cartoonists**: Ladislav Šmelcer, Lubomír Vaněk. **Published by**: Icaris, Ltd., Nám. dr. Holého 8, 180 00 Praha 8. **Printed by:** Apolys, Ltd., Kolbenova 40, Praha 9. Any views expressed in articles are those of the authors and do not necessarily reflect the views of the Editorial Board or IAU. **Online version** http:///www.astronomy2006.com/ga-newspaper.php.

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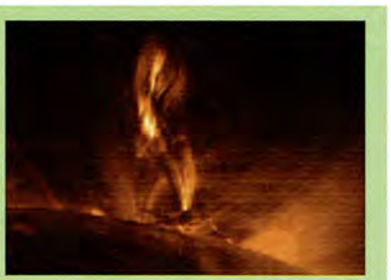
ABSTRACT OF TODAY'S INVITED DISCOURSE

Today's invited discourse at 6:15 p.m. in the Congress Hall

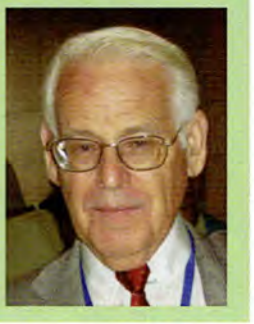


The magnetic field and its effects on the solar atmosphere in high resolution

Alan Title, Stanford-Lockheed Institute for Space Research

To resolve the effects of the magnetic field it is necessary to image the interior and measure its rotation and flow systems; track the responses of the magnetic fields to flows in the surface; and to follow the evolution of structures in the corona. Because the Sun is dynamic, both high spatial and temporal resolution are essential. Since the Sun's magnetic field effects encompass the entire spherical exterior, the entire surface and outer atmosphere must be mapped. And because the magnetic field is cyclical, high-resolution observations must be maintained over multiple cycles.

The last 15 years has been a revolutionary period in solar physics because of the development of new observatories on the ground and in space, advances in numerical simulations, and adaptive optics and post processing techniques. 24/7 monitoring of the full Sun has allowed helioseismologists to determine the temperature, density, equation of state of the solar interior, and velocity structure of the solar interior. New adaptive mirrors and post processing techniques have allowed 0.1 arc second imaging with Strehl ratios of 0.9 over fields of view of 60 arc seconds and more. As a result the temperature structure of the photosphere and chromosphere are much better understood.



These observations are critical to understanding how the surface magnetic fields are connected to the transition region and corona. Coronal observations show that magnetic fields on smaller scales interact with and deliver energy to larger magnetic structures i. e., scale mixing. It now appears that much, if not most, of the heating of the corona is due to magnetic fields that are generated by local magnetic processes.

The almost universal commitment of observatories and Principal Investigators to open data policies coupled with fast internet connections has allowed the international community of solar physicists, astrophysicists, plasma physicists, and fluid dynamicists to participate in the data analysis process.

Imagine...

Imagine that you can only see the solar corona above the limb, that you have never heard about coronal mass ejections traveling through interplanetary space, or about coronal holes, and that your only knowledge in the field of helioseismology are the 5-minute oscillations.

Zdeněk Švestka

That was the situation in solar physics when the IAU met the last time in Prague – in the year 1967. I was president of Commission 10 on solar activity at that time, mainly due to successful observations and interpretations of spectra of chromospheric flares in our unique flare spectrograph at Ondřejov. Nowadays we know that what we observed and analyzed at that time were actually only footprints of enormous invisible coronal flare dinosaurs in the chromosphere.

Only six years later, Skylab revealed the solar corona all over the disk, showing its loop-like structure, the occurrence of bright points and coronal holes, and the existence of coronal transients, later renamed coronal mass ejections. And two more years were needed before the rich structure of the 5-minute oscillations was first resolved, thus founding the prolific field of helioseismology.

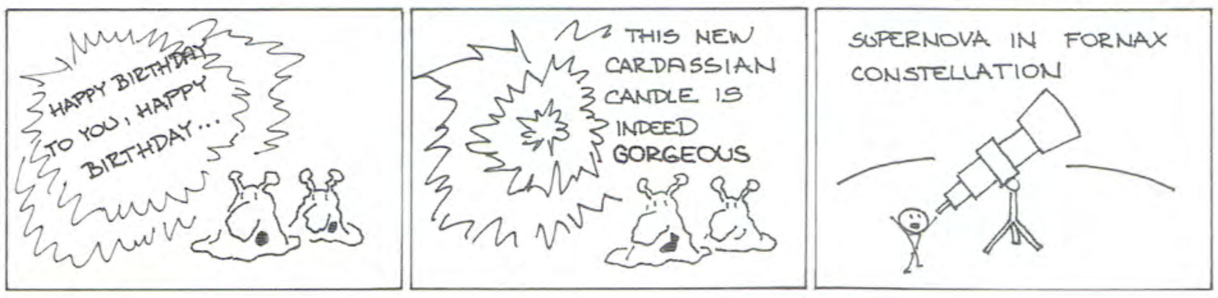
Also in that year, 1967, the first two volumes of the journal "Solar Physics" appeared which, since that time, has published more than 8,000 scientific articles studying the Sun and solar-terrestrial relations. As solar physicists are meeting this year again here in Prague, Volume 237 will be published.

When one reads the solar reports in the Proceedings of the Prague 1967 meetings, it is plain that the main emphasis was on cooperative projects among ground-based observatories. Any observations with high time and spatial resolution made on spacecraft were still missing, but their enormous importance for solar studies was very clearly recognized: Commissions 10 and 44 held a joint session on "Coordination of Solar Observations Made at Ground-Based Observatories and with Space Vehicles" and Commission 10 endorsed the COSPAR resolution to organize a symposium on "Solar Flares and Space Research" one year later, in 1968, in Tokyo. Still, one could hardly envisage at that time the quality of the future achievements in solar space experiments: Could anybody in 1967 imagine the unbelievable images of coronal structures obtained by TRACE, with one-arc-second resolution, 30 years later?

Of course, this outstanding progress in observational techniques would not have been possible without extremely fast development of highly sophisticated computers. Just in the year when the previous IAU Assembly in Prague was taking place, the Ondřejov Observatory got its first computer – and it occupied a whole, large, newly built building. Nowadays a little box on my d esk performs incomparably better than that monster installed 40 years ago.

This progress in solar physics and, of course, in the whole field of astronomy, is certainly encouraging. However, it also produces some concerns, because it is not reflected by any comparable development in the minds of mankind. People still know more about astrology than about astronomy and some parts of the world seem rather to be moving back into medieval thinking. Thus an old man like myself in particular follows the rapid changes with some uneasiness. It is comforting that at least one thing has not changed: the Nuncio Sidereo still has the same editor as in the year 1967 – the staunch fighter against superstition and astrology, who for decades has tried to bring the exciting astronomical discoveries to common people – Jiří Grygar.

Illustration by Robbert Schaefers



Zdeněk Švestka – 40 years as an editor of Solar Physics
Address of František Fárník at the yesterday's celebratory lunch

Ladies and gentlemen, dear colleagues,

I was honored by the suggestion of Lídia to say a few words about Zdeněk during this occasion, focusing on his contribution to solar physics in general. It is a pleasure in the first place but, at the same time, a very difficult task for me. I am sure that speaking about Zdeněk's scientific work for a group of solar physicists is like "carrying coals to Newcastle". Therefore, allow me to be brief about science and to add some personal reminiscences too. Because I am one generation younger, I came to our Institute in Ondřejov after Zdeněk had to emigrate in 1971 and that's why we met for the first time when Zdeněk was nearly 56 years old – the reason is clear : Traveling to the West and, even more difficult, visiting emigrants was almost impossible in those years. This made a division – situation before we met and after. When returning to the beginning, I have to describe a long and fruitful period of Zdeněk's stay at the Ondřejov Observatory which I know from the literature and from the stories told by my older colleagues only. It may sound like a joke that the first contract which Zdeněk received in July 1948 at the observatory was officially as a gardener. Nevertheless, shortly afterwards a group of newly recruited young scientists started to study a brand-new field in Ondřejov – solar physics. Since the very beginning Zdeněk focused himself on optical spectroscopy, especially when using the H-alpha data from the local spectroheliograph. During the fifties, when Zdeněk was already head of the Solar Department, a unique multi-channel optical spectrograph was built in Ondřejov. The idea to build this spectrograph was suggested by Zdeněk and Milan Bláha and the successful observations with the new instrument made Ondřejov one of the leading solar observatories in the world. Results of the Zdeněk's analysis of many optical spectra of solar flares were published in a lot of papers and are summarized in Zdeněk's book "Solar Flares". Here I have to mention also an important contribution of his wife Lída and some other colleagues from Ondřejov. Later on, Petr Heinzel and his collaborators reconstructed this instrument and after Petr met Zdeněk at NASA in 1985, they worked on new spectra taken in Ondřejov. Zdeněk was again the source of inspiration for us. The successful and happy "Ondřejov" period was broken by the Russian invasion in 1968. Zdeněk, already a distinguished scientist, was invited to work in ESTEC in 1970. The political situation quickly deteriorated and Zdeněk had to stay abroad, to emigrate against his will. He spent a short period in Freiburg and then two years in American Science and Engineering in Cambridge, USA, where he participated on the Skylab X-ray telescope and its data analysis. He slowly changed his field of study from the optical region to X-rays. He moved from the USA to the Netherlands and from 1977 he worked in SRON, Space Research Organization of Netherlands, the director of which was Professor C. de Jager at that time. Here, Zdeněk was involved in the development, observations and data analysis of the Dutch hard X-ray telescope, HXIS, which flew onboard the SMM satellite. The historical overview approached the moment when I met Zdeněk for the first time, at a workshop in Annecy in 1981. This is also the moment when I would like to mention one, very important, thing: Zdeněk has (and always had) a very cordial relation to his "home observatory" in Ondřejov and he tried as much as he could to help by all the possible ways. That's why, when I told him that I am interested in observations and analysis of solar X-rays, he suggested a possibility that I could spend some time in SRON in Utrecht where we could analyze together data from HXIS. Since 1983, when I spent 3 months in SRON, our close cooperation continued until the moment, when he decided to retire from science a few years ago. Under Zdeněk's guidance we mainly studied large coronal structures observed in hard (HXIS) and later, when the Yohkoh satellite started observations, in soft X-rays. Among the studied topics were bright surges, flaring arches, rising and stationary post-flare giant arches, post-flare streamers, wind streams from flaring active regions, interconnecting loops and others. It is impossible to describe even the most relevant results during this short presentation.

Besides many scientific papers (ADS gives 285 papers of which Zdeněk is the main author or one of co-authors) he wrote the already mentioned book on solar flares, published in 1976. One of his most important activities, I mean the founding and editing of Solar Physics journal, has already been described by Prof. Engvold. But – that's not all to speak about them: Zdeněk was a very active organizer of many scientific meetings, he was very active in COSPAR and IAU (chairman of Commission 10) and so on. As an acknowledgement of his always cordial relation to his (and our) country, he was elected as a Honorary Fellow of "The Learned Society of the Czech Republic" and for his scientific achievements was awarded in October 1995 by the Golden Medal of The Academy of Sciences of the Czech Republic. The Czech Astronomical Society awarded Zdeněk by the František Nušl price in 2002.

As I said at the beginning – summarizing Zdeněk's achievements in solar physics during a very short talk is difficult and I am afraid that I have missed many things which should be mentioned here. I apologize for that. In conclusion I wish to Zdeněk good health and plenty of optimism (and to his wife Lída too) for the future and I hope to welcome both of them in Prague or Ondřejov many times again.

Today's programme: (thursday 17/8)

- Symposia S235, S236, S237
- Joint Discussions JD01, JD02, JD03, JD04, JD06, JD07, JD08, JD09
- Special Sessions SPS1, SPS2, SPS3a
- Invited Discourse – Alan Title

From Prague to Prague: What has one learnt about the nuclei of comets in the past 39 years?

Sketchy recollections of an old-timer

Zdeněk Sekanina, Jet Propulsion Laboratory, Caltech, USA

Speaking for myself, the short answer is: Plenty! In 1967 cometary physics was at the doorstep of major discoveries, equipped with Fred L. Whipple's model of an icy-conglomerate nucleus, then less than 20 years old and still competing with the now discredited "sand-bank" model. A significant boost to Whipple's hypothesis came in 1970, when orbiting observatories detected an extensive Lyman-alpha halo of atomic hydrogen (predicted in 1964 by L. Biermann and E. Trefftz) and a strong hydroxyl UV emission in two comets, a discovery that pointed to water as the primary parent molecule. In the meantime, progress was also achieved by related research. For example, at the 1965 Liège colloquium Whipple showed with R. P. Stefanik that his model explains why comets split. M. L. Finson and R. F. Probstein used it in their 1968 work to propose a method for analysis of dust comet tails, which opened a new research avenue and showed that some comets release dust and gas at comparable rates of up to many tens of tons per second near the Sun. Refined versions of the Finson-Probstein approach are still employed today. At about the same time, B. G. Marsden began work on two critical projects, the orbital evolution of the Kreutz group of sungrazing comets and the role of outgassing-driven nongravitational forces in the motions of comets.

Marsden's research is described in his contribution to next issue of "Dissertatio". Although my scientific interests at the time were similar, as late as mid-1968, when I was priviliged to work for nearly a year at P. Swings' Institut d'Astrophysique in Liège, Belgium, I did not have the slightest idea that in less than a year I would find myself working at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, right in the midst of illustrious research, under Whipple's directorship, in the same building as his and Marsden's offices, and with Probstein only several miles down the Massachusetts Avenue at another great science center, the Massachusetts Institute of Technology. While my responsibility at first was with the Radio Meteor Project, a preeminent research program that eventually resulted in huge sets of orbital and physical data for almost 40,000 meteors, I soon secured NASA funds for comet research, and I have remained committed to this field ever since.

From the beginning, I was happy with the proficiency of my work at the Smithsonian. Shortly after I resumed my comet research, I made the first discovery based on newly developed computer software. The straight, narrow tails of distant Oort-cloud comets noted for major deviations from the antisolar direction were not plasma tails responding to the low-velocity solar "breeze" (thought by some in the 1960s to replace, far from the Sun, the high-velocity solar wind near the Sun). Rather, I identified them as tails consisting of sizable dust grains ejected at extremely large heliocentric distances on the way to perihelion. My results were not the only critical argument in the controversy but I found it most satisfying that never again did I hear about the solar breeze after my paper was published.

Throughout the 1970s, I continued to assist Marsden in his work on the nongravitational forces, a fascinating problem. I also initiated a systematic examination of dust antitails and formulated a novel model for split comets (just in time for C/1975 V1 West), which has proven to be of great value to me ever since. Then, after Whipple retired as director and spent much of his time on research, we interacted more extensively, eventually focusing on an entirely new, exciting subject – the rotation and precession of cometary nuclei and anticipated effects on the dust coma morphology and orbital motion. A major joint paper was one tangible product of our collaboration, which also had a very positive effect on my further professional career. Like others at the observatory, I benefited from the atmosphere of trust, congeniality, and complete academic freedom, with no bureaucratic interference, something that sounds like a fairy tale today.

As the 1986 return of Halley's comet drew closer, activities related to preparations for launching an interceptor space mission began to pick up. By 1980, it became desirable to move to the Jet Propulsion Laboratory, California Institute of Technology, in Pasadena, the focal point of any American efforts of this kind. Although the spacecraft, Giotto, was eventually launched and operated by the European Space Agency (ESA), the JPL and its scientists were indeed heavily involved. I soon found my new collaborator, S. M. Larson, University of Arizona, very knowledgeable in computer image processing and the only other person of whom I knew had worked on cometary rotation and morphology. I already had an early version of a computer code for modeling dust morphology that I wrote for my work with Whipple. Necessary Halley images were the only missing item. And once again was I at the right place at the right time. I knew that when Halley's comet arrived in 1910, the highest-resolution photographs in the world were taken at the Mount Wilson Observatory, right above Pasadena, with the 150-cm reflector (the 250-cm reflector was not yet completed). I contacted the Observatory's Headquarters in Pasadena with a request to loan me their plates. It took a few days of nerve-wracking wait before the images, which happened to be in perfect condition after more than 70 years(!), were found.

With Larson we published several papers on Halley. In one of them, from 1984, we concluded that Halley's activity must emanate from a few discrete emission sources on the surface, a finding spectacularly confirmed by the Giotto and other closeup images two years later. Although the comet surprised us with its complex rotation, the experience we gained by our dust-morphology modeling was invaluable. And significantly, the long-standing controversy on the nature of cometary nucleus was finally resolved in favor of Whipple's icy conglomerate.

Comet C/2001 Q4 (NEAT). Credit: NASA, NOAO, NSF, T. Rector (University of Alaska Anchorage), Z. Levay and L.Frattare (Space Telescope Science Institute)

My upgraded computer code, which included image-simulation graphics, offered a methodology for morphological modeling of a comet's dust coma. The code was further refined and upgraded in the late 1980s and 1990s, and it served to model the morphology of comets such as 2P/Encke, 7P/Pons-Winnecke, 10P/Tempel, 29P/Schwassmann-Wachmann, 96P/Machholz, C/1983 H1 (IRAS-Araki-Alcock), C/1995 O1 (Hale-Bopp), and recently the distribution of dust jets imaged by the Stardust camera in comet 81P/Wild. The methodology I developed was employed by other investigators as well to study several additional comets.

Over the years, my scientific interests also included the Tunguska object, the striated dust tails of bright comets, the dissipating comets, and the kamikaze comet D/1993 F2 (Shoemaker-Levy), which collided with Jupiter in 1994. In the past 6–7 years, my work, sometimes in collaboration with P. W. Chodas, JPL, has been focused primarily on the cascading fragmentation of comets and its effects on the dynamic evolution and life cycle of the fragmentation products. Notable examples of this process are the Kreutz system of sungrazing comets, the Machholz complex of sunskirting comets and associted objects, and most recently the fragmented comet 73P/Schwassmann-Wachmann.

Although my description has been drastically abridged and is incomplete, it illustrates how much I learnt about comet nuclei in the past 39 years. The nuclei of four periodic comets have so far been imaged in closeup, and they all look different. Perhaps they have different locations and modes of formation and/or subsequent evolution. The next major leap forward will hopefully come from the data collected by the ESA's Rosetta Mission. Its analysis will be a Herculean effort that I gladly leave to my younger colleagues.

What will be the state of comet science 39 years from now? As comet research is oriented more and more toward *in situ* investigations, one can expect that the data analysis and intepretation will increasingly be dominated by specialists other than astronomers or astrophysicists, namely by chemists, geologists, mineralogists, petrographers and petrologists, etc. Good luck to all of them! ❐

Zdeněk Sekanina (left) and Eva Marková (president of CAS; right)

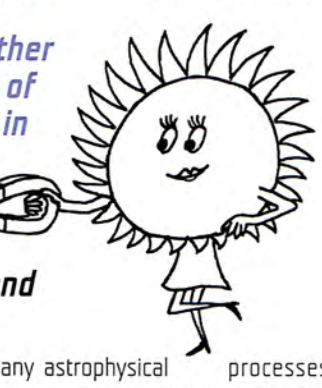
Prize for Zdeněk Sekanina

Jana Olivová

Last evening a distinguished astronomer of the Czech origin, Zdeněk Sekanina from the Jet Propulsion Laboratory in Pasadena, US, received the prestigious Nušl Prize for his life-long achievements in astronomy. The Nušl Prize is the highest award granted by the Czech Astronomical Society (CAS) to prominent Czech researchers for their substantial contribution to the development of astronomy. It bears the name of an eminent Czech astronomer and former president of the Czech Astronomical Society František Nušl (1867–1951). Zdeněk Sekanina was born in Mladá Boleslav near Prague in 1936. While he was only a student of physics and astronomy at Charles University, he published his first scientific studies on comets. These comets and other minor objects in the Solar system have become the main focus of his research both in the former Czechoslovakia and later in the US, namely at the Smithsonian Astrophysical Observatory of Harvard University and since 1980 at the Jet Propulsion Laboratory. His numerous studies were concentrated on the character of the Tunguzka meteorite, comet Halley, the disintegration of the comet Shoemaker-Levy 9 and more recently particularly on the complex of comets observed by the SOHO satellite near the Sun. His pioneer works deal with the main effects influencing the structure and development of comet nuclei, comas and tails.

The Sun's Magnetism

Solar physics is a discipline related to several other branches of science. Because of the uniqueness of the Sun: It is the only star that can be explored in great detail, and being the energy source of our solar system it affects everything in our cosmic neighborhood.



Jan Olof Stenflo, ETH Zentrum, Zurich, Switzerland

The Sun is often called the "Rosetta Stone of astrophysics", since many astrophysical processes and tools that are needed for exploring and understanding the more distant universe are initially discovered, explored, and tested in the astrophysical laboratory that the Sun provides. Examples are the atomic-physics and radiative-transfer tools that are needed for analyzing astrophysical spectra, the plasma physics, dynamo, and acceleration processes that also occur in various forms elsewhere in the universe, magnetic variability and structuring, heating processes and the generation of stellar winds, and asteroseismology to determine the internal structure of stars.

The Sun with its solar wind, eruptions and coronal mass ejections governs the violently fluctuating space weather, which is a major factor to reckon with for all manned space travel. The magnetic variability of the Sun also influences its brightness, which affects the Earth's ozone layer and the global climate. For the quantitative understanding of global climate change and the man-made greenhouse effect one needs to properly identify and sort out the component in the global climate system that is linked to the variable solar irradiance. This hot topic has led to collaborations between solar physicists and climatologists. →

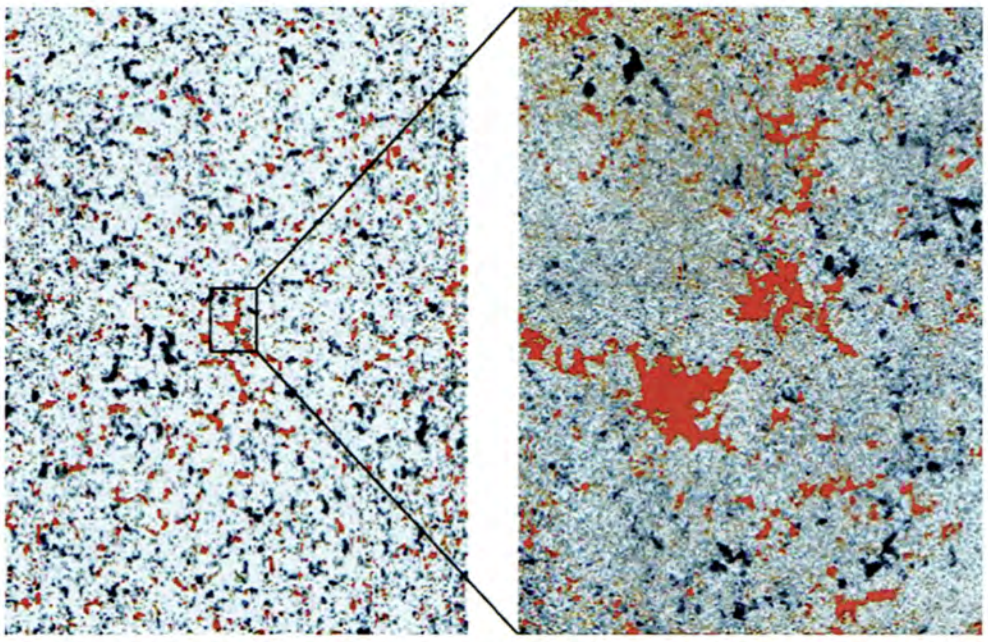


Illustration of the fractal-like pattern of magnetic fields on the quiet Sun. The rectangular area covered by the left map (from Kitt Peak) is about 15 % of the area of the solar disk, while the map to the right (from the Swedish La Palma telescope) covers an area that is 100 times smaller. The two maps represent patterns of circular polarization caused by the Zeeman effect. The dark blue and red areas correspond to magnetic flux of positive and negative polarities, separated by light blue voids of seemingly no flux. Analysis of Hanle-effect observations of atomic and molecular lines made at IRSOL (Istituto Solari Locarno) have shown that these light blue regions are actually no voids at all, but are teeming with turbulent magnetic fields that carry a significant magnetic energy density. Since these turbulent fields are tangled with mixed polarities on very small scales, they are invisible to the Zeeman effect, but they are revealed by the Hanle effect.

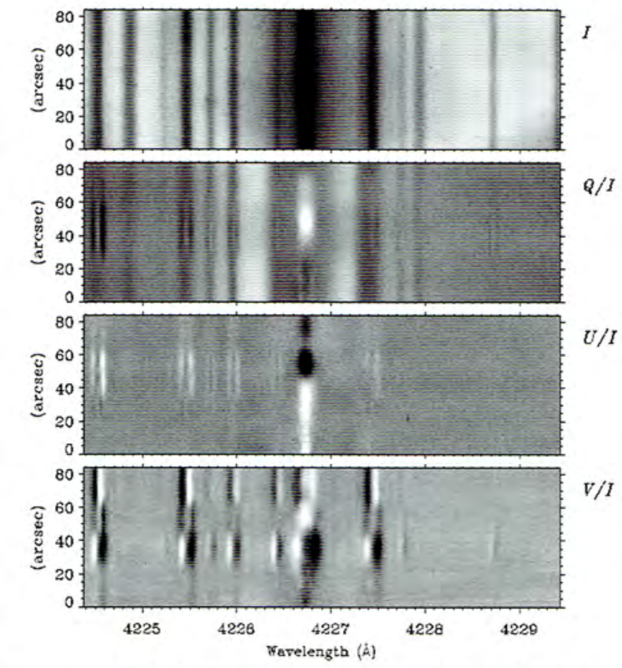
Magnetic fields are responsible for most of the variability on intermediate time scales in cosmic objects. From stars and planets to the scales of galaxies, magnetic fields are produced by dynamo processes governed by magnetoconvection with broken left-right symmetry due to the Coriolis forces in a rotating medium. The Sun presents us with a unique laboratory to explore dynamo processes in depth. Helioseismology allows us to determine the rotational and convective structure of the Sun's interior, where the dynamo operates. The intricate manifestations of the dynamo in the Sun's atmosphere can be directly observed with high spatial and temporal resolution throughout the electromagnetic spectrum. These manifestations include the 11-year activity cycle, sunspots, plasma instabilities (flares and coronal mass ejections), particle acceleration, and the solar wind. The key parameter in this context is the observed magnetic structure at the interface between the Sun's convective interior and radiative exterior, namely the photosphere. The magnetoconvective pattern that we observe here tells us about the fundamental processes governing the dynamo, and it also governs the energy balance and dynamics of the magnetically controlled atmosphere above.

A main objective of contemporary solar physics is therefore to diagnose and explore magnetoconvection with its multitude of magnetic structures in as great detail and depth as possible. The diagnostic tool to determine the magnetic field is spectro-polarimetry. There is a coexistence of a vast range of spatial and temporal scales in the magnetic pattern, from the global scales that govern the solar-cycle time scale, down to the turbulent scales at the diffusion limit, far beyond the resolving power of solar telescopes. Since it is widely recognized that the key to a unified physical understanding can be found in the small scales, there is an ongoing quest both for improving the spatial resolution, like with larger telescopes using adaptive optics, and for developing various diagnostic techniques that allow us to infer the physical properties in the domain that remains spatially unresolved.

It has been realized recently that the Sun's magnetic pattern is fractal-like, with a high degree of self-similarity between the pattern at global scales (> 10^5 km) down to the current resolution limit (close to 100 km on the Sun). Numerical simulations of magnetoconvection suggest that the fractal-like structuring will continue to be several orders of magnitude below the resolution limit. Still the scales that we are just beginning to resolve with polarimetric techniques (with the Swedish 1-m La Palma telescope, and from next year with the German GREGOR on Tenerife) are of crucial importance. This is necessary, since the 100 km scale represents both the scale height of the atmosphere and the transition between optically thick and thin structures, a scale at which the so-called convective collapse mechanism for the spontaneous formation of discrete magnetic flux tubes is expected to operate.

Magnetic fields are traditionally mapped by recording the Zeeman-effect polarization, but recently the Hanle effect has emerged as a complementary diagnostic tool. In contrast to the Zeeman effect, the Hanle effect is a coherency phenomenon that represents the magnetic modification of the polarization produced by coherent scattering. Since its magnetic sensitivity depends on the Zeeman splitting relative to the tiny line damping width (and not relative to the Doppler width as for the Zeeman effect), the Hanle effect is sensitive to weaker fields. Also, since the Hanle effect has different symmetry properties than the Zeeman effect, it gives polarization signatures of spatially unresolved and tangled turbulent fields with zero net flux, while the Zeeman effect is entirely blind to such fields. Therefore the two effects are highly complementary to each other.

More than three decades ago it was possible to use indirect methods (the line-ratio technique) with the Zeeman effect to conclude that most of the photospheric magnetic flux must be in a state of extreme fragmentation and largely carried by kilogauss flux tubes with sizes about 100 km, although the resolved structures seemed much larger and with orders of magnitude weaker in some fields. Only now are we beginning to directly resolve these flux tubes to understand the physics behind them. As the flux tubes occupy typically only about 1 % of the photospheric volume, the remaining 99 % appear field free to the Zeeman effect. Applications of the Hanle effect however reveal that these 99 % are far from field free but are teeming with a tangled or turbulent field that carries enough magnetic energy to be significant for the overall energy balance of the solar atmosphere. Still the fractal-like nature indicates that the flux tubes and the turbulent fields are merely two aspects of the same underlying fractal reality that we try to explore with different diagnostic "filters": When we look at the Sun with our "Zeeman goggles", we see the flux tubes, while when we put on our "Hanle goggles", we emphasize the turbulent aspect of the fields. We are now beginning to employ both tools together to arrive at a more comprehensive view. The difficulty is that the structures that we are dealing with are not spatially resolved.

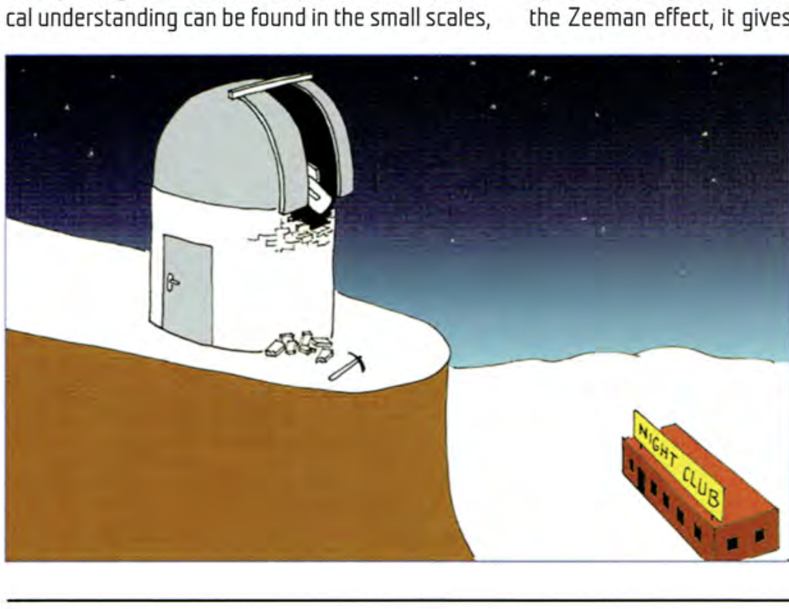


Example of a Stokes vector spectral image (four simultaneous images of the four Stokes parameters). The recording was obtained with ZIMPOL in a magnetized solar region, and shows the spatially structured signatures of both the Hanle effect (in the core of the Ca I 4227 Å line) and the longitudinal and transverse Zeeman effect (in the surrounding spectral lines).

These new diagnostic possibilities have been made possible by the development of highly sensitive spectro-polarimeters, which can image the full Stokes vector, i.e., produce four simultaneous images of the four Stokes parameters that represent the polarization states. A breakthrough occurred with the introduction of the ZIMPOL (Zurich Imaging Polarimeter) technology in 1994, which allows complete elimination of the two main noise sources, seeing and gain table noise, such that the polarimetry becomes photon-noise limited down to polarimetric levels below 0.001 %. With the ZIMPOL technology four image planes are handled simultaneously within a single CCD sensor. The photo charges are cycled at kHz rates between the exposed image plane and three hidden, fast buffers, in synchrony with the electro-optical modulation. This technology has opened up a new window to explorations of the Sun and among other things led to the discovery of the so-called "Second Solar Spectrum", the Sun's spectrum in linear polarization that is produced exclusively by coherent scattering processes (which are modified by magnetic fields via the Hanle effect). This polarization spectrum is as richly structured as the ordinary intensity spectrum but with very little resemblance to it, as if it were an entirely new spectrum.

As we strive to access ever smaller scales, we need larger solar telescopes, which, with the help of adaptive optics and being placed at good sites, can be used near their diffraction limits much of the time. At the diffraction limit, however, the number of photons received per diffraction element is independent of telescope size (since the larger the telescope aperture, the smaller the diffraction element). Although the Sun appears so bright to us because of its large angular size, solar telescopes are photon starved in a similar way as night-time telescopes. One cannot simultaneously maximize the four governing observing parameters, the angular, temporal and spectral reolution plus the polarimetric accuracy, but various trade-offs are necessary, even for the largest conceivable telescopes. In the mentioned 4-dimensional observational space we can however access new, unexplored domains (through the various trade-offs) when the telescope is larger. The 1.5 m aperture McMath-Pierce facility at Kitt Peak has for four decades been the largest solar telescope in the world. The currently best angular resolution is achieved by the Swedish 1-m La Palma telescope with its adaptive optics system. In 2007 first light is expected for the 1.5 m German GREGOR telescope on Tenerife. The US is planning the 4 m ATST (Advanced Technology Solar Telescope), currently scheduled to become operational on Maui in 2014. During much of the 1980s and 90s there were European-led efforts to build a LEST (Large Earth-based Solar Telescope), which did not materialize then but is recently being revived in the form of a new consortium, EAST (European Association for Solar Telescopes), having as one of its main aims to build an EST (European Solar Telescope). It will be optimized for exploring small-scale magnetic fields with spectro-polarimetry, have an aperture of about 3 m, and be placed in the Canary Islands. ❐

Jan O. Stenflo



An Astronomers' Data Manifesto: data needs for new telescopes
Ray Norris

How often do you hear an enthusiastic discussion proposing a new telescope? And how often do they discuss data management? Sadly, not enough. Typically, half the cost of a modern ground-based telescope is in the software and data processing. These need to be planned and developed at the same time as the hardware, rather than leaving it to grad students to figure out when the data arrive. This may seem obvious, especially to those major projects that already routinely follow this practice. However, some projects have not shown such foresight, resulting in instruments which perform well technically, but which have not delivered the expected science. We astronomers need to get our act together and think about these issues before, rather than after, the telescope is funded and built. Find out how at Special Session SPS6: "Astronomical Data Management" on Tuesday afternoon, August 22.

A Walk around the Old Town

Alena Šolcová, Michal Křížek, Jana Olivová

The streets emanating from Staroměstské náměstí (Old Town Square) were where a number of outstanding scientists and artists lived and worked.

The campus of Charles University [minor planet *(4339) Almamater*] at Celetná Street incorporates **Karolinum** [minor planet *(2288) Karolinum*] which is also accessible from Železná Street. It is the main historical building of Charles University, founded by Czech king and Roman emperor Charles IV [minor planet *(16951) Carolus Quartus*] in 1348, being the first university in Central Europe. The original gothic home of Jan Rotlev from the 1380s was adapted to serve the purposes of the university. Although Karolinum is a national historical monument, it continues to serve as an important university building. Its Great Hall is where graduation ceremonies and other important events still take place. In another hall of Karolinum – its *Hall of Patriots* – a famous lecture *"Über das farbige Licht der Doppelsterne"* (About the Coloured Lights of Binary Stars) was given by **Christian Doppler** (1804–1853) in 1842. There he presented his concept of the phenomenon that was later given his name – the Doppler principle. Doppler was dedicated the minor planet *(3905) Doppler*.

In March this year a memorial plaque honouring Doppler was placed on the house at U Obecního dvora 7/799 (Prague 1) where he lived from 1843 to 1847.

A bust of **Bernard Bolzano**, who was among those who heard Doppler's lecture, is placed to the right of the main entrance to the Hall of Patriots of Karolinum. A memorial plaque in honour of mathematician and philosopher Bernard Bolzano (1781–1848) was placed on the house called *"The Four Stone Columns"* in Celetná Street No. 25/590 (Prague 1) where he spent his last years. Bolzano devoted himself to basic principles of mathematics, he was one of the pioneers of logical semantics and predecessor of Geoge Cantor in the study of infinite sets. His name, too, has been given to a minor planet – *(2622) Bolzano*. Bolzano's parental house was situated at the present Mariánské Square. The former university hall of residence on Ovocný trh 12/573 (near Karolinum) was where **Johannes Kepler** [minor planet *(1134) Kepler*] lived between the years 1604 and 1607. It was here he discovered that the orbit of Mars is elliptical. He observed the supernova at the constellation of Ophiuchus from the wooden tower in the garden of that university building. A memorial plaque was placed on the left side of the passage.

On the house at the corner of the Kaprova and Křížovnická Streets (Prague 1) is a bust of chemical physicist and Nobel Prize laureate **Jaroslav Heyrovský** [minor planet *(3069) Heyrovský*], who was born there in 1890.

Eminent Czech physicist, mathematician, astronomer and physician **Jan Marek Marci from Kronland** (or Ioanes Marcus Marci) stayed in a home on Melantrichova Street No. 12/472 (Prague 1) in the years 1635–1667. Twenty years before Newton did, he carefully described the dispersion and diffraction of light, he studied the colour spectrum of the rainbow, the impact of balls and so on, which is depicted in the bottom part of the relief on the memorial plaque placed on the aforementioned house. The name of Jan Marek Marci was given to a minor planet *(3791) Marci* as well as to a crater on the far side of the Moon.

The house on the corner of Maiselova and Kaprova Streets (Prague 1) is where the famous Czech writer **Franz Kafka** [minor planet *(3412) Kafka*] was born. A memorial plaque has been placed on this house. This location is called Franz Kafka Square. ❑

Brief information

❍ **The Business Meeting of Division VIII** is postponed to Session 3 (Club D) on Friday 18th and it will be immediately followed by the Business Meetings of Comission 28 and Comission 47.

❍ **Nuncius Sidereus III** welcomes brief articles and discussion contributions. You can use our e-mail **nuncius@ig.cas.cz**, our mail box next to the escalator on the 2nd floor of the Congress Centre. You can visit us personally in the offices **222** and **223** or you can call us by phone: 239 077 072.

"Astrophysics has been interpreted broadly to include all parts of astronomy that do not actually require you to recognize the constellations or predict the phases of the Moon."

Virginia Trimble

Secret diary of secret agent F.R.Og

August 16th: It seems the IAU has problems with planets. There's either too many of them or too few, don't know now. I decided to help. Went to the Planet Definition Office and said: "You really don't need to have just one type of planets. Introduce several types, e. g. M-types for habitable planets like Earth. It's easy to find out the type, just install a simple subspace detector on the surface of ..." I couldn't continue. The officer looked at me hatefully and hissed: "Get out! This is an astronomical conference not a StarTrek con!" I don't call that an assertive attitude.

NOMENCLATURE FILLER

4. From Confusion to Clarity: Shortcuts lead to confusion

Hélène R. Dickel

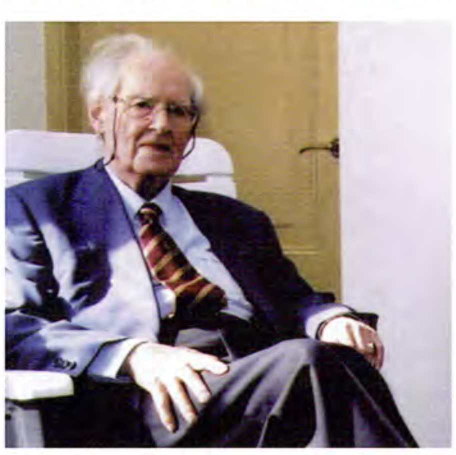
Often an astronomer finds it convenient to shorten a long designation (be it the acronym or dropping the last digits in the coordinate part). However, without the full designation and precise coordinates also being specified, it becomes difficult to find the proper reference to the source. This leads to confusion for the reader and possible errors in associating one object with others observed in different wavelength bands. Complete designations along with accurate positions are essential for the Virtual Observatory to realize its full potential and usefulness.

Reminiscences 1938-2006

A.Blaauw: IAU President 1976–1979

In August 1938, I enjoyed attending my first IAU General Assembly, in Stockholm, Sweden. Ejnar Hertzsprung and Jan Oort, at that time director and assistant director of Leiden Observatory, had managed to obtain travel funds for a couple of students and permission for them to attend the meetings. It was a cosy gathering of some two or three hundred astronomers and their companions. I witnessed celebrities in action, among them Annie Cannon, Arthur Eddington, Bertil Lindblad, Harlow Shapley and Fritz Zwicky, and I enjoyed the boat trip in Stockholm's harbor region as well as the closing dinner in the city's famous City Hall where I happened to be seated among a group of lively Harvard students. Since then I attended many more General Assemblies, 1948 Zurich, 1955 Dublin, 1958 Moscow, 1961 Berkeley, 1964 Hamburg, 1967 Prague, 1970 Brighton, 1973 Sydney, 1976 Grenoble, 1979 Montreal, 1982 Patras, 1988 Baltimore, 1994 The Hague, and Manchester 2000. Moscow 1958 lingers in my memory as the place where, in my capacity as President of Commission 33, Galactic structure, I defended successfully (but not without a bit of opposition) the introduction of the 'new' definition of the galactic pole and a new system of galactic co-ordinates, the system which has been in use since then. The discovery of the thin layer of neutral hydrogen which so nicely marks the plane of symmetry of our Galaxy, and the discovery of the strong radio source Sgr-A near the centre of rotation of the Galaxy had evoked a revision of the co-ordinate system.

Naturally, dominant in my recollections are the years of my presidency of the Union, 1976–1979. I cherish with warmest feelings the memory of General Secretary Edith Müller and Assistant General Secretary Patrick Wayman with whom it was such a pleasure to collaborate. We saw it as one of our main tasks, to clear the way for the solution of a problem that had plagued the Union increasingly in the past decades: the absence of the Peoples Republic of China from the Union since it had withdrawn in the year 1961 when the Union granted membership to Taiwan. It was with great satisfaction that at the conclusion of our term in office, at the Montreal General Assembly in 1979, we could submit to the Assembly the terms of agreement which opened the door for full membership of the entire domain of China including both the Peoples Republic and Taiwan.



My long-time interest in the activities and history of the IAU induced General Secretary Derek McNally (1988–1991) to ask me to write about the history of the IAU, a request inspired by the Union's (then) forthcoming 75th birthday in 1994. I limited my book to the Birth and First Half-Century of the Union (1919–1969) and completed it just in time for the 1994 Assembly in The Hague, where I had the pleasure to present it to Queen Beatrix of the Netherlands at the Opening Ceremony of the Assembly. The archives of the IAU, which I compiled for the purpose of writing the book, are not only a valuable source of information on the IAU's past, but also useful from the broader point of the history of international scientific collaboration in the 20th century. In 1998 the Archives were transferred to, and became the property of, the Académie des Sciences in Paris. I published an extensive guide to the Archives in 1999 (obtainable at the IAU Secretariat).

Research on the origin and earliest history of the Union had been quite revealing. After the IAU was born in 1919 (it happened right after the termination of World War I as the result of a meeting of scientists from the – then – Allied Powers, the International Research Council) its membership remained for many years a one-sided affair with exclusion of the formerly "central" powers. It was only after World War II that membership unbiased by political considerations from the side of the Union became a matter of course. We are fortunate to live in a time in which political barriers hardly play a role any more in scientific intercourse. Preparing for my second Prague Assembly, I now look forward to being in Prague again, and enjoying once more those two benefits of the Union's assemblies: meeting colleagues from all over the world, and learning about recent developments in that wonderful domain of sciences that unites us, astronomers.

Groningen, Netherlands, July 2006

Thursday 17/8

10 °C / 50 °F
morning minimum

29 °C / 84 °F
afternoon maximum

Partly sunny, may be foggy in the morning

SE winds 6 m/s (14 mph)

Friday 18/8

12 °C / 54 °F
morning minimum

28 °C / 82 °F
afternoon maximum

Sunny in the morning, a shower in the afternoon

SW winds 5 m/s (11 mph)

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DISSERTATIO CVM
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PRAGAE — MMVI 18. VIII. — SERIES TERTIA

Defenestrace

It has long intrigued me that the Czech language, renowned for its vowelless and unpronounceable words, also contains obvious counterparts to English words of Latin derivation. My first exposure to this Czech word came during the first IAU General Assembly in Prague in 1967, when a tour of the city provided more than I really needed to know about the first and second defenestrations in the great Bohemian tradition thought by many to have been applied to political opponents as recently as 1948.

Although the IAU GA in 1967 was held a few months before the start of the "Prague Spring", it seemed to me that, even with Novotny still in power, there were signs of hope for a better future. The authorities would still have disapproved of this socializing, but I did spend a very pleasant evening (which included a reading of Good Soldier Schwejk) with Zdeněk and Jana Sekanina in their apartment. Zdeněk's optimism regarding life in Czechoslovakia was considerably less than mine – and rightly so, given what happened on August 21, 1968, when they had the very good fortune to be in Liège at the invitation of Pol Swings. Knowing they were due to return to Prague in ten days, I prevailed on Fred Whipple to see if he could instead arrange a position for Zdeněk at the Smithsonian Astrophysical Observatory. Success sealed a professional and personal friendship between Zdeněk and myself that still continues.

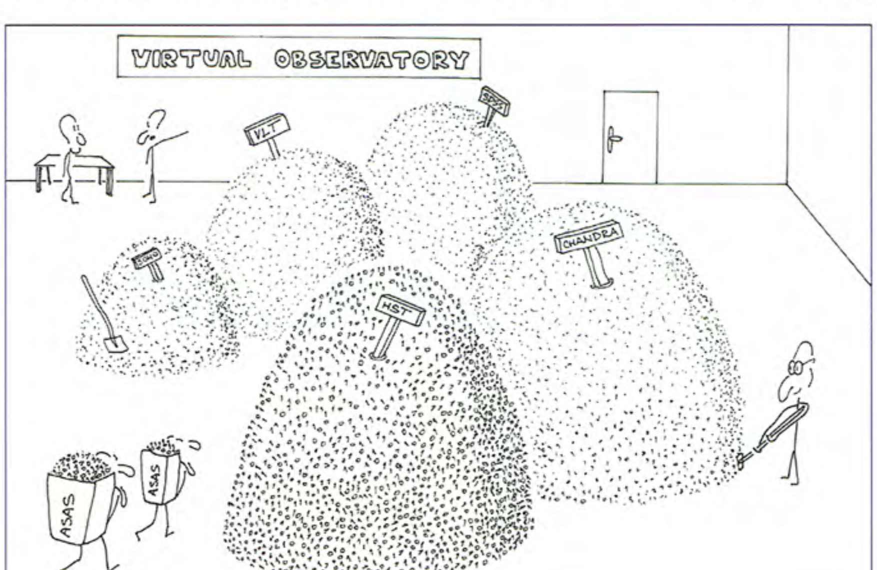
It was at that first Prague assembly that I was appointed director of the Central Bureau for Astronomical Telegrams, and as the IAU comes to Prague again 39 years later I am retiring as director of the Minor Planet Center. As an internationalist who has made friends in many different countries, I have been happy to serve the astronomical community in these ways. Although most IAU members don't seem to understand that the two services are in fact quite distinct (the CBAT is rightly a "union-wide activity") and there was a friendly passage of the baton, not only from my predecessor Owen Gingerich to me, but also from me to Daniel Green six years ago; the three of us still have neighboring offices in the least populated of SAO's buildings.

My predecessor as MPC director was Paul Herget, who in 1967 was retiring as president of Commission 20 when Zdeněk and I were inducted into membership of both the IAU and that commission. At the invitation of the EC, and with the approval of then-director George Field at SAO, I assumed the MPC directorship in 1978 (during my own term as Commission 20 president) at the time of Paul's figurative defenestration from the Cincinnati Observatory, which occurred when the state of Ohio decided it no longer needed to affiliate that very venerable institution with the University of Cincinnati, which itself had been transferred from city to state ownership a few years earlier.

I arranged for Conrad Bardwell to move with the MPC from Cincinnati to Cambridge, and this continuity was essential for the MPC's survival. When Conrad formally retired at the end of 1989 (although he still visits the MPC for a couple of hours most Saturday afternoons), during Irwin Shapiro's tenure as SAO director, I was very fortunate to be able to replace him with Gareth Williams, whose entirely unsupervised work as an undergraduate at University College, London, on identifications of minor planets had impressed me. He came with the very best recommendation from then-IAU General Secretary Derek McNally, namely, that "for him, astronomy means orbits of minor planets". As adept at writing computer programs as he is enthusiastic about actually applying them, Gareth introduced a remarkable degree of automation, without which it would have been impossible to cope with the hundredfold increase in observational activity brought about during the 1990s as the CCD replaced the photographic plate. Indeed, Gareth and Mr. A. U. Tomatic are quite capable of running the MPC all by themselves.

During the 31 years the MPC was in Cincinnati the set of minor planets bearing sequential numbers increased only from 1564 to 2060, with those that were "lost" decreasing from about 200 to 20. Now we know the precise whereabouts of all 134,339 of the numbered objects. Given that there are among these just 423 near-earth objects and 157 transneptunian and other objects in the outer solar system, it is perhaps not widely appreciated that more than 99.5 per cent of the entities with which the MPC deals are very ordinary lumps of rock in the region between Mars and Jupiter – the kind of object that even Commission 20 members half a century ago were deploring as "useless".

How times change! It is little more than eight years since the IAU suddenly began to consider the MPC one of its most significant components, given my offhand suggestion that a particular NEO might come a little too close for comfort in 30 years. There were now to be "terms of reference" and a "contract" between the IAU and SAO for operating the MPC, the rather dormant IAU Working Group on NEOs took a new lease on life, governments established task forces to advise them on the NEO threat, and NASA tripled the funding assigned for NEO research (although the amount assigned to the MPC was initially reduced). I appreciate the kind remarks by current General Secretary Oddbjørn Engvold in his preface to IB 98, although I also think it particularly important to recognize the contributions by Conrad Bardwell and Gareth Williams as MPC associate directors.



And Prague has also changed! As with the MPC, few would have dared to predict the change in 1967 – from a communist Czechoslovak Soviet satellite (who can forget the way all the food disappeared while many of us were still in the preprandial stage at the famous Closing Banquet in Lucerna Hall?) to a capitalist Czech Republic thriving in a European Union, which, despite its failure to get its act together, I nonetheless consider to be a remarkable advance from that time – and well-nigh unbelievable for one who recalls a childhood in eastern England with nights sheltering from the fascist "flying bombs". Of course, we do still live in a sad, mad world, and I suppose that will be so as long as the human race survives – and whether the windows are open or shut.

Brian G. Marsden

PHOTO DIARY

August 15th, 18:30: *Invitation of national IAU representatives at Prague City Hall – Ron Ekers with Deputy Mayor Jan Choděra (right)*

August 17th, 12:30: *Kamil Hornoch (Czech Republic) receives the Amateur Achievement Award of the Astronomical Society of the Pacific*

Farewell Reception

"Back to the thirties – Welcome to the kingdom of swing"

Time: Wednesday 23rd August 2006, 20:00 – 24:00
Place: Industrial Palace * Prague Exhibition Grounds, Výstaviště Praha, Praha 7 – Holešovice
Cost / 1 person: 30 EUR (discounted for GA participants)

Registration available at the registration area

Important notice: The **Division III** discussion of the definition of a planet will take place at 2:00 pm in Club B, not at 11:00 am as reported previously.

Today's programme: (friday 18/8)

- Symposia S236, S237
- Joint Discussions JD06, JD07, JD08, JD09
- Special Sessions SPS2, SPS3a
- Concert (6:15 p.m., Congress Hall)

Some thoughts on the occasion of the 26th IAU General Assembly taking place at Prague

Jorge Sahade, IAU President (1985–1988)

For me, it is indeed a very great pleasure and, naturally, also a fairly large responsibility, to have been asked for a contribution by the Editor of the journal of the present 26th General Assembly of the International Astronomical Union that is taking place in this modern Congress Center full of history and, indeed, magnificent, in the twelve centuries old city of Prague, that holds the honor of being the site of the first university in Central Europe, as of 1348. And soon after, astronomy became an obligatory introductory course together with matters related to the construction and utilization of astronomical instruments.

The great interest and support for astronomy in this part of the world, led to the construction in this city of Prague of the famous Astronomical Clock that you will certainly watch with delight and admiration sometime, and perhaps even more than once, before you leave this wonderful and historical city. You will also come to admire while here the most extraordinary sense of creativity of the people of this land, no matter which field of human endeavor you would consider.

As you might have guessed, Dr. Jiří Grygar, the editor-in-chief of the present General Assembly journal, is an old friend of mine, our acquaintance having started when I came to visit, at Ondřejov, the Observatory of the Czech Academy of Sciences, at the invitation of Dr. Mirek Plavec, now retired and living on the west coast of the United States, but, then, the Chairman of the group on close binary stars over here. This happened immediately after the 1964 IAU General Assembly in Hamburg, which is already more than forty years ago.

On my first evening in this part of the world, I was a guest of the Observatory and was housed on the uppermost floor of the building. When I arrived, the first thing I wanted to do was to take a shower, something that I tried to carry out by all means, in spite of the fact that, when I turned the faucet open, only a thread of water began to come out. A real problem arose when the "flow" of water stopped completely. And, then, I decided to tie the towel around my waist and go down to the next floor to look for some possible solution to the problem. Thus, I came to meet Dr. Zdeněk Švestka, who was then the head of the Ondřejov's Solar Department, and who later left his country to work mostly at Utrecht. Let me add that in 1995, Švestka was awarded the Gold Medal of the Academy of Sciences of this Republic and, in 2002, the Nusl Prize of the Czech Astronomical Society "for his very great contribution to the development of astronomy in the Czech Republic".

I had the very great pleasure of spending my last evening in that my first visit to Prague, as a guest of Jiří Grygar's family, a fact that I still remember with deep gratitude.

The present is the second time an IAU General Assembly is taking place in Prague, a city strongly linked in the 16th and 17th centuries with two great astronomers, Tyge (Tycho) Brahe, whose tombstone may be visited in the Týn Church, located at the Old Town Square, and Johannes Kepler, the latter, as his mathematical assistant. Tycho Brahe came to Prague in early 1599 and immediately after he did invite Kepler to join him. Actually, thus, "at the beginning of the 17th century Prague had become the astronomical center of the world".

The first IAU General Assembly held here in Prague took place in 1967, almost forty years ago, during the Cold War times. For me, it was a very memorable occasion, partly because I was then elected as one of the Vice Presidents of the IAU Executive Committee, together with my late Indian friend, Professor Manali Kallat Vainu Bappu, who was later elected President of the Executive Committee of the Union for the period 1979–1982, and another friend of mine, the late Professor Livio Gratton, from Italy. The 1967 General Assembly was also memorable, apart, of course, from the scientific program, for one special reason, because of the continuously moving, non stop, elevators system, which some of the Assembly participant astronomers did not dare to utilize at all. At this General Assembly I had the opportunity to meet another distinguished Czech astronomer, Professor Luboš Perek, who also became a member of the IAU Executive Committee, then as Assistant General Secretary. I could say that I feel fortunate that I had the opportunity and the pleasure to deal with Dr. Perek on quite a number of occasions. He is still very active and you will certainly have the opportunity of meeting and/or seeing him at this General Assembly. Another Czech friend I enjoyed dealing with during quite a number of years, is Dr. Josip Kleczek, who was very actively engaged with the IAU Schools for Young Astronomers program and in the preparation of multilingual astronomical dictionaries.

The present General Assembly is characterized by quite an ambitious scientific program that comprises 4 Invited Discourses, 6 Symposia, 17 Joint Discussions and 7 Special Sessions that will deal with carefully selected, important and timely subjects. In addition, there will be special activities aimed at those that qualify as Young Astronomers and the usual ones devoted to Women in Astronomy. For me, living in Argentina, the last type of activity sounds somewhat unnecessary, although at least a couple of my lady colleagues might strongly disagree with me, because in my country there exists a very substantial and quite an increasing percentage of women astronomers and no discrimination whatsoever does actually exist, on the contrary, I would say. However, I admit that the problem is indeed there in many other countries and it is, therefore, entirely justified to worry about those cases and try to find ways to bring about a change in the situation.

This General Assembly will provide, as it is always true, excellent opportunities for inspiration, for discussion and for establishing new contacts and new friends. However, at least for a number of us, this will be rather a sad occasion, because we will be remembering, as well as strongly missing, our late Dutch colleague, Dr. Willem Wamsteker, who was the soul and the moving force behind the WSO/UV project, the UV project that follows the so successful, but already inactive, IUE satellite. Around the WSO/UV project, a joint discussion has been organized to take place at this very General Assembly, a meeting that will also honor Professor Cornelis de Jager, a pioneer in UV Astronomy. The WSO/UV project is now in the able and eager hands of our Russian colleagues with the active participation of a number of research groups in other member countries, like China, France, Germany, Great Britain, Holland, Israel, Italy and Ukraine. Other countries, like Argentina and South Africa, will cooperate with their appropriate receiving antennae, by collecting and disseminating the information stored by the satellite at the time it is orbiting in their respective areas of action.

In many ways, then, as it is usually the case, the present General Assembly will provide colleagues with a most valuable opportunity for receiving and disseminating information, for most useful personal discussions and for starting and for planning cooperative researches. Above all, General Assemblies give younger astronomers a wonderful occasion to hear and, perhaps, be inspired by more established colleagues, thus contributing greatly to the progress of our science all over the world. ❐

The quinceañera of astrophysics in 1991

Astronomical reviewing is not a new idea. Fritz Zwicky tackled supernovae (for Reviews of Modern Physics) in 1940, and if you say, well then, weren't all the references to his own papers, you wouldn't be so very far wrong.

Virginia Trimble, University of Maryland, USA

The peacock blue volumes of Annual Reviews of Astronomy and Astrophysics, intended partly to update the Kuiper Compendia on the Solar System and Stars and Stellar Systems, debuted under the editorship of Leo Goldberg in 1963. Volume I contained 14 articles. Volume 43 has 18. Remarkable restraint in its way, given the growth of, for instance, Astrophysical Journal over the same period. But the articles are longer (49 vs. 29 pages on average) and the topics considerably narrower – radio telescopes, dynamics of galaxies, mass loss from stars, and the terrestrial planets in 1963 having yielded to.... well...look for yourself. Indeed the editor of this newspaper has been reviewing highlights of astronomy for the Czech-reading community since 1966.

In comparison, the series that began with "Astrophysics in 1991" (published necessarily in 1992) is a mere adolescent, having some of the traits you might associate with that age group, including rapid growth, a certain lack of discipline, and chronically late.

Whose idea was it? Truthfully, not mine. Howard Bond (STScI) had just taken over the editorship of Publications of the Astronomical Society of the Pacific and thought it might be interesting to begin each January issue with an overview of the previous year. Scheduling then dictated that the "year" must be an academic one, October to September. And he must often have felt like the parent of the Hydra: cut off one topic from the review, and two grow in its place.

Growth indeed, from 14 pages (covering Magellan at Venus to biased cold dark matter) for 1991 to a peak of 90 pages in 2000 (solar physics to unconventional cosmologies), and none much shorter since. After a few years, "mistakes had been made," opening up the opportunity for a Section 13 of corrections, with comments on other folks' mistakes as well. Impossible to pick a favorite, but they have appeared under titles like, "The Lederhosen Prize" (for pulling up of socks), "The James Challis Prize" (for not rushing into print), "Acta et Retracta," and "Ze come out of ze trenches viss ze hands up" (in an accent called Fritzwickese, which belongs to no known language group and so cannot be politically incorrect).

What else has happened? Four wonderful co-authors, Peter Leonard, then a Maryland postdoc, who covered dynamical astronomy (1993–95) before going on to a real job. Lucy-Ann McFadden, also University of Maryland, who looked after the solar system (1996–97) until her programatic responsibilities for NEAR, Deep Impact, and all intervened. Markus Aschwanden, who has made the sun shine out of Lockheed-Martin from 1998 right up to the present. And, new in 2005, Carl Hansen (JILA, emeritus), who brings to astrobiology the wisdom of both an astronomer and a biological organism.

Chronic lateness: Only Ap91–95 actually appeared in January. Ap2000 didn't make it out til September (my husband, Joe Weber, died that year), and Ap05 will probably only just have appeared as we convene in Prague.

Two changes of editorship: Howard Bond stepped down in 1998, so that Ap98 appeared under the new reign of Anne Cowley and David Hartwick (and with the invaluable help of Anne in checking and alphabetizing the references). Surely, critics will say, not a coincidence that I had chaired the search committee that found them? Not entirely, but, scout's honor, we did not discuss the series until after they had agreed to take over the journal. And PASP welcome Paula Szkody (University of Washington) as the new CEO with the January, 2006 issue.

How does the thing get done, given that the 30 or so journals that publish refereed astronomy/astrophysics add up to more than 6000 papers per year? A bit like the six elephants in a Volkswagen – three in front, and three in back. We read; we take notes; we write. Not all in the same fashion. Aschwanden is devoted to the Astrophysics Data Service. Trimble swears by (and sometimes at) paper, filling 150 notebook pages per year (at one line per published article) as she reads. And Hansen works in mysterious ways.

You might still have one frivolous questions and one serious one. The frivolous is: Will there be an "Astrophysics in 2006?" We don't know. And the serious: What is a quinceanera? It's that wonderful party parents sometimes throw for a daughter of Hispanic heritage on her 15th birthday, complete with white dress, flowers, close friends and all. Nearly as much fun as a wedding, and none of the responsibilities afterwards. This is, perhaps, a good metaphore for the ApXX series – the reviewer has almost as much fun as the researcher, and none of the responsibility. But we wouldn't do it otherwise. ❐

Astronomical facilities in the Czech Republic

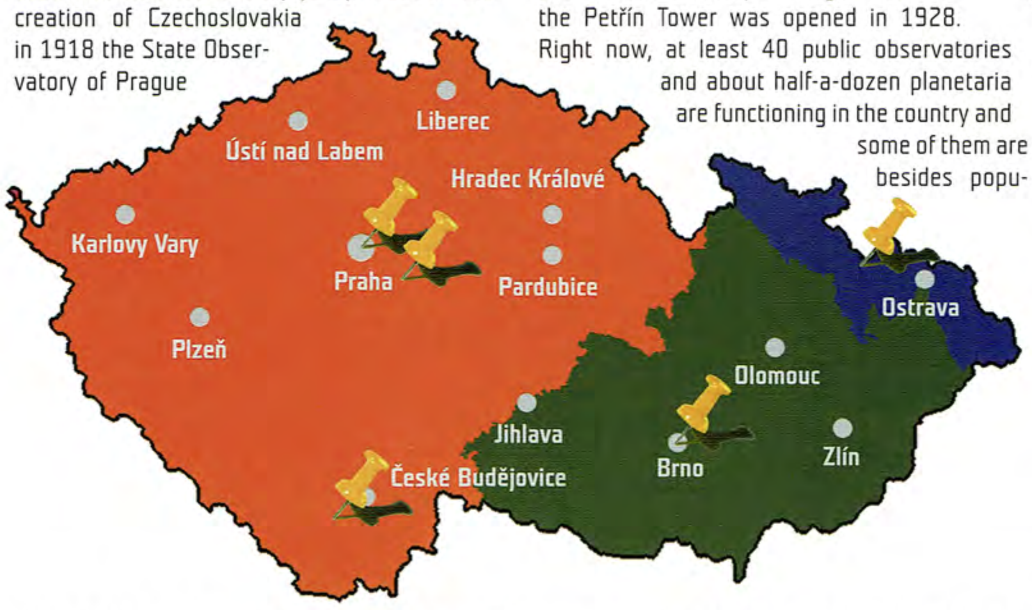
The region of Central Europe underwent a long and often turbulent history. Thus the Czech Republic is the contemporary successor of three historical lands: Bohemia, Moravia and Silesia united by a common Czech language and long cultural tradition. Astronomy forms a rather extraordinary part of this tradition as wittnessed by the historical account presented by Alena Hadravová during the Inaugural Ceremony.

It is perhaps less known that astronomy flourished in these countries again from the beginning of XX[th] century due to the establishment of Ondřejov Observatory in 1898 and founding the Czech Astronomical Society (CAS) in 1917. After creation of Czechoslovakia in 1918 the State Observatory of Prague expanded to Stará Ďala (now Hurbanovo in Slovakia) and during the Second World War a brand-new Observatory at Skalnaté Pleso was erected in High Tatra Mountains (Slovakia) due to the persistency of a well-known Czech astronomer Antonín Bečvář.

Moreover, public observatories and planetaria have been built in many places. The first public observatory in Pardubice (East Bohemia) functioned in the years 1912–1930, then due to the efforts of CAS, Štefánik Observatory in Prague near the Petřín Tower was opened in 1928. Right now, at least 40 public observatories and about half-a-dozen planetaria are functioning in the country and some of them are besides popularization involved in astronomy research of the Sun, variable stars, lunar occultations, observing comets and meteors, etc. Astronomy was also promoted through journals like "Říše hvězd" (The Realm of Stars) and its successor "Astropis" (we borrowed the able editorial staff of Astropis for Nuncius III).


Václav Pačes

From these grassroots, present professional astronomy institutions were grown. By far the largest is the Astronomical Institute of the Academy located in Prague and Ondřejov that bears also the main burden of the organization of XXVI[th] IAU General Assembly. The Prague Congress is held under the auspices of the Academy of Sciences of the Czech Republic that consists of 53 institutions with specialization from astronomy and physics to chemistry, biology and humanities. Its present President Václav Pačes (depicted) was a distinguished speaker at the Inauguration when he displayed an amusing sketch from an old Czech comedy about emperor Rudolph II. In the excerpt Tycho Brahe explained to his master planetary movements in Tychonic planetary system by circulating the glasses of red wine on a table. The point was the wine for the Emperor was secretly poisoned by his enemies who were also present at the reception and should toast the wine after Tycho's confusing play with the glasses.



The map of historical regions of the Czech Republic – Bohemia (red), Moravia (green) and Silesia (blue). Three universities, where the astronomy and astrophysics is being taught, are not only by coincidence distributed in all historical "lands" – in the cities Praha, Brno and Opava. The positions of major cities and other astronomical institutions are also shown.

The Coat of Arms of the Czech Republic also displays the three historical regions which make up the nation. The arms of Bohemia, displayed twice (in the top left and bottom right) to symbolize the traditional importance of that region, shows a silver double-tailed lion on a red background. In the top right, the Moravian red-and-silver chequered eagle is shown on a blue blackground. In the bottom left the arms of Silesia, a black eagle with the so-called "clover stalk" in his breast on a golden background is shown, although only a small south-eastern part of the historical region of Silesia belongs to the Czech Republic (as you can see in the map on the left)

We have given you in these two and a half pages a general overview of the settings, structure and programme of the most important Czech astronomical facilities as a clue for your decision how to spend the forthcoming weekend in our country. Have a good time.

Jiří Grygar

Astronomical Institute of the Academy of Sciences of the Czech Republic

Petr Heinzel, Director

Astronomy in the Czech Republic has a rich tradition which can be traced back to the times when famous astronomers Tycho Brahe and Johannes Kepler worked together in Prague. The original Prague observatory, located in the Clementinum tower, was the basis for later State Astronomical Observatory. After the Czechoslovak Academy of Sciences was established in 1953, it was merged with the Ondřejov Observatory (founded by Dr. Josef Jan Frič in 1898), to create the Astronomical Institute which now belongs to the Academy of Sciences of the Czech Republic. The Institute is located in the village Ondřejov (35 km south-east of Prague) with a smaller part in Prague-Spořilov.

After the private observatory of J. J. Frič was founded, the first scientific observations were carried out by him and his colleagues on 1[st] August 1906. They used the circumzenithal constructed by Dr. Frič and Prof. Nušl and observed the passage of several stars. So the centenary celebrations of the first observation took place at the Ondřejov Observatory just two weeks before GA IAU convened in 1967 in Prague – we cordially invite the participants of the GA to visit the Observatory during the weekend 19–20 August (see the information in the Program Book). The focus of activities of the Astronomical Institute is scientific research in astronomy and astrophysics. Particular research topics concern the formation, evolution, dynamics and properties of stars and stellar systems, the investigation of the Sun, its atmosphere and solar activity which influences the processes on Earth as well as in the whole heliosphere (the so-called 'Space Weather Program'), the studies of near-Earth space, dynamics of natural as well as artificial bodies in the solar system, studies of interplanetary matter and its interaction with the Earth's atmosphere. The observations are performed at the Ondřejov Observatory, where several medium-size facilities are operated. Among them, the 2-meter stellar telescope and two large horizontal solar telescopes used for spectroscopy are worth mentioning. Let's note that the inauguration of the 2-meter telescope took place during the IAU GA held in Prague 39 years ago. Traditionally, a European network is organised to detect automatically the bright meteors, now being expanded also to Australia. A fully automated bolide camera is displayed at the Institute's exhibition stand. Acquired data are analysed using sophisticated theoretical models and extensive numerical simulations (the Institute uses two cluster computers). Around 60 scientists, PhD students and post-docs comprise the Institute's staff.


Historic dome at the Ondřejov Observatory

The Institute has four scientific departments, each consistng of several working groups (for more detailed information see the Institute's Activity Report which is issued every two years; this small yellow booklet is part of the congress materials). These are: solar department (head F. Fárník), stellar department (head P. Koubský), department of interplanetary matter (head P. Spurný) and department of galaxies and planetary systems (head J. Palouš). The latter is located in Prague.

The Astronomical Institute acquires, analyses and disseminates scientific knowledge, edits scientific journals, conference proceedings and other scientific publications, organizes scientific meetings, provides the scientific expertise, opinions and recommendations and carries out consulting and advisory activities. In a close collaboration with the Faculty of Mathematics and Physics of the Charles University in Prague and with some other universities, the Institute provides and guarantees the post-graduate and doctoral studies of astronomy and astrophysics and trains scientists. The Institute has a rich post-doctoral program in which young scientists from abroad are also involved.


The 2-m reflector – the largest telescope in the Czech Republic

Most of the scientific activities of the Institute are carried out in the frame of wide international collaboration, namely with important European as well as other centers of excellence. The Institute participates in solar and stellar observations at large European facilities on the Canary Islands (where the largest world-wide solar telescope GREGOR (1.5 meter) is now being built with the Institute's involvement), as well as in Chile where the European Southern Observatory (ESO) has its most advanced telescopes. The Institute is currently involved in negotiations with ESO and Czech national authorities in order to achieve the full membership of the Czech Republic in ESO. However, not only ground-based telescopes are used, the Institute is also participating in internationally conducted space research, and specifically within the Europen Space Agency (ESA). Participation in large space missions like SOHO, INTEGRAL and others is worth mentioning, with a future engagement in the Solar Orbiter, GAIA or XEUS. This is part of an ESA-PECS program which the Czech Republic has recently joined in preparation for the full ESA membership in the near future. More information at **www.asu.cas.cz/english/**. ❑

Kleť Observatory

Jana Tichá, Director

1.06-m KLENOT Telescope of the Kleť Observatory

The Kleť Observatory is known particularly for its research of asteroids and comets The Kleť Observatory is located in the southern part of the Czech Republic, on the Kleť Mountain at the altitude of 1,068 m, which makes it the highest situated observatory in Bohemia. It is about 30 km southeast of České Budějovice in a location having favourable climatic and excellent observation conditions in the natural preserve Blanský les. The observatory is administered by the South Bohemian Region. It is the only professional astronomical institution in Southern Bohemia.

The astronomical tradition of Kleť dates back to the first half of the 19th century when the Kleť look-out tower was used to perform astrogeodetic measurements for mapping the Czech Kingdom. The Kleť Observatory was built in 1957 as a branch of the observatory in České Budějovice. The second dome opened on Kleť in 1973. Originally, the Kleť Observatory used photographic technology and from 1977 its main equipment was a photographic 0.63-m Maksutov. Since 1993 the observatory has used an electronic CCD detector on a 0.57-m reflector. In 2002 the Kleť Observatory put into operation a new 1.06-m KLENOT telescope, the most advanced and the second largest telescope in the Czech Republic.

KLENOT is an acronym of "KLEť observatory Near earth and Other unusual objects observations team and Telescope". The KLENOT telescope was constructed using a 1.06-m f/3 primary mirror (Zeiss) and a primary focus corrector to obtain a field of view 0.55 × 0.55 degrees. The telescope is equipped with CCD camera Photometrics. The hardware and software equipment for this project consists of a local network containing servers and PCs and Kleť Software Package for image processing, data reduction, identification of moving objects, ephemeris calculations and orbit computations.

The current research programme focuses on small Solar system bodies, i.e. asteroids and comets. Within the programme, we specialize in research of bodies with unusual orbits. It includes follow-up astrometry of Near-Earth objects, distant objects (Centaurs, brighter TNOs) and comets. In the follow-up astrometry of Near-Earth asteroids Kleť has ranked among the most prolific observatories worldwide for more than ten years. These astrometric data helped to confirm new discoveries and to extend their observing arc. Moreover, they are centred on bodies fainter than magnitude 20.0 and fast moving objects. An outstanding series of objects observed at Kleť began with Near-Earth asteroid 1996 JA_1 reaching lunar distance from the Earth in May 1996 and it continues to the present time for instance such objects as close approachers 2002 MN, 2004 FH and 2004 XP_{14}, or Virtual Impactors 2004 MN_4 and 2004 VD_{17}. As far as distant objects are concerned we helped to refine the orbit of bright Transneptunian 2005 FY_9 or the well-known Sedna.

The Kleť Observatory is also systematically involved in confirmation of newly discovered comets. For newly discovered bodies moving in unusual orbits it is necessary to find out whether the body is an asteroid or comet and to identify its cometary features, i.e. presence of coma and/or tail. This interest in cometary bodies results also in the complementary physical studies of the comets. In the framework of the KLENOT Project we detected nucleus duplicity of comet C/2004 S1 (Van Ness) and provided astrometric measurements of 17 fragments of comet 73P/Schwassmann-Wachmann 3 including an independent detection of its several new fragments during 2006 close approach to the Earth.

The search for asteroids and comets has been the main objective of the Kleť Observatory for several decades. The Kleť observatory has 834 numbered asteroids up to now. The majority of them are main belt asteroids. During last decade, our goals changed to follow-up, although all CCD images are still checked for presence of previously unknown bodies. Particular attention has been paid to bodies with unusual orbits. This strategy resulted in discoveries of Near-Earth asteroids Apollo 2002 LK, Aten 2003 UT_{55} with diameter ca. 15 meters as well as a remarkable body 2004 RT_{109}, the asteroid moving on a trajectory typical for short-periodic comets, despite the fact that it is not demonstrating any other signs of cometary activities.

Four comets have been discovered at Kleť so far. The most recent one is the short-periodic comet P/2000 U6 (Tichý). More information can be found at **http://www.klet.org**

Institute of Physics, Faculty of Philosophy and Science, Silesian University in Opava

Zdeněk Stuchlík, Dean

After the Velvet Revolution, Silesian University in Opava was founded in 1991 and the Institute of Physics in Opava appeared as a part of the Faculty of Philosophy and Science. At present, the Institute of Physics guides bachelor, master, and PhD studies in theoretical physics, and bachelor studies in applied physics.

Research activities of the Institute of Physics are concentrated on relativistic and particle physics. In 1998, the Relativistic Astrophysics Group (RAG) was established; a group which unites researchers and students of Silesian University, collaborating in the field of relativistic astrophysics, with colleagues of institutions such as Oxford University, International School for Advanced Studies in Trieste, Chalmers University in Gothenburg and many others. Currently, their research is performed with the generous support of the Czech Goverment under the research project "Relativistic and Particle Physics and its Astrophysical Applications".

Our research includes the following topics: behaviour of particles and fields in the black hole backgrounds, accretion processes onto black holes and neutron stars (both theoretical and observational aspects), optical phenomena related to these accretion processes, the internal structure of neutron stars and quark stars, their cooling and oscillations, the relevance of the recently observed repulsive cosmological constant in accretion processes around supermassive black holes in the centre of quasars and giant active galactic nuclei, some aspects of the inflationary cosmology, CMB fluctuations and other related topics. The analytical methods are combined with numerical simulations in the research.

At present, the research group consists of 10 senior scientists and about 15 PhD students. Since 1999, annual "RAGtime workshops" are organized on black holes and neutron stars by the Institute of Physics in Opava for researchers and students of the Silesian University and cooperating institutions. For more information, please see **http://english.fpf.slu.cz/structure/uf**

Department of Astrophysics, Institute of Theoretical Physics and Astrophysics, Masaryk University in Brno

Zdeněk Mikulášek, Head

The Department of Astrophysics is a branch of the Institute of Theoretical Physics and Astrophysics of the Masaryk University in Brno, Czech Republic. Eight members of the Department provide training in astronomy of next to hundred students of astronomy in the three-level concept of education (Bachelor's study – Master's – Doctoral). Required courses include spherical astronomy, celestial mechanics, stellar spectroscopy and photometry, theory of stellar structure and evolution, theory of stellar atmospheres, galactic structure and dynamics, relativistic astronomy and cosmology. Students of astronomy also gain a solid basis in physics and applied mathematics and statistics. Many graduates of Brno astronomical studies have now their positions as scientists or tutors in astronomical institutes and observatories of Czech and Slovak Republics.

Astronomy at the Masaryk University has its long tradition, it has been lectured since the twenties of the last century, while the Astronomical Institute of Masaryk University was founded shortly after the World War II by Prof. Josef Mikuláš Mohr. A number of outstanding Czech astronomers, such as Luboš Perek, Vladimír Vanýsek, Jiří Grygar, Zdeněk Kvíz or Luboš Kohoutek worked here or started here their scientific career. Nevertheless, for the majority of them Brno was only the changing station in their way to more inviting positions in Astronomical Institute of the Czechoslovak Academy of Science or Astronomical Institute of the Charles University. Now the Brno astronomy has reached its golden age. The new staff of the Department of Astrophysics is young, efficient and well-grounded both in education and science, the interest of applicants from Czech and Slovak Republics in the study of astronomy is enormous.

Main research topics of the staff members of the Department involve study of hot stars and stellar systems with hot components and the research of variable stars of all types. We are concentrated in the complex research of chemically peculiar stars of the upper part of main sequence, where we study namely the interconnections among their magnetic field geometry and vast spectroscopic and photometric spots on their surfaces. From both theoretical and observational points of view we study atmospheres of hot stars and the wind blowing from them. We are engaged in variable star research with an emphasis on the development and application of new sophisticated methods for variable stars data processing and interpretation, study of eclipsing binaries and carbon Miras. Special attention is also paid to studies of education and history. Our research is fully supported by several Czech and international grants. The Department collaborates very closely with Astronomical Institute of the Academy of Science of the Czech Republic in Ondřejov and Astronomical Institute of the Slovak Academy of Science in Tatranská Lomnica, namely with their Stellar Departments in many common research projects. Astrophysicists from both institutions act as excellent supervisors of a number of Master or Doctoral Thesis. The most outstanding is the collaboration between the Department and Nicholas Copernicus Observatory and Planetarium in Brno, where the important part of the astronomical training of students takes place. University students are involved in activities of the public observatory and could use its equipment.

The Department manages the Masaryk University Observatory in Brno (Kraví hora), equipped with a 0.6-m reflector with a CCD camera (see the photo). The building of our dome was erected together with similar dome of the Observatory and Planetarium. The MU Observatory is used both for the students in training and obtaining photometrical data on variable objects in the sky.

The current personnel of the Department is Filip Hroch, Jan Janík, Jiří Krtička, Zdeněk Mikulášek (Head), Vladimír Štefl, Miloslav Zejda and part-time associates Zdeněk Pokorný and Viktor Votruba. For more detailed info, see **http://physics.muni.cz**

Dome with the 0.6-m reflector at Kraví hora Observatory
Image credit: Hvězdárna a planetárium M. Koperníka v Brně

The Astronomical Institute of Charles University in Prague

Petr Harmanec, Director

The Astronomical Institute of Charles University was founded by Prof. August Seydler, its first director, in 1886 and begun functioning in a garden house at Letná district of Prague. In 1900 it was moved into another villa on Švédská Street in Prague – Smíchov where it remained until 1997 when it was moved to its present location on one of the campuses of the Faculty of Mathematics and Physics to which it presently belongs.

Education at the Faculty is organised in such a way that all students receive an initial "grounding" in mathematics and physics for the first five semesters when they pass a aggregate exam in physics and defend their first written thesis to obtain the BSc. degree. Those willing to continue for their master degree choose a specific discipline, one of choices also being astronomy.

Undergraduate students therefore begin their astronomical education at the Astronomical Institute

The Institute's former location on Švédská Street

in the third year of their study and are expected to finish their education at the faculty within five years, with the option of extending their study for one more year if required by their Diploma thesis.

During the last few years, between 5 and 10 students have graduated each year. The obligatory education includes spherical astronomy, celestial mechanics, electromagnetic radiation, stellar spectroscopy and photometry, theory of stellar structure and evolution, theory of stellar atmospheres, galactic structure and dynamics and relativistic astronomy. Besides, students have a large selection of specialized optional courses, some of them being taught also by external experts, mainly from the Astronomical Institute of the Academy of Sciences in Ondřejov.

The Astronomical Institute and the Institute of Theoretical Physics also jointly coordinate the education of PhD students in theoretical physics, astronomy and astrophysics with the help of a committee which is composed of representatives of both Faculty Institutes as well as colleagues from several institutes of the Academy of Sciences. At present, the vast majority of PhD theses is written in English and reviewed by one Czech and one foreign referee.

There is an agreement about mutual collaboration between Astronomical Institute and the Astronomical Institute of the Academy in research, student training and education. Both institutes jointly run a 0.65-m reflector equipped with a CCD camera and photometer which is located in Ondřejov and students are also trained on several instruments at the Astronomical Institute of Academy in Ondřejov, especially stellar spectroscopy with a 2-m reflector, monitoring meteors, gamma-ray bursts with a robotic telescope, or studying stellar radiation over a large range of wavelengths. During PhD studies, many students are able to obtain observational data via European and international programs in a number of world observatories or via international collaboration with colleagues abroad.

Main research topics by staff members of the Institute include:

- Studies of the physical properties, dynamics and evolution of comets, small bodies in the solar system and planetary systems in general, with a special emphasis on the effects of non-gravitational forces like the Yarkovsky or YORP effects.
- Detailed spectroscopic and photometric studies of binaries an multiple systems with hot components, including complicated emission-line objects.
- Investigation of the role of relativistic effects in various astronomical objects like the physics of accretion disks around rotating black holes, both stellar and galactic ones, interaction of stars with galactic disks or motion of stars near galactic centre.
- Cosmological studies and statistical investigation of the properties of different groups of gamma-ray burst sources.
- Special attention is also paid to studies of the history of astronomy.

For more detailed info, including a specific course, see **http://astro.mff.cuni.cz/en**

Czech Astronomical Society

Czech Astronomical Society (ČAS) was founded on December 8th 1917. ČAS consists of 7 local branches, 9 special sections and 11 corporate members (e.g. Astronomical Institute of the Academy of Sciences of the Czech Republic). It is a member of the Council of Scientific Societies of the Czech Republic (a body representing more than 70 societies) and a corporate member of European Astronomical Society. Local branches, for example organize solar eclipses expeditions and popularizing astronomy, special sections are practicing specialized activities in particular subjects (variable stars, the Sun, star occultations by Solar system bodies, history of astronomy, interplanetary matter and others). ČAS focusses on specialized activities, but the emphasis is placed on popularization of astronomy. It has an informational web page, **www.astro.cz**, (in Czech) with 1700 visits a day on average. ČAS also looks for young talent – it organizes an Astronomical Olympiad established for primary and secondary schools. ČAS also awards three prizes: the prize of Zdeněk Kvíz is for exceptional achievements in variable stars and interplanetary matter research or popularization; the Littera Astronomica prize for popular publishing; and the Nušl prize awarded for a lifelong scientific contribution to astronomy. Professor František Nušl was long-standing president of Czech Astronomical Society (1922–1957), director of National Observatory (1924–1938) and also a vice-president of IAU (1928–1935).

The SINS Survey: Rotation Curves and Dynamic Evolution of Distant Galaxies with SINFONI

Measuring physical properties such as the dynamic mass and angular momentum of early universe galaxies is crucial in guiding galaxy formation models. Until recently detailed spatially-resolved studies of galaxies beyond z ~ 1 were not feasible. The situation has now changed with near-infrared integral field spectrometers, such as SINFONI, and the adaptive optics-assisted near-infrared integral field spectrometer at the VLT. Using SINFONI, we can investigate the morphologies and kinematics of optically/UV bright z ~ 2–3 galaxies on spatial scales of 4–5 kpc down to 1 kpc (with AO). The most surprising outcome is that many of these galaxies appear to be large, rotating, and probably gas-rich disks.

L. Tacconi, N. Bouché on behalf of the SINS Team

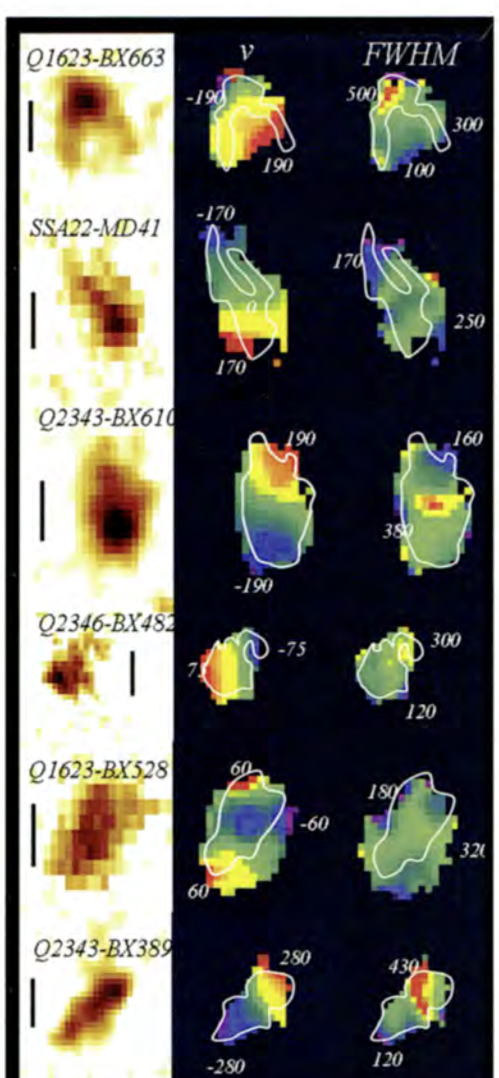


Figure 1. H_α morphology and kinematics of 6 z ~ 2 BX galaxies observed with SINFONI. For each galaxy, the panels show the H_α emission line map (left), the velocity map (center), and the velocity dispersion (right). The vertical bar in each of left panels denotes 1″, or 8 kpc; velocity ranges are marked. The kinematics of four of these six galaxies is consistent with a rotating disk while two (BX663, BX528) are more consistent with a merger.

The SINS survey: First convincing evidence for rotating disks at z ~ 2

The near-infrared integral field system (IFU), SINFONI, consists of a high throughput spectrometer, SPIFFI, built by MPE and a curvature sensing adaptive optics module, MACAO, built by ESO (Eisenhauer *et al.* 2003, Proc. SPIE **4841**, 1548; Bonnet *et* al. 2004, The Messenger **117**), and soon to be coupled with the laser guide star (LGS) facility PARSEC. SINFONI provides exciting new opportunities for spatially resolved studies of high redshift galaxies. The substantial advantages of IFUs over classical long-slit spectroscopy enable the study of kinematics of high redshift galaxies directly and to see how galaxies are being built.

On Wednesday (in S235), we presented our observational program, the "SINS" survey, which consists of 14 star-forming (UV-selected) "BM/BX" galaxies at z ~ 2, as well as ~ 10 K-band selected galaxies from the K20 and BzK surveys. All were observed with SINFONI under seeing conditions of 0.5–0.6″, corresponding to 4–5 kpc, with typical exposure times of 3–6 hrs. The first results discussed in Förster, Schreiber *et al.* (2006, ApJ, **645**, 1062) are shown in Figure 1. In summary, H_α is spatially resolved (with clumpy morphology), shows evidence for rotation. For three sources, the velocity gradient along the major axis flattens at radii ~ 10 kpc. Our sample has an average V_c of 180±90 km.s^{-1}. Most interestingly, the local velocity dispersion, v_c/σ, is found to be 2 to 4, implying that their disks are dynamically hot (Ellipticals have v_c/σ ~ 0.1–1, and local spirals have ~ 10–50).

SINFONI AO observations: detailed anatomy of a z = 2.38 star-forming galaxy

The combination of a superb spectrometer and an AO system in excellent atmospheric conditions is a recipe for spectacular results. In March/April 2006, we were lucky to benefit from excellent AO observations of a massive z = 2.38 star-forming galaxy for which a suitable AO star was available. The results are published in yesterday's issue of Nature (Genzel *et al.*, Aug 17, 2006). This galaxy, BzK-15504, was selected by the "star-forming BzK" colour criteria. During the observing run, we quickly recognized our luck and spent 6 hours on-source. The observations resulted in a spatial resolution of ≈ 0.15″ (or 1.2 kpc) and provide the most detailed view of the H_α morphology and kinematics for a z ~ 2 galaxy to date (Figure 2). The resolution is more than three times better than the data shown in Figure 1. The H_α morphology appears clumpy and extends over 2″ (16 kpc). The kinematics shows a smooth velocity field, and is fairly symmetric along the major axis, centered on the continuum peak. Most importantly, the outer parts of the rotation curve flatten at radii ~ 8–10 kpc, providing compelling evidence for a rotating disk. Interestingly, in the inner few kpc, we see a twist of the isovelocity contours relative to the larger-scale pattern, suggesting radial flows that could be related to inflow of material towards the nuclear regions, and/or to outflow due to an AGN. There are no obvious signs for a major merger. BzK-15504 appears to be a large, massive (M_{dyn} ~ 10^{11} $M_\odot$ within 10 kpc), gas-rich clumpy disk possibly in the process of channeling gas towards a central growing bulge and fueling an AGN.

Outlook

Our SINFONI results provide a first glimpse of the dynamics, sizes, morphologies, masses of galaxies at early stages of their evolution, at z ~ 2.5 and unveil their kinematics in unprecedented detail. In the near future, we look forward to studying larger samples (with laser-assisted AO observations) that will lead to substantial progress in our understanding of galaxy formation.

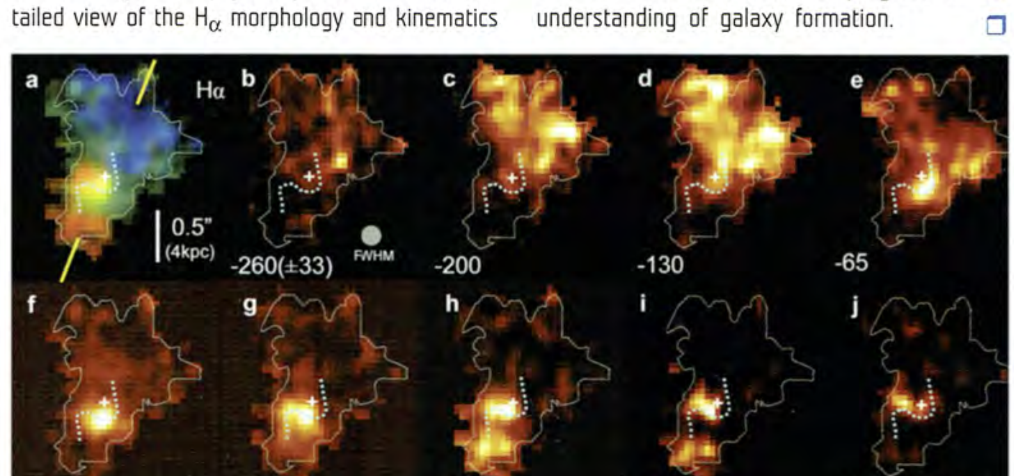


Figure 2. Velocity maps of H_α emission in BzK-15504 at z = 2.38. Panel a) is an RGB composite colour map of the H_α emission colour coded by velocity. The vertical bar shows 0.5″ or 4 kpc. Our AO-assisted PSF was 0.12″ or 1kpc as shown in Panel b. Panels b-i are the velocity channel maps. The dotted light blue curve visualizes the gas radial flow.

Astrometry from Prague 1 to Prague 2 IAU General Assemblies

Like any other fields in astronomy and astrophysics, astrometry has, during these forty years, undergone tremendous progress and extension in its scope. And even more fantastic prospects are now in preparation.

Jean Kovalevsky, Observatoire de la Côte d'azur, Grasse, France

One may describe astrometry in 1967 as "business as usual". The main instrument was the meridian circle and even the new micrometers could lead only to marginal improvements of the uncertainties (at most 40 % during the next 20 years). Advances in photography increased the number of objects, but with degraded precision. Astrolabes were more precise, but the number of observed objects was small. Similarly very good parallaxes were obtained in a few observatories, but at the expense of several years or even decades of observations. This is illustrated by Figure 1 and, for those catalogues that gave proper motions, by Figure 2.

The expectations for the following decades were quite modest, and this proved to be the case. The next 25 years were essentially marked by the construction of the FK5, issuing the IRS (International Reference Stars), a continuous work on zone photographic catalogues and the replacement of the SAO reference catalogue by PPM and ACRS.

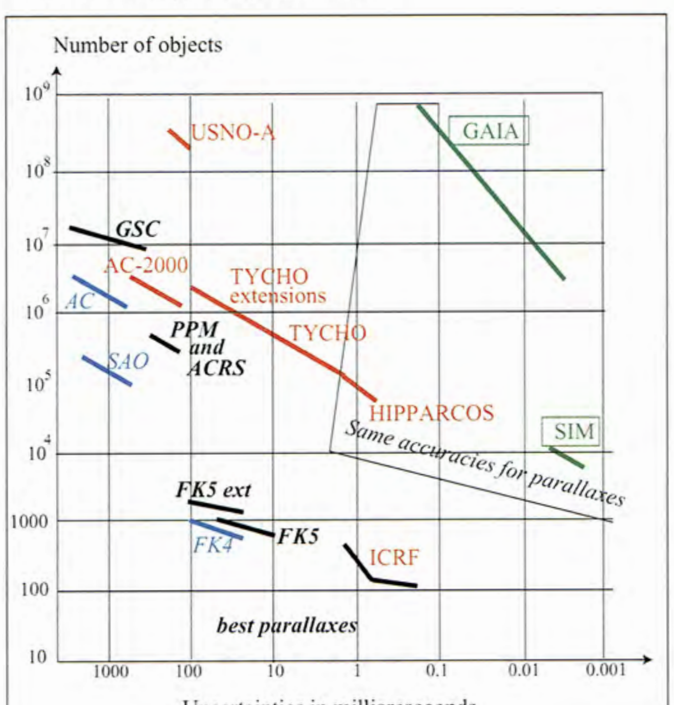
However, during the 1967 Prague IAU General Assembly, a very important event took place, though almost unnoticed. The French astronomer, Pierre Lacroute, presented to Commission 8 (page 68 in the Proceedings) his proposal of an astrometric satellite, which could obtain, in one second, the position of a star with an uncertainty of 0.01 arcseconds. This was the starting point of the Hipparcos saga.

Ground-based astrometry continued for some time; in particular, it helped to construct the Input Catalogue, which needed positions to 0.4 arcseconds for 120,000 stars. But, little by little, astrolabes and most of the transit instruments were closed. Another major event of these years was the advent of astrometry in radio waves. VLBI provided a number of observations of positions of a few hundreds of extragalactic radio-sources to better than 0.5 milliarcseconds. From this, the International Celestial Reference System (ICRS) was built and replaced the FK5. But the competition with Hipparcos could only be focussed on the number of objects. Several large photographic surveys were carried on. They were referred to the ICRS through Hipparcos and Tycho stars (see figures).

In my view, the most important consequence of Hipparcos is that astrometry became an inescapable source of data for most fields of astrophysics: distance scale, galactic kinematics and dynamics, stellar populations, star luminosities, star models, stellar evolution, etc... There is hardly an issue of the leading journals (ApJ, AJ, Monthly Not.) without one or several papers using the results of Hipparcos or data derived from it. Astrometry has become a major component of Astronomy at large.

But, as in 1967, another revolution is now being prepared. ESA approved and started to implement a new astrometric satellite, GAIA, for launch in 2011-12. It will observe up to a billion stars with uncertainties between 5 and 200 microarcseconds, a jump of 2 to 4 orders of magnitude above what exists now (see figures). The status of the programme will be presented Monday, August 21, 11:00-12:30 during the first scientific meeting of Commission 8. ❐

Fig. 1. Range of uncertainties in positions of the main astrometric catalogues
- In blue italics, prior to 1967,
- in black bold italics, 1967-1994,
- in red plain roman, from Hipparcos to present,
- in green boxes, approved programmes.



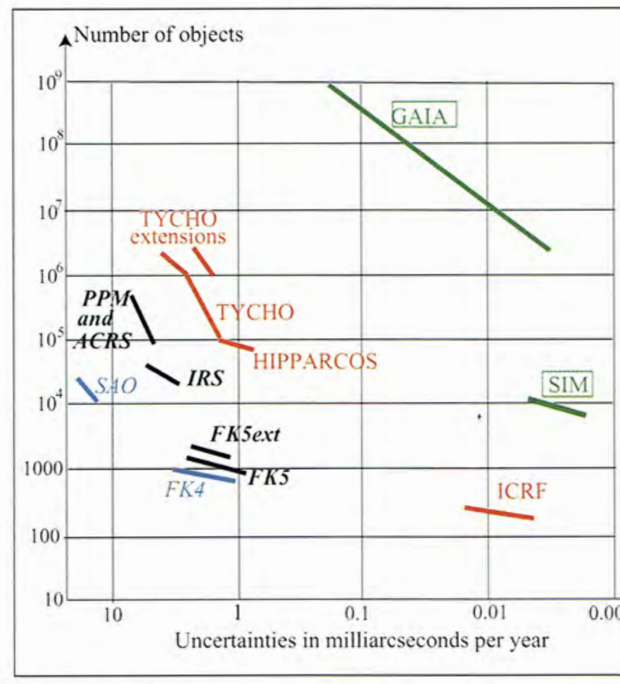


Fig. 2. Range of uncertainties in yearly proper motions of the main astrometric catalogues
- In blue italics, prior to 1967,
- in black bold italics, 1967-1994,
- in red plain roman, from Hipparcos to present,
- in green boxes, approved programmes.

An Astronomers' Data Manifesto: The Digital Divide

Ray Norris

Have you heard of the Digital Divide? For some of us, accessing a journal, or downloading a Spitzer image, is only a few key-clicks away, while for others it involves getting a photocopy (remember them?) or printout from an overseas colleague. Some institutions still don't have broadband access that others have at home. But how can we astronomers solve the world's problems? There are ways. For example, some journals provide free or cheap access to our colleagues in developing countries. And some astronomers work with their colleagues in other fields to argue for funding for a connection. All these problems are soluble, provided there is the will and awareness to do so. Find out more at Special Session SPS6: "Astronomical Data Management" on Tuesday afternoon, August 22.

Our constant Sun

When I meet visitors at the McMath-Pierce Telescope on Kitt Peak, I always make a point of assuring them that Old Sol is an unchanging, friendly star. Many have heard of solar flares and coronal mass ejections, which can portend trouble on Earth. But these are uncommon transient events which usually require special instruments to be seen. To the "man on the street" the Sun is a reliable and fixed source of energy. At least within our life-times.

William Livingston, National Optical Astronomical Observatory, USA

Thank goodness for magnetic fields to make an otherwise benign Sun interesting. At this GA we were treated by Alan Title to exciting views of the Sun's dynamic transition layer as observed by TRACE. Magnetic field lines spring from the surface (photosphere) into the tenuous corona. Freed of the constraining bounds of the dense photosphere, these fields exhibit all kinds of contortions made visible (traced) by the spectral transitions of highly ionized atoms such as Fe IX, Fe XII, and even Fe XV. The recorded pictures have 5 s time resolution, and as the fields evolve and the Sun rotates, one gets a 3D moving show.

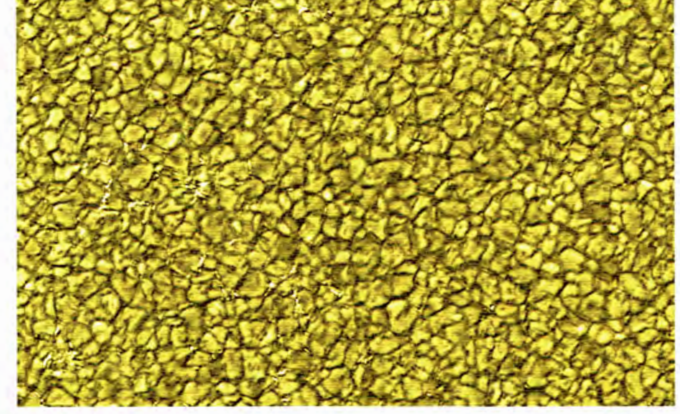
But now select a single field line and trace it back to the white-light photosphere. There it becomes a barely discernible sub-arc-sec bright dot wedged into the gap between individual convection granules. To resolve these magnetic elements requires good seeing and optical perfection. In the accompanying photograph from the Dutch Open Telescope we see a part of the quiet solar disk. A few magnetic features can be made out as tiny bright marks nestled amongst the granulation. Notice what a small fraction of the surface they occupy and how they are confined to what are called inter-granule lanes. As far as we can tell, there is little or no interaction between these magnetic points and the granules. In particular, the hot magnetic features do not seem to transfer heat to the quiet photosphere. In other words, the basal photosphere is not affected by solar activity, i.e. the presence of magnetism.

What about the 0.2% increase in total solar irradiance at solar max that we find from spacecraft radiometers? How does this fit in the above concept of no temperature change? As the dense photosphere releases the field lines they expand upward. Toward the solar limb, where we see higher, the enlarged magnetic elements become visible as bright faculae. These faculae become the source of the increase of 0.2 % in the Sun's output. Modelers like Sami Solanki and his colleagues (T. Wenzler et al.) have shown that indeed the total solar irradiance signal can be derived, or reconstructed, from full disk solar magnetic maps (magnetograms). Such magnetism may provide an adequate explanation for solar variation.

What about sunspots? The dimming of these features is easily seen in the irradiance data from space. These are short-lived events. Hank Spruit has shown that the energy blocked by spots may be slowly transferred to the nearby photosphere, but if this is the case, the consequence is diluted and difficult to detect. A relative measurement that could register temperature variations in the upper atmosphere is limb darkening. Granulation noise is a factor. Peter Foukal waged a limb darkening observation campaign and pushed the limit to about 0.1 %, but he and others found no cycle related variations.

Since 1974 we at Kitt Peak have attempted to use the temperature sensitive Fraunhofer line of carbon at 538.0 nm to measure variability of the Sun-as-a-star. Plenty of light assured a good signal/noise in its line strength determination. Early on we thought changes were being seen. But as our observational techniques matured we saw little or no evidence of the activity cycle in our data. Valentine Penza, Rome Observatory, has carefully modeled the same archives, now extending into 2006. When she compares the C line with nearby Fe and Ti lines, the presence of active regions is seen and she has sought a residual quiet Sun variation, but without clear success.

In my opinion the basal quiet Sun atmosphere is constant to within our ability to measure it. Uncovering its variation remains a challenging observational task. ❐



Summary of Symposium S235: New light on faint galaxies

Isaac Shlosman, Ron Buta, Françoise Combes

In the last quarter of the XX[th] century, we have achieved a profound understanding of large-scale structure formation in the expanding Universe. The WMAP and COBE satellites have verified the intellectual accomplishment of a generation of astronomers in the most dramatic and convincing way. The Universe appears to resemble a "soap opera", with voids and filaments everywhere, and with dark matter halos preparing the grounds for subsequent fireworks – and here we are in complete agreement with the Old Testament which claims that the first light came after a long night. While clouds which have been noticed on the physics horizon by Lord Kelvin some one hundred years ago are still visible even today, in the shape of a dark force and quantum gravity, people have become accustomed to an occasional rain. The current effort has switched to understanding the structure formation on sub-halo scales – the origin of the luminous parts of galaxies, disks and ellipticals, stellar bulges, bars and the central supermassive black holes, all require a substantial effort from the next generation of scientists.

With this in mind, the IAU Symposium #235 on Galaxy Evolution Across the Hubble Time has been conceived. The goals of this meeting formulated by the Scientific Organizing Committee have succeeded in attracting a full audience. The present scientific efforts to make sense of the seemingly intricate evolutionary path taken by galaxies in this Universe require, as a first stage, the data collection on the never before attempted quantitative and qualitative levels. Numerous surveys involving large teams of scientists start to deliver fruits from the so far forbidden garden. Other large collaborations are currently engaged in state-of-the-art numerical simulations, in the attempt to convert astronomy from being an observational science to becoming a designer laboratory, albeit virtual so far. A new word has become part of our astronomical vocabulary: "downsizing", which refers to the observation that luminous (massive?) galaxies form early in the Universe while only small galaxies form stars today. Indeed, massive early-type galaxies look "red and dead" during most of the second half of the age of the Universe.

In an interesting development, many presentations at this Symposium require that the process of galaxy formation and their subsequent evolution on the scales of tens of kiloparsecs is correlated with processes on dramatically smaller spatial scales of individual star formation and scales related to fueling of accretion processes onto the central black holes. Are galaxies assembled gradually as required in the hierarchical clustering scenario, or rather in one avalanche? There are clear hints that nature likes both roads. Why is it that we still have plentiful amounts of gas in disk galaxies – despite vigorous starbursting events? To what extent is this regulated by the energy released by the growing black holes in the galactic centers? What quenches the star formation? Are all elliptical galaxies parented by spirals? While this Symposium will not answer all these questions, hopefully it will provide a small but necessary step in the right direction.

For example, Annette Ferguson described the structure of galaxies at faint light levels. She argued that in the Lambda-CDM paradigm, structure grows in a hierarchical manner, and that if small satellites have stellar components, the signatures of this growth would be in the form of tidal debris and diffuse stellar halos. This is dramatically shown in this deep image of the Andromeda Galaxy M 31 (Figure 1), where faint filaments and structures seen in the outer regions are likely due to ancient accretion events that heated the disk. Filippo Fraternali described the detection of gaseous, neutral hydrogen halos around nearby edge-on spirals (NGC 891, Figure 2). He argued such halos are made of low angular momentum material and that gas accretion from an intergalactic medium might play a role in their formation. A milestone in the study of high redshift galaxies was presented by Linda Tacconi, who showed new observations of the kinematics of $z \sim 2$ galaxies, revealing that disks in rotation were already current at this epoch. One of the best examples was obtained with adaptive optics due to a nearby guiding star, but laser guide stars are now coming to the forefront and such observations will be extended considerably in the future. ❑

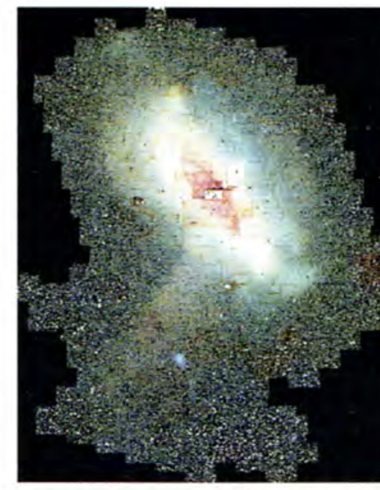
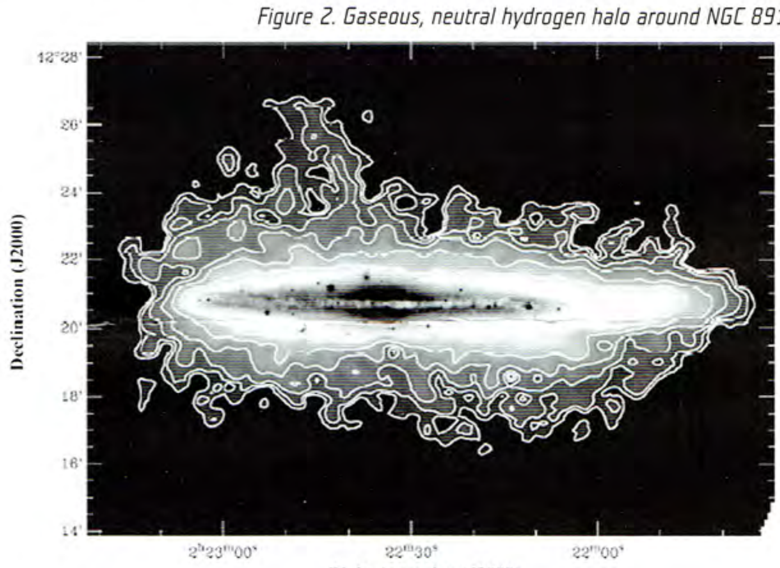


Figure 1. Deep image of the Andromeda Galaxy M31

Figure 2. Gaseous, neutral hydrogen halo around NGC 891



Interview with Gerry Gilmore: Dark matter on small scales

Jana Olivová

Nowadays scientists have at their disposal a huge amount of observational data gathered by numerous instruments placed both on Earth an in the space. At the same time they have their sophisticated computer models and simulations. Sometimes those two sets of data give quite a good description of the universe, sometimes they do not correspond with each other, sometimes the models are not accurate. What do scientists need to learn to improve their models? What information is missing?

Well, two fundamental things are going on here. The first is that gravity is defining everything – and gravity is determined by dark matter. And we do not know what dark matter is. And not surprisingly because we do not know what it is we cannot make very accurate predictions of how it behaves. Dark matter might be very complicated, there might be ten or twenty different sorts of things in there making it all up and in the same way there are a lot of different physical forces happening among the little bit of matter we know about. So that is the first complication. But we are making enormous progress these day and just determining, just observing how dark matter does behave on small scales – and so we can learn. But the thing that is really missing is understanding the physics that is going on when you make stars and galaxies and how you join them together. It is now clear that the simplest ideas that we had that you would just start with almost uniform gas in the early universe and just let it fall under its own weight is not nearly imaginative enough. So this is one of those great cases which we had like Tycho´s supernova. The only way we can make progress is to go and look at what the universe is telling us and deduce from that what is really happening. We are actually pretty hopeless at making models just by sitting at our white offices and with computers and thinking of what we would have done if we had been making galaxies. So the key is to disclose this interaction between building the simplest possible model, finding out what is wrong with it, learning from that and improving it. We are only just starting to get that process in step. Just recently now with things like the Hubble telescope and the VLT and all the big generation of telescopes we have got ample beautiful data – and we realize the models are completely wrong. It is time now to put some new information back into the models and try and make them predict enough so that once again we can prove them wrong and learn something new.

Gerry Gilmore, Cambridge University, UK

Are you implying then that if scientists learn what dark matter is maybe they will have to change all their theories about how the universe works?

Yes, that is absolutely right. It is certainly true – we know already – that dark mater is more interesting than the way that is described in our existing models. In the models – at least the most common models – dark mater is assumed to have no properties at all apart from gravity. And that is just unrealistic.

But right now, just this year, we are learning very rapidly about the properties of dark matter in particular on small scales. And we are learning that it does not just pile up into tiny little bricks, it is distributed in a way that is much more rich and interesting and we are starting to learn how that will determine the structures, the very small structures in the universe, which is where galaxies come from. There is also a lot of very complicated physics where you have got to deal with the way gas moves around and the way magnetic field works and things like that. Now we do know that the models we have got work astonishingly well at explaining the large-scale structures of the universe. And so as large-scale properties, they are not going to change very much, they are really described beautifully by very simple models. But those models have almost no information in them. They have just got gravity plus an observation of what the universe was actually like taken from a satellite. So all they have done is take an observation and put in a little bit of gravity and say right, that explains a large-scale structure. There is not much more to learn. On the scale of galaxies – things like the Milky Way and smaller – we have an enormous amount more to learn. And as we learn more we realize that there are actually feed-back implications on bigger and bigger scales all the way up.

And we will be able to improve on much larger scales as well as much smaller scales.

What is then the most fundamental thing you would like to learn first in your research?

Well, the thing I am spending most of my time doing right now is actually mapping out the dark matter on very small scales.

And what in your opinion may dark matter be?

Well, my guess is that it is at least one, probably several different types of a new elementary particle. I think that is the most plausible explanation, largely because we see it behaving so smoothly on a very small scales, so the exotic things like rocks and black holes and new forms of forces and so on now do not look very plausible. Now it does look like it is new elementary particles. And that is actually very exciting because the elementary particle experiment on the Large Hadron Collider at CERN starts in just one year. And so this is going to be such an exciting two or three years because our observations are already determining the property of dark matter on very small scales. We know a great deal more about it than we knew just a year ago – and the most obvious candidates are not actually very consistent with our astronomical observations. And so the elementary particle people for a start want to know now whether their most obvious candidates – these Higgs-type particles exist or not – and we are already saying that even if they exist they are not the real answer, they are only a part of the answer. And the most exciting thing we want to learn, of course, is what is most of it, and most of it is the dark matter. That is going to be a harder problem and I think the real advances there over the next ten or fifteen years are going to be made by observation, not by theory. ❑

Invitations to private walks through Prague of Mathematics, Physics and Astronomy

Klementinum and Old Town Bridge Tower

Alena Šolcová, Michal Křížek, Jana Olivová

This time we offer you an invitation to **Klementinum** (or The Clementinum, minor planet *(3386) Klementinum*) in Prague´s Old Town, in the immediate vicinity of the famous Charles Bridge. There you can find, among other things, an observatory dating back to mid-18th century and the oldest meteorological station in Central Europe, which has been keeping an uninterrupted line of meteorological data since 1775. Klementinum was originally a Dominican monastery. In the 16th century, it became the seat of a Jesuit College and University. In 1654, it merged its activities and libraries with Charles University and formed Charles-Ferdinand University. After the Jesuit order was abolished in 1773, Klementinum continued to house the University and focused on philosophical and mathematical studies, astronomy and theology. Today Klementinum is a national cultural monument and the seat of the National Library of the Czech Republic and the State Technical Library. The whole large complex of buildings is dominated by the Astronomical Tower, which was completed in 1722. It is topped with a sculpture of Atlas bearing on his shoulders an armilar sphere (the symbol of astronomy). Thanks to the prominent Jesuit mathematician, physicist and astronomer, Josef Stepling, the tower was equipped incrementally with astronomical instruments while Jesuit scholars used it for astronomical observations. Stepling and his student Antonín Strnad also began to carry out regular meteorological measurements there in the second half of the 18th century. Klementinum is thus the oldest meteorological station in Central Europe and has been regularly gathering meteorological data since 1775. The meridian intersecting the Astronomical Tower in Klementinum was used by astronomers to define time in Prague (Tempus Pragense).

After an independent Czechoslovakia was formed in 1918, the Klementinum observatory became the seat of the Czechoslovak Astronomical Society for some time.

Fifteen sundials can be found on the premises of Klementinum. Near its famous and beautifully decorated Chapel of Mirrors, there is a memorial of Stepling, the founder of the Klementinum observatory. The astronomical tower has been open to the public in recent years. It displays a reconstructed historical quadrant and other astronomical instruments. The ceiling fresco in the old mathematics hall (a music department today) documents that – interestingly enough – as early as the 18th century, the Jesuit College permitted a depiction of Copernicus' cosmological model that was unacceptable to the Catholic Church in those days. Another fresco at the "Newer mathematics hall" of Klementinum symbolizes the cosmos as viewed by G. Bruno and R. Descartes: every individual star painted there is – like our own Sun – the centre of a planetary system and comets move among them. It was also in Klementinum where Albert Einstein, B. Bolzano, Č. Strouhal, A. Seydler and other gave their lectures. Klementinum is open to the public and the sightseeing tour includes the Baroque Hall and the Astronomical Tower, which is 52 metres high with 172 steps.

Opening hours:
Monday to Friday: 14:00–19:00
Saturday, Sunday: 10:00–19:00
Every full hour a guided tour

Leaving Klementinum you catch sight of the **Old Town Bridge Tower** which is a gateway to the famous Charles Bridge. The Tower is richly decorated with sculptures. Its decorations include the Aristotelian cosmological model of the universe. It was probably designed by Emperor Charles IV himself together with Master Havel from Strahov. The upper part depicts the stable sphere of stars, under which there are a supra-lunar and sub-lunar spheres accompanied with representations of human vices. The number of all decorations is connected with time: with the number of months in a year, days in a week and hours in a day. The year chosen for the construction of the Bridge Tower is also remarkable: 1357. If this number is completed in the following way: 135797531, one creates what is called a palindrome comprising all one-figure odd natural numbers. Emperor Charles IV chose that special sequence on the recommendation of Master Havel from Strahov as the best moment to establish the Stone Bridge (from 1870 Charles Bridge) and the Old Town Bridge Tower at 5 o'clock 31 minutes on July 9, 1357 of the Julian calendar.

It is also worth noticing that Charles Bridge was designed and calculated in such an ingenious way that it withstood many destructive floods, even the otherwise devastating flood that hit Prague on August 14, 2002. On that day the highest ever flow of water was recorded in the Vltava River – more than 5000 m^3/s, while the normal flow is around 150 m^3/s. ❑

Nomenclature Filler

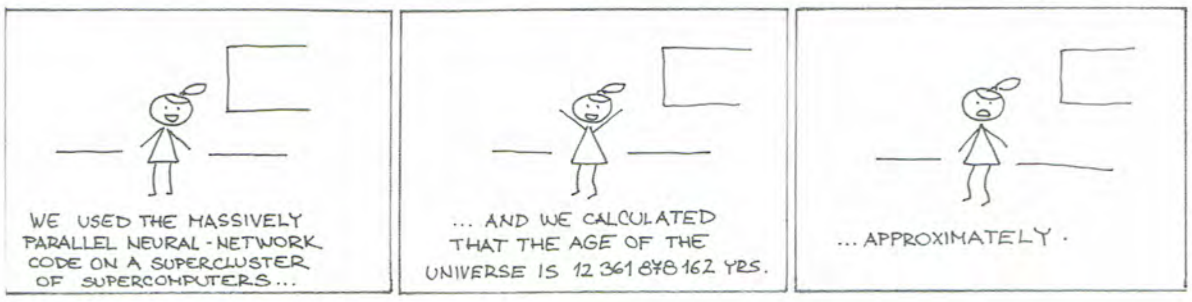
5. From Confusion to Clarity: Coordinate-based designations are just "names"

Hélène R. Dickel

and should have enough significant figures to unambiguously identify the sources. It is expected that precise coordinates will be provided in the paper (e. g., in a table), accompanied by any needed explanations and other relevant information such as cross-identifications. ***Important reminders*** – Coordinates within the designation shall be *truncated* (not rounded). Because designations that include coordinates are treated like proper names, they shall not be changed even if the positions change or become more accurately known.

Secret diary of secret agent F.R.Og

August 17th: I've got another letter from home. A.M.Phibian, my boss, asks me if I don't want to change my career from a secret agent to a secret scientist. I think he means it as an irony, which is a bad sign. As if I didn't try. I tried to find out who observed my home planet and why, but that's not easy. Observers – I know some by names – Spitzer, Eso or Vla – are an upper caste. Astronomers cannot command them, they only express wish: "I hope Alma will be able to observe this kind of objects!" And then they just hope that Alma hears it and will do it. Strange but true. I became depressed in the evening. Next GA will be in Rio de Janeiro, among trees and lianas and flowers of tropical forests. That reminds me exotic rainy forests at my home planet. Warm rains and hidden pools and damps! Hearty people of tropical lands! Beautiful women with red and blue skin! Lovemaking in wet leaves! Oh... I feel so homesick. F. R. Og phone home!



Brief information

❍ **Final programme: Science meeting of Division IV "Stars":**
Monday, August 21, 2006, 09:00–12:30, room Club C
Stellar astrophysics in the 2010's – Extrapolating scientific challenges some decades into the future
– J. Aufdenberg: Optical Aperture Synthesis and Interferometric Stellar Imaging
– A. Quirrenbach: Interferometric Spectroscopy across Spatially Resolved Stellar Disks
– R. Bachiller: Stellar Evolution Studied with ALMA
– K. Menten: Submillimeter Analyses of Stellar Photospheres
– L. Lindegren: Browsing for Rare Stellar Types in the GAIA Catalog
– K. Carpenter: Stellar Imager (SI) Space Mission: Stellar Magnetic Activity
– W. Cash: MAXIM – Coronal Structure with X-ray Interferometry

❍ **Final programme: Special Session 4a – Hot Topics:**
Friday 18 August (Panorama Hall)

Planets
14:00 Planets around M dwarfs (Allan Boss)

Galactic
14:20 Recurrent Galactic nova RS Ophiuchi (Mike Bode)
14:40 The current outburst of RS Ophiuchi (Stewart Eyres)
15:00 Probing the Faintest Stars in a Globular Star Cluster (Harvey Richer)

Announcements
15:20 Aurigid Meteor Storm, 1 September 2007 Dr. P. Jenniskens
15:30 Coffee

Transients
16:00 Sunquakes: helioseismic response to solar flares caused by high-energy particles (Sasha Kosovichev)
16:20 The double pulsar system J0737-3039A/B as a test-bed for general relativity (Marta Burgay)
16:40 Pulsing magnetar (Scott Ransom)

Extragalactic
17:00 DEEP2 Survey of the distant Universe (Jeff Newman)
17:20 Precision cosmology using H_2O mega masers (Jim Braatz)
17:40 Close

❍ **The next issue** of Dissertation cum Nuncio Sidereo III will be available Monday morning.

Friday 18/8
13 °C / 55 °F
morning minimum
27 °C / 80 °F
afternoon maximum

Some clouds, with a shower in the afternoon

SE winds 4 m/s (10 mph)

Saturday 19/8
15 °C / 59 °F
morning minimum
26 °C / 79 °F
afternoon maximum

Partly sunny, but a shower possible

S winds 2 m/s (5 mph)

Sunday 20/8
13 °C / 55 °F
morning minimum
24 °C / 75 °F
afternoon maximum

Cloudier, risk of a thunderstorm

SW winds 5 m/s (12 mph)

Monday 21/8
11 °C / 52 °F
morning minimum
21 °C /70 °F
afternoon maximum

Partly cloudy, maybe a shower or two

W winds 5 m/s (12 mph)

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D I S S E R T A T I O C V M

NVNCIO SIDEREO III | 6

Planet redefinition proposal defeated by alternative idea in internal test vote! See page 3 and electronic supplement!

MMVI 21. VIII. — SERIES TERTIA

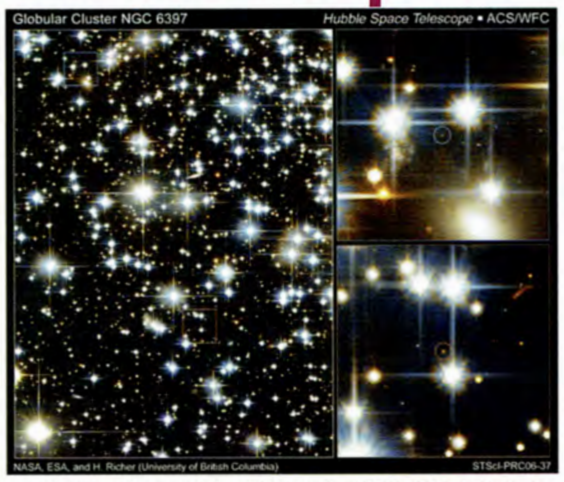
Summary of SPS4a – Hot topics

First portions of cutting-edge science from this special session were enthusiastically served in (surprisingly an quite empty) Panorama Hall of the Congress Centre during Friday afternoon, chaired by Lodewijk Woltjer, former IAU president.

Michael Prouza

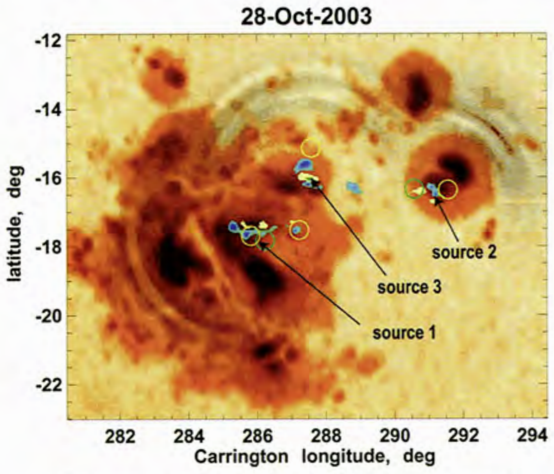
The session was opened with the talk by Allan Boss about recent discoveries of extrasolar planets around M dwarf stars. As first it was discovered a planet with the mass of 14 Earths orbiting the star 55 Cancri – and so the new class of so-called super-earths was established. Now we are discovering every year a number of these Neptune-mass planets, but we still do not know if these super-earths are gaseous or rocky. We need to discover more (as usual), for example at least one exoplanet transiting its star. Probably we will have to wait for the results of forthcoming missions like COROT, GAIA, SIM, TPF-C or Darwin/TPF-I.

The following two talks dealt with the 2006 outburst of recurrent nova RS Ophiuchi and were given by Mike Bode and Stewart Eyres. This recurrent nova is composed of a white dwarf star (1.2–1.4 $M_\odot$) and a red giant (M2III), orbiting around common barycenter within period of 455 days. About every 20 years, enough material from the red giant builds up on the surface of the white dwarf to induce a thermonuclear outburst. The last outburst began on February 12th, 2006 and was carefully observed in the whole spectral range spanning from X-rays to radio. Many new interesting features were discovered and further analysis is ongoing. However, already now it seems to be clear that the mass is accreting faster than it is removed in ejecta and therefore the white dwarf is pushing to the Chandrasekhar limit and will end up as the SNIa. Then Harvey Richer presented the results of careful analysis of HST observations of the faintest stars in a globular cluster NGC 6397. NGC 6397 is the second closest globular cluster to the Earth. For the first time the truncation of white dwarf cooling sequence and the end of H-burning main sequence for Population II stars were seen. Then Peter Jenniskens presented his prediction of Aurigid meteor for 2007 – a topic that is well covered by his own article on this page.



Globular Cluster NGC 6397 Credit: NASA, ESA & H. Richer

After the break Sasha Kosovichev showed the audience beautiful movies of sunquakes that are actually helioseismic responses to solar flares. We were able clearly see these ring-like waves moving across the solar surface. The sources of sunquakes are downward propagating shocks caused by high-energy electrons.



Sunquakes: X-ray (yellow circles), γ-ray (green circles) and acoustic sources (1–3) of X17 flare (October 28, 2003) and expanding ring-like waves excited by this flare observed on the Sun's surface. Credit: A. Kosovichev.

Next speaker was Marta Burgay. She reminded us of the discovery of the already famous double pulsar system J0737-3039 A/B by Parkes High-Latitude Survey. This system is an excellent over-constrained laboratory to test the general theory of relativity and tcurrent results confirm its prediction with precision better then 0.05 %. Unfortunately, there is still valid a press embargo (until August 23) on the topic of next talk given by Scott Ransom, therefore we can mention only directly the contribution of Jeff Newman, who presented results of the DEEP2 project. DEEP2 is a redshift survey of 50,000 distant galaxies utilizing the DEIMOS spectrograph on the Keck II telescope.

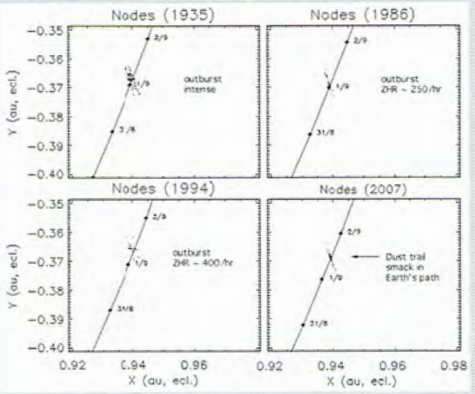
Currently with the use of more than 80 Keck nights more than 33,000 redshifts is already measured primarily for galaxies with redshifts $0.7 < z < 1.4$. Data Release 2 will present 75 % of the survey and will be released in January 2007. Jeff Newman introduced also AEGIS project – All-wavelength Extended Groth strip International Survey – that is the combined effort many different instruments and satellites including Chandra, Spitzer and VLA and spanning over 9 decades of frequencies.

As the last speaker Jim Braatz gave a lecture about the use of megamaser for precise measurements of Hubble constant. A megamaser is an extragalactic source with an unprecedented isotropic lumino-sity of ~ $10^3\ L_\odot$. It is a million times more luminous than nearby sources of masers. 89 extragalactic megamasers have been detected up to now. Braatz expects that using the measurements of rotation curves and accelerations of more than 10 such extragalactic masers we can have the measurement of H_0 with the systematic error less than 3 km.s^{-1}.Mpc^{-1} that will be valid across all scales of distances. ❐

The 2007 September 1 Aurigid meteor storm

Peter Jenniskens (SETI Institute) and Jérémie Vaubaillon (Caltech)

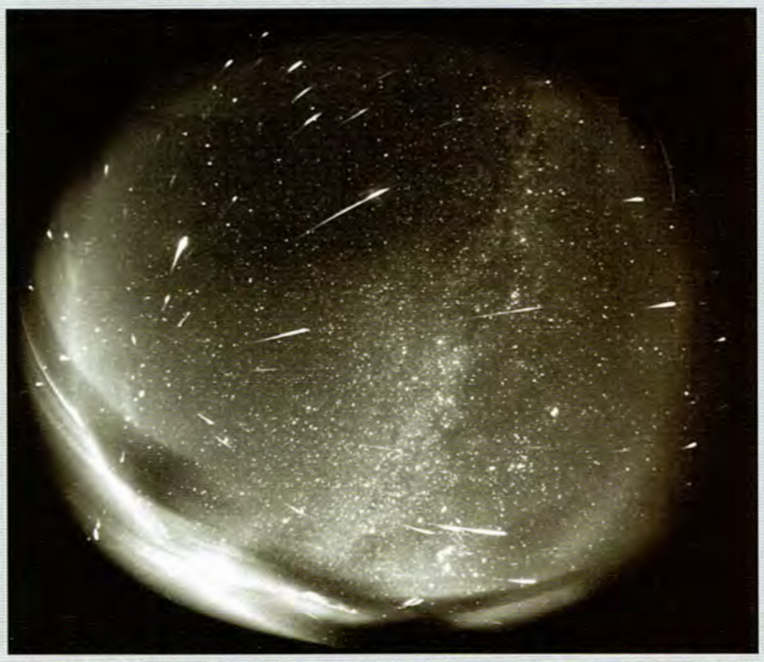
With the past Leonid storms still fresh in memory, the Earth is about to encounter another comet dust trail, which should shower the western USA and northern Pacific with a rain of meteors on September 1, 2007. This time, the comet is of the long-period type, orbiting the Sun only once every ~2000 years. When it last past Earth's orbit in 82 BC, dictator Lucius Cornelius Sulla took control of Rome and a young Julius Ceasar was still only his subordinate in the East. In that year, the comet lost a cloud of dust particles. Since, it has taken some particles longer to return than others and a trail of dust is now passing Earth orbit constantly. Only when the planets steer of that trail and into Earth's path do we get to see a meteor outburst.



We predict that the Earth will encounter the 1-revolution dust trail of the long-period comet C/1911 N1 (Kiess) on September 1, 2007. A two-hour meteor outburst of "alpha-Aurigids" will occur with many +1 and +0 magnitude meteors. The encounter will peak at 11:37 UT, which makes the shower visible from the western United States, where the radiant will be high in the sky just before dawn. The Moon will be only three days before full Moon (on Sept. 04 at 02:32 UT) and high in the sky (~69° at San Francisco), but the typical Aurigid meteor will be so bright that the Moon won't dim much of the display.

What makes this shower so special is the opportunity to see bits and pieces of the comet's original crust. Long-period comets have just recently returned from cold storage in the Oort cloud and are still covered by a crust that resulted from 4.5 billion years of exposure to cosmic rays. When the comet returns to the inner solar system, that crust is crumbled and creates peculiar meteors. The only other time that the dust trail of a long-period comet was investigated, during the 1995 alpha-Monocerotid outburst, it was found that the meteoroids had lost all of their volatile sodium minerals.

We can not be certain that the dust of comet Kiess is also from its original crust, but we better grab this opportunity. There will be no other chance to study long-period comet dust trails in the next three decades. More information on the prediction of meteor outbursts and the parent bodies of meteor showers can be found in the book "Meteor Showers and their Parent Comets" by Cambridge University Press, scheduled to arrive from the printer on August 16. Contact information: **pjenniskens@mail.arc.nasa.gov** ❐


Another and still probably the most famous meteor shower – all-sky image of Leonids taken November 17, 1999. Credit: Juraj Toth, Modra Observatory, Slovakia

ABSTRACT OF TODAY'S INVITED DISCOURSE

Today's invited discourse at 6:15 p.m. in the Congress Hall

Similar phenomena at different scales: Black holes, Sun, supernovae, galaxies and galaxy clusters

Shuang Nan Zhang, Tsinghua University, Beijing, China

Many similar phenomena occur in astrophysical systems with spatial and mass scales different by many orders of magnitudes. For example, collimated outflows are produced from protostellar systems, gamma-ray bursts, black hole X-ray binaries and supermassive black holes; various kinds of flares occur from the Sun, stellar coronae, X-ray binaries and active galactic nuclei; shocks and particle acceleration exist in supernovae remnants, gamma-ray bursts, clusters of galaxies, etc.

In this talk I will summarize briefly these phenomena and possible physical mechanisms responsible for them. I conclude that similar physical processes dominate in astrophysical systems with vastly different scales. I will emphasize the importance of using the Sun as an astrophysical laboratory in studying some of these physical processes, especially the roles magnetic field play in them; it is quite likely that magnetic reconnections dominate the fundamental energy release processes in all these systems. As a case study, I will show that X-ray light curves from solar flares, black hole binaries and gamma-ray bursts exhibit a common scaling law of non-linear dynamic property, over a dynamic range of many orders of magnitude in intensities, in support of self-organized criticality mechanisms operating in their energy release processes. A future high timing resolution and high throughput solar X-ray timing instrument, aimed at isolating and resolving the fundamental elements of solar X-ray light curves, may shed new light on to the fundamental physical mechanisms, which are common in astrophysical systems with vastly different mass and spatial scales.

Today's programme: (monday 21/8)

- Symposia S238, S239
- Joint Discussions JD10, JD11, JD12
- Special Sessions SPS3b, SPS5
- Women in Astronomy Lunch Debate
- Invited Discourse – Shuang Nan Zhang

Summary of Symposium S236: NEOs – Opportunity and risk

Petr Scheirich

Near-Earth object science has experienced revolution during the last fifteen years. Even since the previous IAU symposium concerning small bodies, and the ACM conference last year, many new things have been done and many of them were presented here.

After minor changes in program (and looking forward to minor changes in 'minor planet' definition...) six invited papers and five oral presentations took place during Monday.

As shown by H. Levison, W. Bottke and V. Emel'yanenko, the NEOs come to the near-Earth region from the main belt as well as from trans-Neptunian sources. The transport from TNO and from beyond is even more important considering that 9 million long-period comets fits the NEO definition (have perihelion distance lower than 1.3 AU) and thus 99.99 % of NEOs come from the Oort cloud. G. Gronchi presented interesting talk about the uncertainty of a minimum orbital intersection distance (MOID) and showed that they found possible impact solutions for asteroids that are not even NEAs according to their nominal orbit.

At closer region, the main belt, delivers its material to the Earth in a democratic way, with the same probability of finding fragments from larger and smaller objects, and thus one can be surprised that we see only 35 parent bodies of meteorites on Earth. An explanation of this issue is the same as in the real democracy: "Only well positioned and funded political parties can win in the competition" (W. Bottke). While the meteoroids in small asteroid families decay rapidly, big families decay so slowly that even now they can produce meteorites via a collisional cascade.

Unfortunately J. Burns didn't show a show with rotating nuts during his speech about collisions and rotation of asteroids, but his illustrative experiment of a yogurt-damping timescale (transition to the rotation around the axis with the largest angular momentum) was very amusing for the whole audience. And do you know why asteroid families have ears? (Really Ferengi ears, as shown in one of D. Nesvorny's figures.)

Tuesday's sessions continued with shapes, internal structure, surfaces and composition topics. During the morning session we saw plenty of beautiful radar images of NEAs, however they are not real sky-plane projections but distributions of echo power in time delay and Doppler frequency. Nevertheless, even boulders or gentle indentations on the surfaces of bodies are visible on the images with the best resolutions. Among roughly two hundred radar-detected there are many interesting bodies – from tumblers to binary NEAs, even a candidate of a tertiary asteroid was found, 2002 CE_{26}.

P. Michel introduced an interesting perspective in his presentation about tidal disruptions. When the Roche limit is calculated, a fluid body approach is commonly used, i.e., no cohesion strength is assumed. But what about a self-graviting body consisting of sand grains. Do you think that it hasn't any cohesion strength? Well, then why can you easily walk on sand and you don't sink? Certainly this kind of stuff has strength. Even the cohesion of regolith on asteroids is so strong that the surface of (99942) Apophis will remain intact by tidal forces during its very close approach to the Earth in 2029.

The next four sessions during Wednesday were about rotations of asteroids, binaries, data handling and mining and current and future surveys for NEOs. Over three hundreds of NEAs have determined rotational periods; thirty of them are discovered to be binary ones. There are many interesting features in a plot of their period versus diameter. 99 % of NEAs larger than 200 m rotate slower than the disruption limit for bulk density of 3,000 kg.m^{-3}, which indicates their rubble-pile structure. On the other hand, excess of bodies with periods larger than 30 hours is clearly visible, with no obvious lower limit. The recent result of Pravec & Harris indicates that all binary NEAs have a ratio of total angular momentum and angular momentum of the equivalent sphere spinning at the critical spin rate close to one.

M. Kaasalainen showed that many examples of lightcurve-derived shapes nicely correspond to adaptive optics images of the same bodies and even a surface color map of (15) Eunomia was shown. NEA binaries have complicated origin and evolution. Richardson & Walsh went over hundred of thousands of calculations simulating a creation of asteroid from rubble-piles. However, some properties of their population have to be explained, most likely with YORP effect (radiative spin-up or spin-down of asteroids).

Wednesday afternoon sessions were full of numbers. From growing of NEO discovery rates and their observations in databases to increa-sing size of CCD cameras whose pixel numbers doubles every eighteen months. This lead to the 1.4 gigapixel camera developed for survey, probably the only one funded by an authority (US Air Force in this case) not interested in obtained data, Pan-STARRS.

1:1000 scaled model of asteroid Itokawa, presented by M. Yoshikawa

Does Phobos look like fluid? Image courtesy of NASA.

The morning sessions on Thursday were targeted on missions to NEOs. An often mentioned target was the potentially hazardous Charles Bridge-sized and sea otter shaped asteroid Itokawa. In contrast to artificial images released before Hayabusa mission, almost no craters have been found on its surface. Japanese spacecraft Hayabusa took two touchdowns on the surface; the second one with totally unexpected duration of thirty minutes.

Sessions about impact risk and its monitoring, and smaller NEAs relatives, meteoroids, took place after lunch. Alan Harris pointed out a funny thing: based on an estimation of number of NEAs larger than 1 km published in 2002, a current survey completeness down to this size have to be 102 %. Good news for Spaceguard survey!

Opened by Oddbjørn Engvold, the last session during the Friday's morning concerning the IAU role on the NEO problem resulted in a lively discussion about information secrecy versus checking the data, responsibility to inform the press, media firestorms, etc. Quoting one of its participants: "Astronomy is a service to provide information to mankind, but mankind doesn't know how to deal with it ..." ❐

JD03: Solar active regions and 3D magnetic structure

Michal Sobotka

The beginning was not the best: The main organizer, D. P. Choudhary, unfortunately was unable to reach Prague in time due to massive anti-terrorist precautions at U.S. and British airports. The session started, however, and the participants were able to hear about the ubiquitous solar magnetic fields, from the solar convection zone up to the corona. Solar flares and coronal mass ejections (CMEs) were given special attention.

The magnetic field of our Sun is responsible for most of solar active features, including the largest energetic events that can affect the near-Earth space environment, producing space weather. The solar magnetic field is generated by dynamo mechanisms below the visible layer (the photosphere) and erupts into the solar atmosphere. The cross-section of the erupting field structure at the photosphere is observed as an active region, above which there exists a complex three-dimensional magnetic dome. Magnetic links among different solar layers are our important clues to understand how the solar cycle works, how the corona is heated and how the enormous energy of flares and CMEs is released.

Essential but still unknown details about the solar dynamo were discussed as well as ambiguities in magnetic field measurements. Thanks to rapidly evolving techniques of spectropolarimetry and extremely high spatial resolution (about 100 km on the solar surface) we have learnt a lot about the structure of the magnetic field, which is very complex in the solar photosphere and chromosphere and tends to be slightly simpler in the corona. Outside active regions, the "quiet" photosphere and chromosphere are full of tiny magnetic flux tubes and loops creating the continuously changing "magnetic carpet". Sunspots correspond to the largest magnetic concentrations with field strengths reaching 0.5–0.6 T in some rare cases. Magnetic canopy structures extend far away from active regions. Sophisticated field-extrapolation methods that start from the observed photospheric magnetic configuration and model the structure of magnetic field in the corona are very helpful in the interpretation of what is observed in the corona in radio and in microwaves. Studying the topology of the coronal magnetic field, we can learn about particular points where the energy is released and flares can be excited ... Well, in my opinion, JD03 was quite exciting, in spite of the precautions at the airports. ❐

JD08: Solar and stellar activity cycles

Michal Švanda

In three half-day sessions during Thursday and Friday we had a possibility to hear 18 invited very inspirational talks and to read around 80 posters, all covering the topic of stellar and solar activity. I don't intend to comment all the talks and posters, but let me write some a very general comments.

It has been shown in recent few decades that activity cycles are the common property mainly of the late spectral type stars. The best documented example – the Sun – lies nearby just 150 milion kilometers from us. In spite of the fact that the activity of the Sun has been observed in many ways during last four centuries, the true nature of the solar variability is still poorly understood. However, in last few years, there is a significant increase in understanding the solar dynamo, which has been the main cause of the cyclic variability of the Sun. Now we can operate much better the flux-transport dynamo models that can be fed by details of observed solar features. These data can be acquired by the promissing method of helioseismology even in the interior of the Sun and taken as the boundary or initial conditions for the models. Although the comparison with the real observed values is promissing, the question is: Do we truly understand the fundamental physics, or do we just reproduce the signs of the solar variability?

The equivalent signs of magnetic activity can be found and observed in other stars. Due to the progress in the observational methods coupled with the progress in mathematical processing of the signal in the way of inversion methods, we are able to observe the magnetic features and also coronal structures or equivalents of solar prominences at the stars that we can directly resolve just only as bright points. It turns out that in comparison to other magnetic active stars, the Sun is quite stable and thanks to that, the life on the Earth is able to evolve in many different forms. Observational results suggest that the physics of the magnetic activity at late-type stars is the same, so that the same models can be adapted. Although current models can generally reproduce main features of the magnetic variability of active stars, correct physical explanation and prediction of some details, like great minima of activity that is still missing.

There was one common conclusion of almost all the speakers: To confirm and improve the models, more systematic and high resolution data are needed. New ground-based (LOFAR, STELLA etc.) and space instruments (COROT, GAIA, SDO, etc.) could solve this problem. ❐

An Astronomers' Data Manifesto: Safeguarding legacy data
Ray Norris

When our nearest and best-studied supernova exploded (SN1987A in the Magellanic Clouds) astronomers scurried to find old plates showing the host star pre-supernova. They were fortunate. The plates still existed, kept carefully in plate libraries, and our knowledge of supernova astrophysics is now that much richer. Supposing it happened now? Most plate libraries have been closed, and now the plates gather dust in some storage room, undigitised, inaccessible, and deteriorating. But not all old plates are worth keeping. How do we choose which data should be preserved, digitised, and migrated into data centres? And how can we fund it? And what about your 9-track tapes, Exabytes, CD--ROMs, DVDs? Will they be readable in 50 years time? Find out at Special Session SPS6: "Astronomical Data Management" on Tuesday afternoon, August 22.

IAU 2006

Lodewijk Woltjer, IAU President (1994–1997)

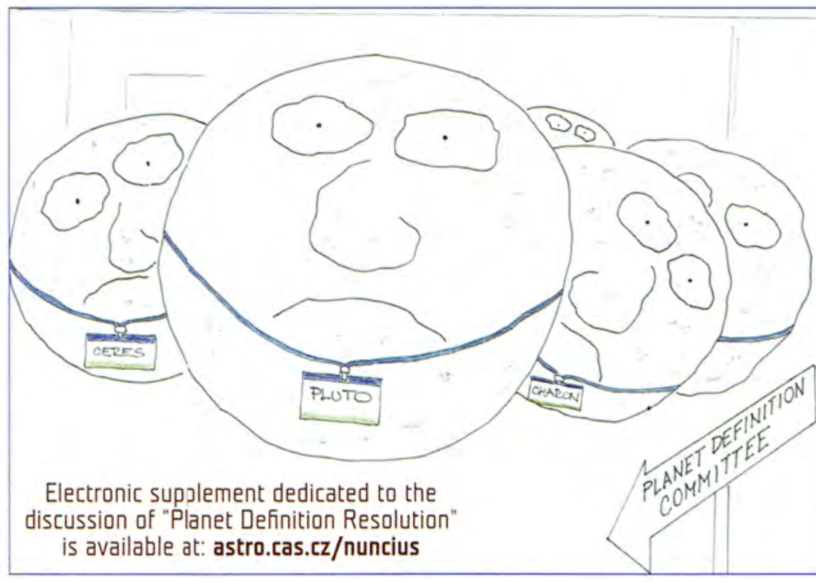
It is most satisfying to see that a quarter of the world's 10,000 astronomers has been able to attend this year's General Assembly. That so many have undertaken the voyage to Prague shows that the IAU still has a major role to play in worldwide astronomy. It remains our only universal "gathering of the clan".

The progress of astronomy in the developing countries is particularly welcome. China's ground and space based telescopes appear to progress well, as does India's major X-UV satellite. Elsewhere numerous space projects are under way, while South Africa and Spain are entering the league of 8–10 m class telescope countries. The successful start of the construction of ALMA – the Europe, Japan, USA common project in submillimeter wave astronomy – show the potential of worldwide cooperation; its initial difficulties may contain lessons for SKA, the Square Kilometer Array, a truly worldwide project in radioastronomy that appears to be gaining momentum. With the cost of the largest astronomical projects approaching or even exceeding a billion euros or dollars, it is no surprise that issues like industrial return, management control and other political factors take on increasing importance that scientists can only ignore at their peril.

Other issues than the construction of instruments require even more international cooperation. There is no point in building large telescopes on the ground if the sky at radio or optical wavelengths becomes too polluted. Space debris put our satellites at risk. Proposals or plans for the active militarization of space are a source of concern. It is bad enough if the nations of the Earth are classifying each other as friends or foes – of course without agreement on who belongs to which category. But even throughout the cold war two domains were kept free of weapons: space and Antarctica; it is of greatest importance to astronomy that both remain so. ❐

Dialogue on the proposed Planet Definition Resolution

This dialogue presents written comments received by email and comments received in discussion on the planet definition resolution. ***Responses are provided by the Planet Definition Committee.*** *An open forum for ongoing comment and discussion will be held Tuesday August 22 at 12:45–13:45 in the Congress Hall.*



Electronic supplement dedicated to the discussion of "Planet Definition Resolution" is available at: **astro.cas.cz/nuncius**

Comment: Astronomers made a mistake in calling Pluto a planet. Science should distinguish itself from politics by admitting an error. Planets are special, we should keep it at just 8.
Response: A definition can be made by drawing an arbitrary line in the sand according to a preconceived notion of what the answer should be. Alternatively, one can seek a fundamental physical principle equally applicable to "planets" in all solar systems. Self-gravity is proposed as the most universally applicable fundamental principle upon which to base a definition. Pluto happens to satisfy this definition.

Comment: Making Ceres a "planet" seems to be an unwanted side effect.
Response: Applying a fundamental physical principle, without bias toward desired (or undesired outcomes) allows Ceres to be labeled as a "planet." Ceres was considered a planet from the time of its discovery until the 1850s when the Royal Astronomical Society listed it among a group they labeled "minor planets." Ceres remains a minor planet relative to the eight classical planets, although it might be more informative to refer to it as a dwarf planet.

Comment: The definition of "planet" should also include the requirement that it has cleared its orbital zone. A planet should dominate its zone, either gravitationally, or in its size distribution.
Response: This is an extremely important and valid point of view. The proposed definition considers the intrinsic properties to be most important, just as a star is a "star" whether among hundreds of thousands of others in a globular cluster or alone in a spiral arm. The upper size limit of "planet" (not a part of this resolution) is determinable by gravitational physics. It is most consistent if the same physics defines both the upper and lower limits.

Comment: The proposed definition of a planet that includes Ceres and Charon, as well as a constantly changing number of up to hundreds of other solar-system objects in future years, seems too complicated. It is all too complex to be taught to small children.
Response: The basic concept of "round" being a property for "planet" can be learned at an early age. Most likely, the eight classical planets will be most emphasized. Pluto will be known as the first planet known among perhaps hundreds of other "plutons". (Some children will take on the challenge to memorize all the plutons.) Ceres may become popular as the "smallest planet."

Comment: The mnemonic about "my very educated mother" will be ruined.
Response: My very educated mother cheerfully just served us nine pizza pies. (The latter two p's are for "Pluto and other plutons.")

Comment: The proposed change will lead to confusion and near constant turmoil for no really good reason. The main beneficiaries of the resolution, if approved, are likely to be publishing companies and textbook authors.
Response: An important lesson of science is the flexibility to change in the light of new information. In this case it is the new understanding of the outer Solar System that changes our view.

Comment: This "pluton" category seems to be a not-so-thinly-veiled attempt to retain Pluto as a "special" planet, with little other benefit and the potential for much confusion.
Response: The "pluton" category is a way to distinguish the largest bodies beyond Neptune.

Comment: Many bodies in the Solar System as small as a few kilometers have relaxed themselves into gravitational equilibrium shapes. These cannot be planets.
Response: The "planet" definition requires sufficient self-gravity "to overcome rigid body forces." A body that satisfies this requirement is different from a small fractured body ("rubble pile") re-arranging itself into an equilibrium shape. Indeed, there is a boundary size where this distinction will be difficult to determine. Intelligent application of the definition is the task of the (to be decided) Division III committee.

Comment: An alternate to the name "pluton" should be found. "Pluton" is also a geological term denoting an igneous rock formation characterized by an intrusion of magma.
Response: Use of the same words across disciplines is not uncommon. Mercury is both the name of a planet and of an element. There may be mercury on Mercury. "Nucleus" is another example. The Planet Definition Committee was aware of the geological sense of the word "pluton," but chose to reuse it. In any context where ambiguity is possible, a descriptive qualifier could distinguish planetary plutons from igneous ones.

Comment: It is inconsistent or too complicated for Charon to be considered a planet within a Pluto-Charon "double planet" system. Why aren't the Moon, Titan, Europa, etc. also considered as planets? Using the barycenter as a distinction is too arbitrary.
Response: The issue of the barycenter of a double or multiple system is not actually in the resolution and will be an issue to be resolved by future action of the IAU Division III.

Comment: The candidate list seems odd. Some objects listed are unlikely to be "planets" under the proposed definition, while one might also consider some 50 or more other currently known trans-Neptunian objects.
Response: The list is admittedly incomplete. It includes objects that will almost certainly fall short of hydrostatic equilibrium, thus allowing the lower cut-off boundary to be evaluated. It also includes candidates known only by preliminary physical measurements. ❐

Black hole with an extreme spin

Astronomers have discovered large numbers of black holes in the universe and have measured the masses of a few dozen. Some of the black holes are in X-ray binary systems with normal stellar companions. These have the masses of several solar masses. Other black holes are found in the nuclei of galaxies and have masses of a million to a billion solar masses.

Ramesh Narayan, Jeffrey E. McClintock, Rebecca Shafee, Ronald A. Remillard, Shane W. Davis, Li-Xin Li

An astrophysical black hole is completely described with just two numbers: its mass and its dimensionless spin; the latter parameter, called a^*, is limited to the range 0 (non-spinning hole) to 1 (maximally spinning hole). While mass is relatively easy to measure, until recently no credible spin estimates were available. The first plausibly reliable spins have now been estimated for four black holes in X-ray binaries.

The spin estimates were obtained by modeling the radiation from black hole X-ray binaries. In these binaries, gas is steadily transferred from the companion star to the black hole via an accretion disk. The gas becomes hot and radiates X-rays as it sinks deep into the potential well of the hole. The innermost radius of the accretion disk, inside of which gas free-falls into the hole, is a function of the spin of the hole. By modeling the X-ray emission it is possible to measure the radius of the disk's inner edge and thereby to estimate the black hole spin.

Our group has used this method to estimate the spins of three black holes: 4U 1543-47 ($a^* \sim 0.75$–0.85), GRO J1655-40 ($a^* \sim 0.65$–0.75), GRS 1915+105 ($a^* > 0.98$). Our collaborators have studied a fourth system, LMC X-3 ($a^* < 0.26$). The large spin of GRS 1915+105 is most interesting since black holes are predicted to have particularly extreme properties as a^* tends to unity. For instance, the relativistic jets for which GRS 1915+105 is famous may possibly be powered by the spinning black hole. It has also been suggested that the formation of rapidly spinning holes may be associated with long gamma-ray bursts. The method of estimating spin that we have developed could be applied to other black hole X-ray binaries. However, it is unclear if it will work for supermassive black holes in galactic nuclei.

Watch for the companion article by Vladimír Karas, Bozena Czerny and co-workers (scheduled for Thursday's issue #9 of NS III) who describe a different method of measuring black hole parameters which is well suited for supermassive black holes. ❐

NOMENCLATURE FILLER

6. From Confusion to Clarity: Significance of the J in a designation
Hélène R. Dickel

We are getting technical here so pay attention ☺ – equatorial coordinates shall always be preceded by ***J*** if they are for the standard equinox of J2000.0 (i. e., IRCS position or FK5-based, Julian equinox 2000.0 system). They should be preceded by ***B*** if they are for the old standard equinox of B1950.0 (i. e., Bessel--Newcomb FK4-based, Besselian equinox 1950.0 system). Galactic coordinates shall be preceded by a ***G***. The absence of a code at the beginning of recognizable equatorial coordinates will be interpreted, by default, as a missing ***B***. Note: there is a space between the acronym and the ***J*** but no space between the ***J*** and the coordinate part of the designation.

Climbing up to the stars: Petřín Hill

Michael Prouza

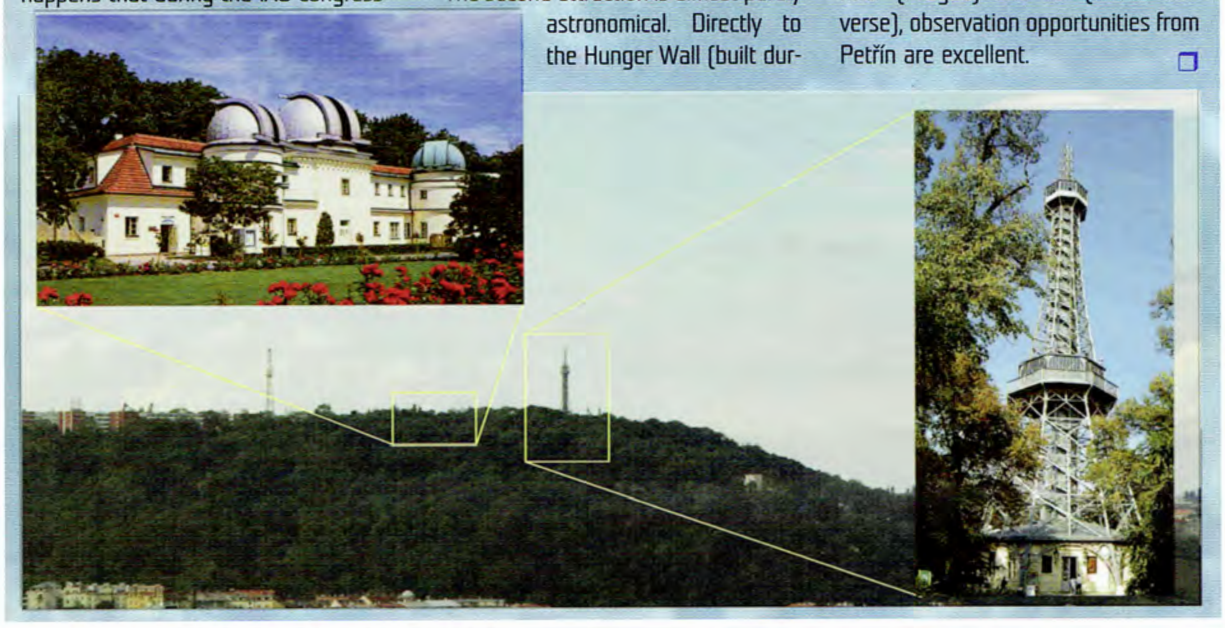
If you are looking for the real rock climbing experience within the city limits of Prague, you should visit Prokopské údolí, Divoká Šárka or any of the artificial climbing walls (**www.stenaholesovice.cz** is probably the best website). However, in this invitation we are not aiming that high. We just would like to offer you a trip into the one of the most beautiful parks in Prague, to offer you a trip that is a bit physically demanding, but can be crowned by observation of the starry sky with a magnificent one-hundred-year old König refractor.

Petřín Hill, administratively part of the Lesser Town, is the Prague's green breast with easily recognizable Observation Tower on the top. It rises more than 120 meters above the Vltava riverbed and reaches a height of 318 meters (1043 feet). Ordinarily you could simplify the ascent and get to the elaborate rose garden near summit by funicular. Unfortunately, it happens that during the IAU congress this funicular is undergoing a scheduled reconstruction (until September 1st, 2006). Therefore you will have to find your way through the park starting either from the river bank at Újezd near Most Legií Bridge or from Pohořelec above Prague Castle. Your steps will wind up between inviting lawns, statues of poets and apple trees, but eventually you will approach one of the major attraction atop the hill.

The first attraction is probably the **Observation Tower**, offering a stunning view of the Prague panorama. This tower is scaled down copy of Eiffel tower, built in 1891 for the Jubilee Exhibition. There is no elevator inside and again, you must use your own strength to climb its 299 steps to get to the observation deck. Then you will be rewarded by unforgettable view of the city center and on the clear day you can even see the highest peak of the Czech Republic – Sněžka (1,602 m), which is 150 km from the tower. (Opening hours: Daily 10–22 h)

The second attraction is almost purely astronomical. Directly to the Hunger Wall (built during the reign of Emperor Charles IV in the 14th century) is attached the **Štefánik Observatory**. Actually rebuilt from the old wall sentry house and opened in 1928, the observatory still serves the public for the popularization of astronomy. The main telescopes of the observatory are a double Zeiss astrograph after the Viennese selenographer König placed in the main dome (bought in 1928) and a 40-cm Maksutov-Cassegrain installed in the western dome in 1976. During the day the main observation target is naturally the Sun, while during the night the selection is wider. Usually your guide will start with showing you the Moon and some planets (but only classical planets will be shown; you cannot expect any plutons or dwarf planets) and then continue into the deeper universe – you will see that even in the middle of light-polluted Prague you are able to observe some really deep-sky objects. (Opening hours: Tuesday–Friday 14–19, 21–23; Saturday–Sunday 10–12, 14–19, 21–23; Mondays closed)

During the day or at the dusk – both near (Prague) and far (whole universe), observation opportunities from Petřín are excellent.



Brief information

- **Should we have a Working Group on The Galactic Centre?** This is one of the topics for discussion at the science meeting of Division VII on Monday August 21 in Room Club B. Anyone interested in participating in such a WG is encouraged to attend the meeting (see Program book page 128/9).
- **Monday afternoon, August 21**, (Club C instead of room 1.1!) will be dedicated to European affairs. The European Astronomical Society is organising an open session with, as first part, presentations of some European networks running at the moment: Astronet, OPTICON and RADIONET, and their plans for the future. A second part will be particularly interesting for young astronomers, since it deals with the situation of the astronomical Job market in Europe. This includes presentations of the specific situations in some countries like France, Germany and Italy, as examples. A representative of the EU Commission will present the Marie-Curie program and the perspectives for FP7 and ample time will be provided for questions and discussion. Participation and input from the world community is very welcome. The session will be concluded by the General Assembly of the EAS.
- **Women in astronomy working lunch**
  When: Monday August 21, 12:30–14:00
  Where: Small Hall (Ground Floor)
  How: Entry by ticket only as the event is booked out with 300 participants
  What: Keynote speakers followed by table discussions and final Plenary reporting session. Theme: Career Development for Women
- **Final programme: Tuesday August 22 SPS4b – Hot Topics**
  09:00 Mergers and the Milky Way – Amina Helmi
  09:20 Petal-shaped occulter for observing exoplanets – Eric Schindhelm
  09:40 A Definitive Measurement of the Faraday Rotation in Sgr A*, and the constraints it provides on the Black Hole Accretion Flow – Jim Moran
  10:00 Short duration GRBs (10:20 Coffee)
  11:00 Lessons from the double pulsar – Michael Kramer
  11:20 Evidence for baryonic oscillations
  11:40 WMAP, observations – David Spergel
  12:00 WMAP, cosmological parameters– Joanna Dunkley (12:20 Lunch)
- **Programme correction – other meetings:** "ESA: The GAIA astrometric and spectrophotometric survey mission" starts at 3:30 p.m. (not 2 p.m.)

Secret diary of secret agent F.R.Og

August 18th: It's getting more and more difficult to stay in the cover at the conference. Earthlings keep asking me where's my poster. "The poster didn't make it at Heathrow" answer usually does the trick, but once I was forced to draw my results. I used the protypical astronomical plot with several homogenously distributed points and a linear fit.
August 19th: Must find out what the IAU officer meant by StarTrek. If my hi-tech proposal was of the StarTrek level, what does that say about ST?
August 20th: Relaxed in a bubble bath with a glass of Martini. Not stirred, only shaken. Life is beautiful.

International Center of the Science "GeoNa"

Alexander Gusev

For the further successful development of scientific-educational activity of the Russian Federation, the Republic of Tatarstan, Kazan city is offered the national project – the International Center of the Science and the Internet of Technologies "GeoNa" (**Geo**metry of **Na**ture – "GeoNa" is developed wisdom, enthusiasm, pride, grandeur), which includes: original designs building "GeoNa", 59 floors, height with a spike 302 m, complex of conference halls, Center of the Internet of Technologies, 3D Planetarium, training complex "PhysicsLand", active museum of natural sciences, cognitive system "Spheres of Knowledge", which will host congresses, fundamental scientific researches, educational actions.

3D Planetarium: 3D video-acoustic representation of the expanding universe, the dynamic world of colliding galaxies and accretion black holes, exploration of the Moon and asteroid hazard, distribution of a reasonable Life in the universe.

Forum: Within the framework of project "GeoNa", an organization of the International scientific-economic forum of potential investors and sponsors is planned for June 27–29, 2007 at Kazan University, Russia. Objectives of the forum will be formation of the international scientific organizing committee of the center "GeoNa", the statement of the Charter of the center, election of agencies, formation of the managing company. Visit **www.geona.ksu.ru.**

Introducing a New National Member: Thailand

National Astronomical Research Institute of Thailand (NARIT)

On Tuesday August 15, 2006, the IAU General Assembly voted to accept Thailand as a new member of the IAU. The GA was addressed by the Deputy Permanent Secretary of the Ministry of Science and Technology, Thailand, Dr. Suchinda Chotipanich. Thailand founded two years ago its first national astronomical institute, NARIT. The aim of NARIT is to be a research-emphasis institute providing a collaborative network for developing and strengthening knowledge in astronomy. This will also provide an education and learning culture in astronomy for the public and thus encourage them to seek further involvement with science and technology. On July 20, 2004, the Cabinet approved in principle a proposal to establish a National Astronomical Research Institute of Thailand (NARIT) to commemorate the 200th birthday of King Rama IV, the Father of Thai Science, and also to celebrate the 80th birthday of the present King of the Kingdom, King Bhumibol. One of NARIT's main goals is to establish the National Observatory, located on the very top of the highest mountain in Thailand, Doi Intanon National Park, which is also renowned for its superb climate and tourist attractions. At 2,550 m above the mean sea level, the observatory has superb seeing conditions suitable for advanced research in astronomy and astrophysics. The automated telescope with 2.4 m clear aperture, single mirror type, will be one of the largest and most advanced telescopes in Asia. The observatory is scheduled to officially open on December 5, 2008, which marks the 80th birthday of King Bhumibol.

Monday 21/8
11 °C / 52 °F morning minimum
21 °C /70 °F afternoon maximum
Partly cloudy
W winds 5 m/s (12 mph)

Tuesday 22/8
10 °C / 50 °F morning minimum
20 °C /68 °F afternoon maximum
Partly cloudy with showers or thunderstorms
W winds 5 m/s (12 mph)

Dissertatio cum Nuncio Sidereo III is the official newspaper of the IAU General Assembly 2006. Contacts: **e-mail** – nuncius@ig.cas.cz, **address** – Nuncius Sidereus III, Kongresové centrum Praha, a.s., 5. května 65, 140 21 Praha 4. **Editor-in-chief**: Jiří Grygar, **deputy editor**: Petr Lála, **secretary**: Pavel Suchan, **assistant secretary:** Kateřina Vaňková **editors**: Soňa Ehlerová, Daniel Fischer, Jana Olivová, Michael Prouza, Petr Scheirich, Michal Sobotka, Michal Švanda, **technical editors**: David Ondřich, Jan Verfl, **English corrector**: John Novotney, **cartoonists**: Ladislav Šmelcer, Lubomír Vaněk. **Published by**: Icaris, Ltd., Nám. dr. Holého 8, 180 00 Praha 8. **Printed by:** Apolys, Ltd., Kolbenova 40, Praha 9. Any views expressed in articles are those of the authors and do not necessarily reflect the views of the Editorial Board or IAU. **Online version:** www.astronomy2006.com/ga-newspaper.php.

D I S S E R T A T I O C V M
NVNCIO SIDEREO III | 7

P R A G A E — M M V I 22. V I I I. — S E R I E S T E R T I A

Abstract of today's invited discourse

Today's invited discourse at 6:15 p.m. in the Congress Hall

The power of new experimental techniques in astronomy: Zooming in on the black hole in the centre of the Milky Way

Reinhard Genzel, Max-Planck-Institut für extraterrestrische Physik

Evidence has been accumulating for several decades that quasars, the most luminous objects in the Universe, are powered by accretion of matter onto massive black holes. I will discuss recent observations, employing adaptive optics imaging and spectroscopy on large ground-based telescopes that prove the existence of such a massive black hole in the centre of our Milky Way, beyond any reasonable doubt. These observations also indicate that the Galactic Centre black hole may be rotating rapidly. The central black hole is surrounded by a cluster of young massive stars, partly arranged in two rotating disks. I will discuss possible explanations for this 'paradox of youth'.

Photo diary

August 20: *Astronomy in East-Bohemia. Participants visited the towns of Jaroměř-Josefov, Žamberk and Litomyšl in traces of astronomers Wilhelm von Biela, Theodor Brorsen, August Seydler and Zdeněk Kopal. This trip was a part of Colloquium "Astronomy in Prague in the Mirror of Centuries" about the history of astronomy. From the left: Josefov – the memorial plaque of Wilhelm von Biela was unveiled on the occasion of this trip, Litomyšl – the monument honouring Prof. Zdeněk Kopal, Žamberk – welcome drink with the mayor. See the article by Martin Šolc in the Electronic Supplement.*

Special Session 7: Astronomy in Antarctica

Michael Burton, University of New South Wales, Sydney, Australia

The ends of the Earth are not the first place that come to mind to most astronomers when they think about where to build their next telescope. But they should be! For on the summits of the Antarctic Plateau are the driest, coldest and most stable observing sites on the surface of our planet, providing the best views of the cosmos across wide swathes of the spectrum, from visible to millimetre wavelengths. Come and learn why at Special Session 7 – Astronomy in Antarctica! Indeed, not only will you learn about the advantages Antarctica can provide astronomers, you will learn about some of the many astronomical activities that are already underway there. The history of astronomical adventures in Antarctica in fact goes back nearly 100 years, though for most of this time this has just meant cosmic ray and meteorite research. The past decade, however, has seen a steady rise in activity, across a great range of astronomical parameter space. Perhaps most prominent have been adventures in cosmology, with the demonstration that the Universe is flat (BOOMERanG) and the first measurements of polarization in the CMBR (DASI) coming from Antarctica. But solar, infrared, sub-millimetre and high energy astronomy have all been featured, with currently the largest science project in Antarctica being the construction of the first neutrino telescope, ICECUBE, at the South Pole. On the summits of the Antarctic plateau, France and Italy have recently opened Concordia Station at the 3,200 m Dome C, and a range of proposals to build telescopes there is under active discussion by the EU-funded ARENA network. China has sent the first humans to the plateau's 4,200 m summit, Dome A, and announced plans to build a new station there. With the International Polar Year taking place over 2007/08 (50 years on from the International Geophysical Year, which opened up Antarctica to science), astronomers have also proposed to test the two most promising sites in the Arctic region, the 3,200 m Summit Station in Greenland and the 2,600 m Ellesmere Island in the Northwest Territories of Canada.

A fine summer day at Concordia Station, Dome C, Antarctica, one of the summits of the Antarctic plateau. The twin towers of the French-Italian station are to rear, with the Australian automated site-testing laboratory (the AASTINO) on its ice hill to foreground. Photo John Storey.

Come and hear all about it at Special Session 7! The session has four themes to it. The first provides an overview of Astronomy in Antarctica, and the story of AST/RO, a 1.7-m sub-millimetre telescope which spent a productive decade at the South Pole, resulting in over 50 refereed papers. Session two discusses high energy astrophysics, in particular the activity associated with neutrino detection. Theme three covers some of the current projects, such as the first telescopes for Dome C (IRAIT and PILOT) and some of the site testing activity to fully quantify the conditions there. The fourth session covers some of the future ideas and plans that your colleagues have proposed. There will also be a business session at the end of the meeting, to discuss in particular a proposal to establish an astronomical research program with SCAR (the equivalent body to Antarctic science that the IAU is to astronomy), to make astronomy the sixth formal Antarctic scientific research program.

The full program for this session can be seen at **www.phys.unsw.edu.au/jacara/iau** ❐

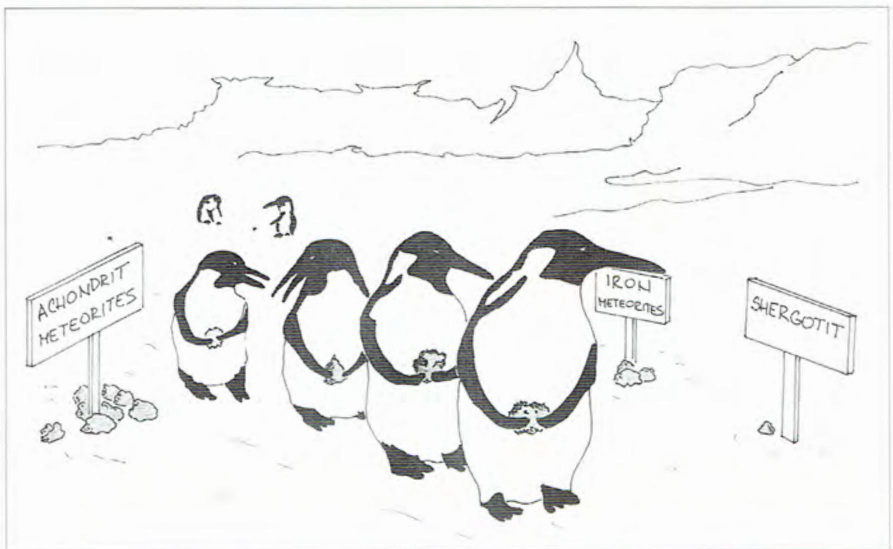
Yoshihide Kozai, IAU President (1988–1991)

In 1988 when the General Assembly was held in Baltimore U.S.A. I was elected as the President. In fact I was the last President without having served as the President-elect. Therefore, I had no experience as a member of Executive Committee (EC). Still I had to chair the first EC meeting on the last day of the General Assembly, Baltimore. Fortunately, Dr. Derek McNally and other members assisted me very much to make the meeting moving smoothly.

The problem of concern to many those days was to find some way to improve the General Assembly structure in order to attract the interest of young astronomers, particularly. In fact during the General Assembly those days there were many business (administrative) meetings organized by commissions and their working groups, where senior members dominated. On the other hand not so many scientific sessions were organized according to impression of many members. And they said that symposia and colloquia out of General Assemblies were more exciting and useful.

After discussions among EC members and Dutch astronomers, who intended to host the General Assembly in 1994 in The Hague, the Netherlands, the new structure of the General Assembly was introduced in 1994 and is in use at this General Assembly at Prague too. At the same time a new idea of the structure of IAU itself was proposed and Division structure of IAU was realized in 1994. The General Assembly in 1991 was held in Buenos Aires, Argentina. Thanks to efforts of LOC we very much enjoyed Sunday's excursion including the barbecue party, which particularly impressed us. Still, an accident took place on the final day of the General Assembly as a fire damaged meeting building, so that the second session of the plenary meeting had to be held in a cinema theatre. ❐

Announcement: the group photo of participants of both Prague congresses (the XIII[th] in 1967 and the XXVI[th] in 2006) will be taken on Thursday 24 at 9 a. m. in the Congress Hall. Please, use the entrance on the 1[st] floor next to the central stairs.



Electronic Supplement "Planet Definition Proposal Discussion" is being continuously updated. Please see **astro.cas.cz/nuncius** and find there contributions from: Alan H. Batten, Richard G. French, Paul Weissman, Gonzalo Tancredi, Harald Gropp, Mark E. Bailey, Paulo Ferrero and David J. Tholen.

Electronic supplement to No.7: G. Valsecchi – NEOs, our celestial neighbors, M. Šolc – History of the comet 3D/Biela and photos of 1006 SN Cake by F. Winkler.

Update On Planet Definition Resolution: A quorum of the Planet Definition Committee, with representation from Division III, the Resolutions Committee, and the Executive Committee met several times since the discussion held on Friday 18 August to consider issues raised. The draft resolution on planet definition has been considerably amended. The new version will be presented today (Tuesday 22 August) at the special plenary session scheduled for 12:45 in the Congress Hall. (The amended version is being refined at the Nuncius Sidereus III publication deadline.) Paper copies of the new draft resolution will be distributed at the Congress Hall.

Today's programme: (tuesday 22/8)

- Symposia S238, S239, S240
- Joint Discussions JD10, JD13, JD14, JD16
- Special Sessions SPS3b, SPS4b, SPS5, SPS6, SPS7
- Invited Discourse – Reinhard Genzel
- Planet Definition information meeting

RadioNet: at the heart of European radio astronomy

More than 70 years ago, the discovery by Karl Jansky of the radio emission of extra-terrestrial origin opened a new window to the Universe. As pointed out by Joseph Shklovsky in the 1970's, this discovery marked the beginning of a revolution in astronomy, transferring it from an optics-only to a multi-wavelength experimental science. Three quarters of the century on, radio astronomy shows no sign of slowing down its progress.

Leonid Gurvits, Joint Institute for VLBI in Europe, Dwingeloo, The Netherlands

The 76-m Lovell telescope at the Jodrell Bank Observatory (UK) is an efficient member of the RadioNet Transnational Access programme.

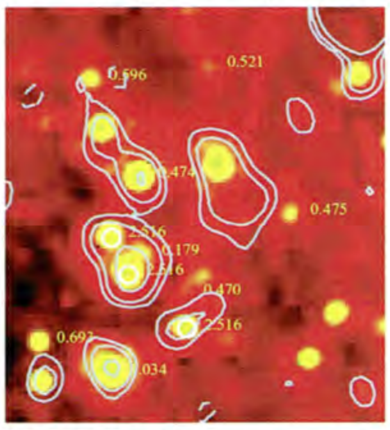
Since 2004, a significant fraction of radio astronomy developments in Europe have been conducted under the auspices of RadioNet, an Integrated Infrastructure Initiative (I3), funded under the European Commission's Sixth Framework Programme (EC FP6). RadioNet unifies 24 radio astronomy institutes and observatories from EU and EU-associated countries. The project is coordinated by the University of Manchester, Jodrell Bank Observatory, UK. The main objective of the RadioNet project is to enhance the quality of radio astronomy research in Europe. The network activities are implemented through three outreaches – Joint Research Activities (JRA), Trans-National Access programmes (TNA) and Networking Activities (NA).

The RadioNet Joint Research Activities amalgamate the professional skills and expertise of scientists and engineers in three areas:

- design and production of affordable low-noise Phased Arrays for Reflector Observing Systems (PHAROS), coordinated by the Netherlands Foundation for Research in Astronomy (ASTRON, Dwingeloo, The Netherlands);
- state-of-the-art development of Advanced Millimetre and Sub-millimetre Technology for Astronomical Research (AMSTAR), coordinated by the Institute of Millimetre Radio Astronomy (IRAM, Grenoble, France);
- investigation and implementation of Advanced Long Baseline User Software (ALBUS), coordinated by the Joint Institute for VLBI in Europe (JIVE, Dwingeloo).

The three JRA's enable European radio astronomers to base their studies on cutting-edge technologies – a key prerequisite for conducting advanced scientific research.

The Trans-National Access component of RadioNet is aimed at the European observers' community. It offers a wide range of access options to the world-class observing and data processing facilities. These include eight infrastructures (five of which are aperture synthesis arrays) covering the range of wavelengths from sub-millimetres to metres. One of the facilities, the European VLBI Network (EVN), includes a global network of radio telescopes in Europe, China, South Africa and USA (Puerto Rico) and is the largest VLBI facility in the world in terms of integrated collecting area and baseline lengths. Its operations are supported by the EVN Data Processing Centre at JIVE in Dwingeloo. Each RadioNet TNA facility has on its staff support scientists who assist the TNA observers ("users") at all stages of a project – from writing an observing proposal to analysing experimental data. Observers supported by the RadioNet TNA programmes can either use remote access to the observing and data processing facilities or get financial support for visiting these facilities and getting "hands-on" experience – something particularly valuable for young astronomers.



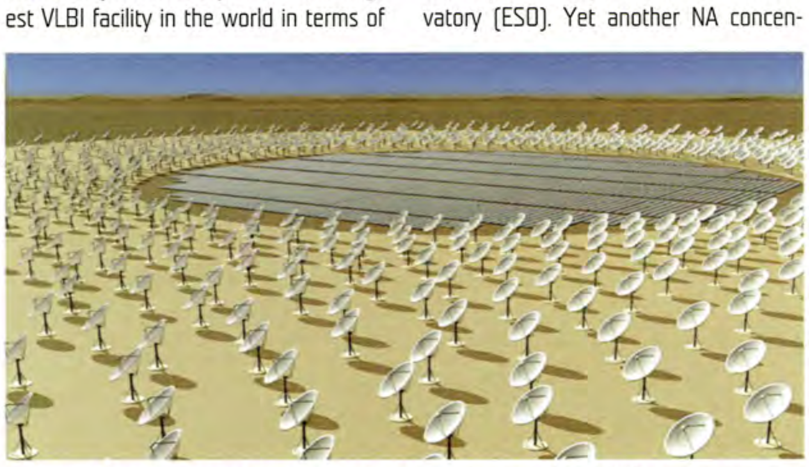
At very faint radio flux densities, the radio sky is dominated by distant star-forming galaxies. These are galaxies that are forming stars at a fantastic (non-sustainable) rate, ~ 10-1000 times greater than our own Milky Way. New Mid-Infrared images from the Spitzer Space Telescope show that star forming galaxies are also dominant in deep 24 micron images of the sky. The striking correspondence between these 2 wavelength ranges is demonstrated above – a deep 1.4 GHz (21 cm) Westerbork Synthesis Radio Telescope (WSRT) map (light blue contours) is superimposed on a bright orange Spitzer Mid-IR image (Egami et al. astro-ph/0603657) of the same field. Most of the Spitzer/WSRT sources are located at a moderate redshift (values indicated on the image) with the exception of a gravitationally lensed (multiply imaged & highly magnified) source located at z ~ 2.9 (white circles). Courtesy Michael Garrett, JIVE, The Netherlands.

The third RadioNet component, Networking Activities provides the necessary cohesion to the whole infrastructure. In particular, it involves support for scientific radio astronomy symposia and schools. One of these is the traditional Young European Radio Astronomers Conference (YERAC) that has marked the beginning of their professional careers for several generations of European radio astronomers. Another NA, the so called "Engineering Forum" facilitates contacts between engineers and scientists involved in the development of radio astronomy instrumentation. Through one of its NA's, RadioNet provides a "bridge" to the Atacama Large Millimetre Array (ALMA), the project coordinated in Europe by the European Southern Observatory (ESO). Yet another NA concentrates on developing "synergy" between various radio astronomy facilities, in particular, supplying a standardized web-based tool for observing proposals (the "NorthStar" software). Electro-magnetic spectrum management is also a subject of a dedicated NA: this topic is becoming increasingly important as the sensitivity of radio telescopes improves while the level of human-made radio frequency interference (RFI) goes up owing to ever-growing use of all kinds of electrical and electronic gadgets in our daily life. Last but not least, there is a special Networking Activity devoted to communicating to the professionals and general public major developments in the field of radio astronomy.

In addition to the Integrated Infrastructure Initiative RadioNet, the European Commission supports two radio astronomy related FP6 Design Studies (DS). One of them, the Square Kilometre Array Design Study (SKADS) is focused on developing advanced technologies for the next generation radio astronomy facility, the Square Kilometre Array. In a few years the SKADS project will produce several technology demonstrators for the SKA. The latter, a collective endeavour of the world-wide consortium of radio astronomy institutes, is to become fully operational by 2020. Another Europe-wide radio astronomy FP6 I3 project, EXPReS unifies radio astronomy and networking organisations involved in developing high data rate fibre optics connection between radio telescopes and data processing facilities. With the data rate reaching gigabits and even tens of gigabits per second per telescope (or antenna element), radio astronomy pushes the limits of data transport technology. EXPReS will provide invaluable enhancements to such advanced radio astronomy facilities as e-MERLIN, LOFAR, e-EVN and SKA as well as various spin-offs to the general use communication technologies.

Keeping up with the spirit of multi-wavelength and multi-disciplinary science, RadioNet maintains close contact with its sister-networks funded under the EC FP6: OPTICON that unifies optical astronomy observatories; ILIAS, the astro-particle network; and EuroPlaNet, the Coordinated Action of European planetary scientists. Together, these groupings define the front-line of astronomy developments in Europe.

Further information on RadioNet can be found at its web page **www.radionet-eu.org** and at the booth No. 23 of the General Assembly exhibition. ❐



*An artist's view of the central segment of the Square Kilometre Array (SKA), a next generation radio astronomy facility that will provide two orders of magnitude increase in the sensitivity over any existing radio telescope. The SKA reference design involves phased-array antennas for lower frequencies (the central part of the picture) and a large number of parabolic antennas for higher frequencies. Further details are available at **www.skatelescope.org**.*

The age of the world from the highest authorities

Erik Høg, Copenhagen University, Niels Bohr Institute

***3967 B. C. God creating Sun and Moon** by Michelangelo Buonarotti (1475-1564) in the Sixtine Chapel, Vatican*

The Universe is infinitely old, it has existed from eternity. Albert Einstein agreed with Aristotle on this point though they had different reasons. Einstein included the cosmological constant in his General Relativity in 1915 in order to explain the static universe which implies an infinite age. In fact a static universe of infinite age had been the general opinion of scientists for many decades.

The 6,000 year age of the world from the Bible was no longer tenable for scientists, after the geological age of millions of years for the Earth had been accepted by about 1850. In Denmark, however, the public was kept officially informed of the biblical time scale up to 1911. The widely read Copenhagen University Almanac included every year on a front page the "year of creation of the world", 3967 B.C. as computed by Longomontanus, the famous pupil of Tycho Brahe. This important information was given for so long on insistence from the ministry of education against protests from astronomers. But the geological time scale had already been accepted by geologists at the university by 1866.

After the discovery in 1929 by Edwin Hubble of the recession of galaxies it suddenly gave meaning to think of an "expansion age" of the universe. Hubble found an age about 2 billion years from his expansion constant $H = 500\ km.s^{-1}.Mpc^{-1}$. We now know that this age was 10 times too small due to systematic errors of the absolute luminosities of galaxies making them 100 times too faint resulting in 10 times too small distances.

The long quest into galaxy distances and the Hubble constant is presented in great detail by G. A. Tammann (2006) on which the present table is partly based. The most accurate results come from the WMAP mission: $H_0 = 72$ in a flat universe with $\Omega_\Lambda = 0.7$ and the age 13.6 Gyr with a few per cent uncertainty.

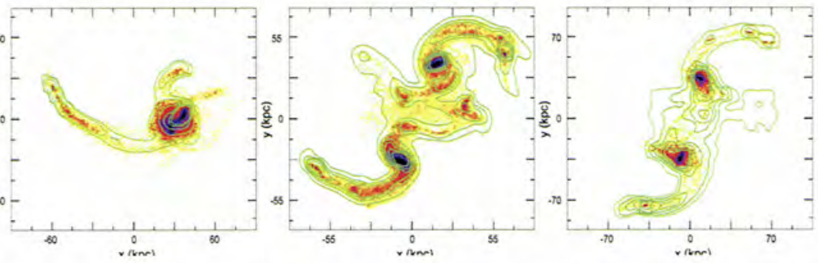
For seven decades, ever since Hubble's discovery the "age paradox" haunted astronomers: the oldest stars in our own Galaxy were older than the whole universe! The age paradox (evidenced by two columns in the table) has now been resolved through immense efforts by observers and in theoretical astrophysics to improve the expansion constant and the ages of stars.

By the year AD 1900 the astronomical universe had a depth of 30,000 light years and contained only our Milky Way system. Today the visible part of the universe extends nearly a million times deeper. The geological ages of the Earth (last column of the table) were originally relative ages based on the thickness of sediments. Absolute calibration became possible a century ago, based on the decay of radioactivity in rocks and later in meteorites. Astronomy has still a long way to go before achieving the better than one per cent accuracy of the geological age. ❐

The Bible: *According to some interpretations (e.g. Bishop Ussher) the world was created 5972 years ago*
Hinduism: *The world is older than 300 000 billion years*
Aristotle: *The world is infinitely old and cyclic*

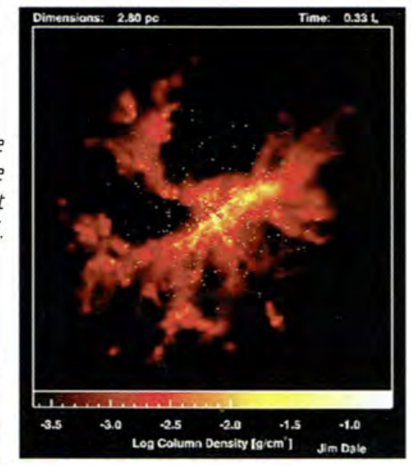
AD	The Universe	The oldest stars	The Earth
	Modern ages in billion years:		
1900	Infinite	> 0.1	> 0.3
1925	Infinite	> 3	> 1.3
1950	1.8	3-6	3.5
1975	5-6	10-20	4.56
2000	13-15	–	4.56
2003	13.7	–	4.56
2006	13.6	12-15	4.56

The age of the world according to the highest religious, philosophical and scientific authorities – collected by Erik Høg in 2006.



Left: Three different simulations of interacting galaxies with extended dark matter halos, all showing triggered tidal dwarf galaxy formation at the tips of the tidal tails. The simulation on the right also shows many smaller star-forming regions that formed along the tails. Credit: Duc et al. 2004, Astronomy and Astrophysics, 427, 803.

Right: SPH model of the ionization and compression of a molecular cloud. This image shows the column density distribution in the final stage, after the cloud has been pushed away from the ionizing source and new stars have been triggered in the compressed fragments. Credit: Dale et al. 2005, Monthly Notices of the Royal Astronomical Society, 358, 1365.



Summary of Symposium S237: Triggered star formation in a turbulent interstellar medium

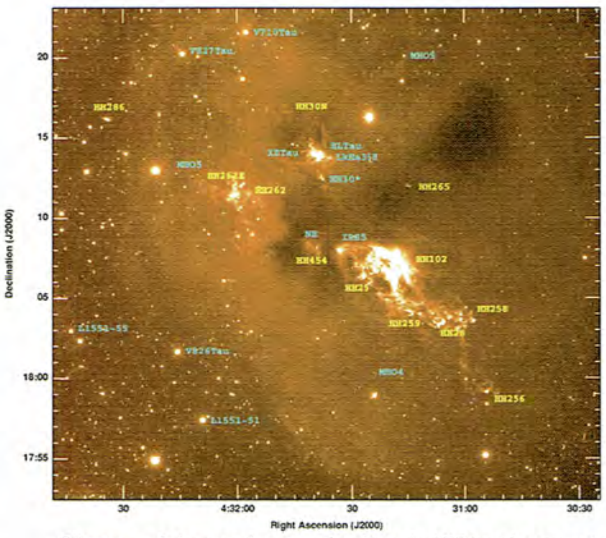
Bruce Elmegreen, IBM Watson Research Center

Stars form in the dense cores of molecular clouds, but the formation process of these stars, like the formation process of the cores themselves, is not simply a gravitational collapse and fragmentation of ambient interstellar matter (ISM). The ISM is far too chaotic and turbulent for that. Galactic gravity alone tends to make spirals, either the long and symmetric type from self-gravity in the stars, or the short and flocculent type from self-gravity in the gas. The motion that results stirs the gas further, causing shocks and compressed regions on smaller scales. Supernovae and other stellar disturbances also shock and compress the gas, as does the continued force from self-gravity. On the comparatively small scale of molecular clouds, and especially in the cores of these clouds, all of these stirring motions blend together to make a random turbulent mixture. This mixture creates its own shocks and intersecting shocks, ultimately forming dense sheets, filaments, and clumps down to scales that are so small they cannot usually be observed.

The Galactic HII region RCW 79 contains a cavity of ionized gas surrounded by a dust and molecular ring. The ring has five fragments, three of which contain very young stars that presumably formed when the ring collapsed by self-gravitational forces. Credit: Zavagno et al. 2006, Astronomy and Astrophysics, 446, 171.

The dense molecular clumps that are midway in this range of scales, too small for internal motions to shock and fragment further and yet large enough for self-gravity to overcome the thermal pressure, are believed to be formation sites of individual and binary stars. Magnetic diffusion and turbulent energy dissipation leads them to higher and higher densities on timescales of ten to one hundred thousand years. Because the turbulence and self-gravity that made them is scale-free, they usually cluster together in a hierarchical fashion, forming clusters within clusters of young stars. The densest of these clusters can end up gravitationally bound, like the Pleiades, while on larger scales, the lower density parts are almost always unbound, like the OB associations and star complexes that highlight the original density wave spiral arms and flocculent spiral arms.

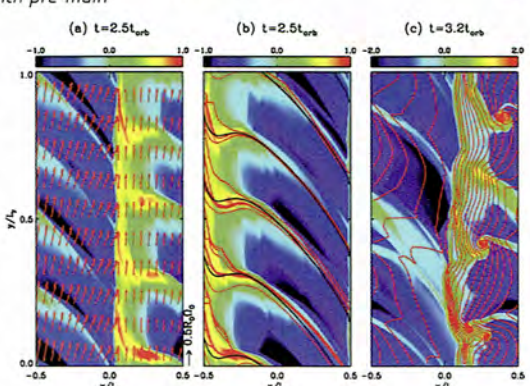
The formation of massive stars has severe repercussions in this chain of events. The ionization, winds, and eventually supernovae from these stars compress and move the dense gas again, creating new dense cores and more star formation. Over time the disturbance spreads outward, compressing even the low density ISM into a giant shell or outflow from the galaxy. Stellar triggering like this is observed on many scales, from tiny globules in the "pillars of creation" part of the M 16 nebula to whole molecular clouds in Lindblad's expanding ring around the Sun.



SII image of the star-forming cloud Lynds 1551 with pre-main sequence, young stellar, and Herbig-Haro objects labeled. The dark cloud points away from the Orion star-forming region and was probably influenced by pressures from massive stars in Orion. The bright emission perpendicular to the dark cloud (which includes the Herbig-Haro bright spots) is shock emission from the interaction of young stellar winds with dense gas. Credit: Moriarty-Schieven, et al. 2006, Astrophysical Journal, 645, 357.

Whole galaxies can be triggered into forming stars as well. Interactions lead to spiral arm torques and gas inflows, which make the ISM denser and more strongly self-gravitating than it was before. Peripheral gas around galaxies can form long tidal tails, which collapse into knots that form their own clusters. Some of these knots may be ejected from the galaxies altogether, forming small stellar systems that resemble Dwarf Irregulars.

The ISM is an active environment with a variety of energy sources that can push it around and make it highly turbulent. Yet is it very cold from a lack of strong thermal heat sources and rapid collisional dissipation. The result is a pervasive network of supersonic expansions and turbulent motions that compress it in multiple steps and eventually trigger star formation. Many stages in the process can be observed directly, and much of it can be modelled numerically. The current limitations of both techniques will make star formation in a turbulent ISM an active topic of research for many years to come. ❑



Simulation of the gravitational collapse of a 3×6 kpc region of a spiral arm. Surface density and velocity are shown for the full region on the left, surface density and streamlines (red) for the post shock region are shown in the middle, while surface density and magnetic field lines for a later time are shown on the right. The gas collapses into giant cloud complexes that resemble the beads on a string of star formation along galactic spiral arms. Credit: Kim & Ostriker 2006, Astrophysical Journal, 646, 213.

Flying into the lunar shadow

Daniel Fischer

His day job is being the instrument scientist of the Hubble instrument NICMOS and studying young exoplanets and circumstellar disks at the University of Arizona's Steward Observatory – but Glenn H. Schneider has another passion: Since 1970 he has spent one and one quarter hours in the umbra of the Moon in a total of 26 total solar eclipses. And for three of these Schneider went into the air, always taking care of the tricky navigation to the right spot at the right time: This certainly makes him the most experienced airborne eclipse chaser ever. His first eclipse flight was also the most complex one, as the Moon just barely covered the Sun in October 1986. "If you define totality by the complete and instantaneous extinction of the photosphere, then it wasn't total," Schneider recalls, but "if you define totality as being completely immersed in the umbra, then it was." Together with six other "umbraphiles" as Schneider likes to call them, he chartered a small plane out of Iceland, had it fly 1,000 km over the North Atlantic – in an era without GPS – and yet "we managed to pull it off": the umbra was encountered with an error of just a few hundred meters, giving everyone on board four seconds of totality, plus the opportunity for some unique pictures. At the same time, the umbra could be seen projected onto the clouds way below the airplane in the shape of a squashed cigar: "The fact that we could see the umbra below us, to me makes it a total eclipse," Schneider tells everyone claiming it was an annular one instead, albeit one with the ring broken by lunar mountains on the limb in some place all the time. But technically, at least according to one famous set of eclipse predictions in wide use then, totality lasted 0.00 seconds...

The "diamond tiara" eclipse October 3, 1986 was photographed by Glenn Schneider from a Citation II aircraft at an altitude of 44,000 feet above mean sea level over the north Atlantic Ocean near Greenland.

The next time Schneider went airborne was in 1992 when totality would last over 6 minutes instead but would again avoid solid ground. This time the flight was commercial, with many amateur astronomers on board but Schneider once again on the flight deck. By now he had developed software that could optimize the flight patch for encountering the umbra in the best spot at the best angle, but there was no way to connect his computer to the actual navigation system of the DC-10. So the path data calculated by the computer had to be hand-typed into the aircraft system all the time. To hit the eclipse right, the DC-10 actually had to slow down considerably, coming dangerously close to stall speed, but again the navigation worked well and all passengers got a great view of the solar corona and the play of light and shadow in the open air at 41,000 feet and below. When you fly along with the lunar shadow as it races over the Earth with about Mach 2, you lengthen your totality time quite a bit – so imagine what flying supersonic could do. In 1973 the first-ever built Concorde in a much-reported experiment had managed to stretch 7 minutes of totality on the ground to 75 minutes, offering the astronomers on board unique observing capabilities through special windows.

The long eclipse of 2001 looked to Schneider as worthy of a repeat of that feat, now with much more advanced imaging equipment. Sadly the Paris crash of a Concorde in 2000 would make this impossible, and so the thoughts turned to the Antarctic eclipse of November 2003. Here Schneider really invested heavily, travelling to Australia several times to test his equipment in a flight simulator. Again he was allowed to work from the flight deck of the B 747 (which in turn meant that he never met his fellow passengers in the cabin as the door stayed locked all the time): "We put four imaging systems on board with a gyro platform," Schneider explains: "It worked out great!" Even long exposure photography to get the outer corona was possible this way. So what's next? The big flying observatory SOFIA in 2009, perhaps, including use of its large telescope! 'Geometrically that eclipse would be ideal for observing it with SOFIA," Schneider marvels: "It's a 6-minute duration eclipse, and it's at an altitude where the SOFIA tracking would be perfect for a long duration." So stay tuned – and check out Schneider's previous achievements at **http://nicmosis.as.arizona.edu:8000/** ❑

Nobel Prize Laureates and Prague

Alena Šolcová, Michal Křížek, Jana Olivová

The centuries-old city of Prague has a long and rich tradition in cultivating and developing science and research activities. A number of outstanding personalities in mathematical and physical sciences and astronomy were born or worked here, including probably the most famous of them – Tycho Brahe, Johannes (Jan) Kepler and Albert Einstein. May we therefore invite you to take a walk through the narrow streets and wide squares of both historic and modern Prague and follow in their footsteps? In so doing, you will see Prague's Old Town Square, the sprawling Hradčany Castle, the Lesser Town, the New Town and other parts of Prague. First of all we would like to remind you that Prague is the home town of no fewer than five Nobel Prize laureates: It may also interest you to know that most of them have their celestial counterparts, literally, on minor planets that have been named after them. The first of them was **Bertha von Suttner** (a daughter of Count Franz Kinský) who won the Nobel Peace Prize in 1905. Only a couple weeks ago, on June 8, 2006, a memorial plaque was unveiled to her honour at Old Town Square at No. 12/606, in the right passage-way through the Kinský Palace.

Both **Gerta Theresa Cori** and her husband **Carl Ferdinand Cori**, who were awarded the Nobel Prize in Physiology or Medicine in 1947, were born in Prague and studied medicine here.

In 1922, they moved to the US. A memorial plaque to Carl Ferdinand Cori has been placed on his former home at Salmovská Street No. 6. The plaque honouring his wife Gerta Theresa Cori sets apart the house where she lived on Petrská St. 29. A minor planet has also been given their name – it is *(6175) Cori*. Chemical physicist **Jaroslav Heyrovský** graduated in 1918 from Charles-Ferdinand University in Prague where he invented the polarographic method and became the father of electroanalytical chemistry, which won him the Nobel Prize in Chemistry in 1959. A bust has been placed on the house at the corner of the Kaprova and Křížovnická streets, where he was born in 1890. A memorial plaque can be found in Lada Street in Prague's New Town. A square and a grammar school in Prague and the Institute of Physical Chemistry of the Academy of Sciences of the Czech Republic bear the name of J. Heyrovský. He is buried at the Vyšehrad Cemetery (section 13O, No. 28). The minor planet *(3069) Heyrovský* commemorates this outstanding personality.

The fifth of the group of Nobel Prize winners is poet **Jaroslav Seifert** who was awarded the Nobel Prize for Literature in 1984. One of his collections is entitled Halley's Comet. The minor planet dedicated to him is called *Seifert* and its number is *(4369)*. The poet was born in the district of Prague called Žižkov, on Bořivojova Street No. 104, where you can find a memorial plaque to his honour. One of the streets of Prague has been renamed after him in recognition of his literary attainment. ❒

Brief information

- **Universe Awareness informal get-together.** As a follow-up of this morning's Press Conference (11:30 in Meeting Room 3.3) and official launch of the Universe Awareness (UNAWE) initiative, the UNAWE team will be available for discussion this afternoon between 17:30 and 18:00 in meeting room 2.1. Universe Awareness (UNAWE) is an international project that will expose underprivileged young children, aged between 4 and 10 years, to the inspirational aspects of astronomy.
- **Division III – A new commission 'Extra-Solar Planet'** has been formed. There will be a meeting on August 23 at 16:00 in Club D. Any person interested in joining this commission is warmly invited to come along. Iwan Williams, president Div. III
- **Wednesday, August 23: The Division XII** Business meeting will take place in Club C at 12:30 (beginning of the lunch break, immediately after Session 2).
- **History of Astronomy sessions, Commission 41:** A full programme is contained in the blue-coloured booklet "History of Astronomy: Commission 41 Activities at Prague" which is widely available at the entrance and elsewhere.
- **Programme correction** — Ancient Historical Astronomy, Archaeoastronomy and Ethnoastronomy:
  11:00–11:15 C. Ruggles: Fundamental problems of modern archaeoastronomy
  11:15–11:30 J. Steele: Ancient and modern use of Babylonian astronomical records
  11:30–11:45 T. Medupe, B. Warner et al.: A project to study the scientific content of Timbuktu Manuscripts
  11:45–12:00 K. Malville, H. Thomson, G. Ziegler: Recent discoveries at Llactapata, Peru
  12:00–12:15 R. Norris: Australian aboriginal astronomy
  12:15–12:30 A. Sidorenko-Dulom: The UNESCO thematic initiative "Astronomy and World Heritage"
- **JENAM 2007 – European Astronomers will meet in Armenia:** Next JENAM will be held in Yerewan in Armenia, August 20-25, 2007. For further information please contact the chairman of the LOC, Areg Mickaelian (**aregmick@apaven.am**). A webpage on the conference will be ready in the near future accessible via the homepages of the EAS (**www2.iap.fr/eas**) and ARAS (**www.aras.am**).

Secret diary of secret agent F.R.Og

August 21: I have to admit I still didn't find the author of paper about strange infrared galactic objects. Nobody knows him. Or her. It's difficult to tell with Earthlings, their shape is the same. Pity they don't use feromones or some clear distinction. I already had few ... ehm ... misunderstandings. Whatever the author is, it is still hiding in the crowd. Maybe instead of localizing one person among two thousand I should try to find everyone who knows something about sirgogs. Of course, as I already discovered, it's completely useless to use the name. We talk about people who cannot decide if they should spell 'planet' or 'pluton'. So it's all down to observables but, by the cosmic egg, how am I to calculate J, K or M magnitude of my home planet? Will have to steal a basic astronomy textbook from the exhibition stands.

NOMENCLATURE FILLER

7. From Confusion to Clarity: Is my object the same as yours?

Hélène R. Dickel

Who hasn't asked this question at one time or another? Both the Simbad Astronomical Database and NASA Extragalactic Database (NED) have **name-resolvers** which are helpful for figuring out the proper designation for a source when all you have is a shortened, cryptic version. Be forewarned, however, that the name-resolver query may result in several possible candidates for your source. This illustrates why it is so important for authors to give complete designations *and* accurate coordinates for their sources in the first place.

Information Bulletin on Variable Stars is 45 years old

Katalin Oláh, Konkoly Observatory of the Hungarian Academy of Sciences, Hungary

The "Information Bulletin on Variable Stars" was established in 1961 during the General Assembly of the IAU, in Berkeley, by the 27th Commission. The variable star community at that time needed a quicker way of communicating new discoveries and urgent announcements than was possible through the existing journals. The Director of Konkoly Observatory, Hungary, Prof. L. Detre offered to publish this Bulletin. During these 45 years, IBVS went through several methodological and technical changes and developments during the past decades.

It turned out very soon that IBVS serves not only as an advertising forum for discoveries and announcements. Following a real need for publishing short notes and papers it soon became an express journal for the variable star community. During the previous Prague General Assembly in 1967, IBVS was entrusted with the task of publishing variable star designations in advance of a Supplement or a new edition of the General Catalogue of Variable Stars (GCVS). From the very beginning about half of the published notes were written on close binaries. This fact was administratively acknowledged in 1992 when IBVS became the official publication of Commission 42 (Close Binaries), as well.

Originally IBVS was mailed to all Commission members free of charge. But with the increasing membership, Konkoly Observatory could no longer finance this task alone. At the 1988 GA in Baltimore the new President of the 27th Commission, M. Breger made serious efforts to solve this problem, which was completed during the next GA in 1991 in Buenos Aires, by forming an Editorial Board for the IBVS. During the first meeting of this Board in Vienna in 1992 the introduction of subscription fee for IBVS was decided and announced. The IAU Executive Committee provided a grant of 1,000 USD helping several countries to subscribe. However, we received the biggest help from Christiaan Sterken, who managed all the financial and administrative tasks during the next five years until the Budapest office was able to handle these issues.

Keeping a professional scientific level has always been the main task of the editors. From the beginning until 1996 all papers were read by the editor(s) thus ensuring promptness of the publication. Since 1996, with the new era of fast communication via the internet IBVS became a fully refereed journal: beside the editors' experience in various fields of variable star astronomy, external referees are evaluating the papers. The Editorial Board and advisors, elected in every 3 years, help the editors in different issues.

The former President of Commission 27, Béla Szeidl was the Editor of IBVS for the longest time, or 22 years between 1968–1990. His enthusiastic work and support throughout the (sometimes hard) years made IBVS a well recognized journal.

Using the new technical possibilities, the Electronic IBVS program started already in 1993. First, all the issues published before the electronic era were digitized. The electronic IBVS appeared on the web as early as in 1994, and now experiments with Virtual Observatory features. Photometric sequences published in IBVS can be visualized with a "grid" tool: the CDS Aladin. All papers from the first issue are now available free of charge on-line in the IBVS webpage. Two CD-ROMs were published containing issues 1–4000, and 4001–5000.

Recently, following the technical developments in obtaining variable star measurements through massive surveys and automated telescopes, IBVS announced various possibilities for publishing special notes, in two collected papers in the end of each 100 issues. One contains important new discoveries of variables, the other publishes observational material on interesting objects. Only the basic information of each note is printed in the collected papers, the bulk of the data are published electronically. Information content is the one and only measure that decides if a paper is accepted and to which section of IBVS it is directed. We suggest that all authors of IBVS send their observational data to the database where they are available to the public.

The quality of the journal, however, cannot be established with technical innovation only – researchers of the stellar variability need to submit good papers!

The history of IBVS, annoucements, reports, editorial notes, composition of the Editorial Board and all the published issues of IBVS are found in our webpage at **http://www.konkoly.hu/IBVS/IBVS.html** ❒

Yet another brief information:

- **IHY Discussions today and Thursday.** The International Heliophysical year celebrates the 50th anniversary of the IGY in 2007. Its activities related to the IAU will be discussed today in SPS5, Meeting Hall V, starting at 14:00. There will also be a Div. II working group on the IAU Thursday August 24 at 9:00 in Small Theater.
- **Final programme: Tuesday August 22, Room Club E SPS4b – Hot Topics**
  09:00 Mergers and the Milky Way – Amina Helmi
  09:20 Petal-shaped occulter for observing exoplanets – Eric Schindhelm
  09:40 A Definitive Measurement of the Faraday Rotation in Sgr A* – Jim Moran
  10:00 Short duration GRB's
  10:20 On the birth, evolution and nature of neutron stars – Michael Kramer (10:40 Coffee)
  11:00 Large scale structure up to z ~ 1 and beyond: VVDS Results – Bianca Garilli
  11:20 Evidence for baryonic oscillations – Carlos Frenk
  11:40 WMAP: observations – David Spergel
  12:00 WMAP: cosmological parameters – Joanna Dunkley

Tuesday 22/8
11 °C / 52 °F morning minimum
21 °C /70 °F afternoon maximum
Mostly cloudy with showers
W winds 5 m/s (12 mph)

Wednesday 23/8
10 °C / 50 °F morning minimum
20 °C /68 °F afternoon maximum
Cloudy with a shower likely
W winds 5 m/s (12 mph)

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D I S S E R T A T I O C V M
NVNCIO SIDEREO III | 8

P R A G A E — M M V I 23. V I I I. — S E R I E S T E R T I A

SPS4b – Hot Topics II

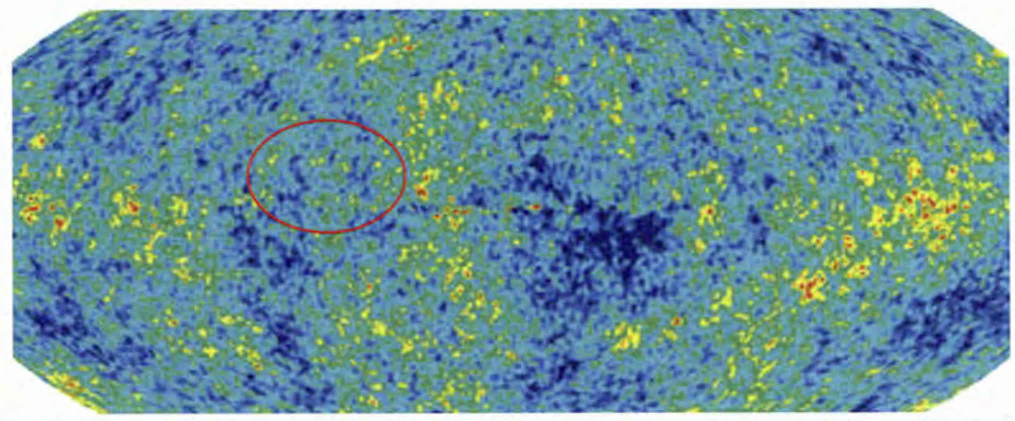
Second part of Special Session 4 – „Hot topics", started on Tuesday morning with a very few visitors in the auditorium. Situation got much better at the start of the Session 2 at 11:00, but still it seemed like there were not many people interested. We assume that this is mostly due to not so fortunate organization of this session. The final program has been known only one day ahead and therefore many people potentially interested to come along were already not able to change their plans.

Michal Švanda, Michael Prouza

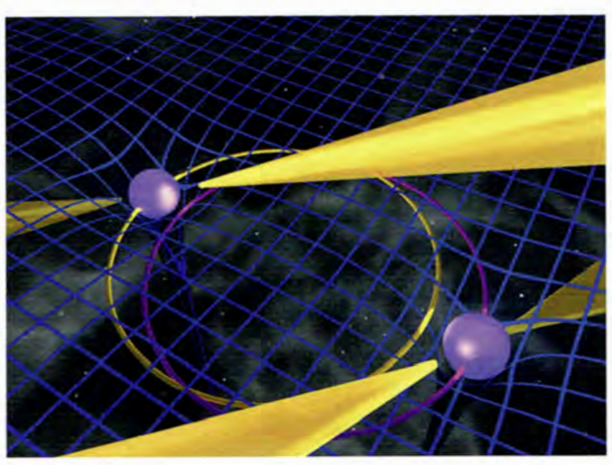
The Session 1 was started by Amina Helmi, who presented the search of tidal tails and debris endorsing the theory that galaxies are formed though merging of smaller pieces. Sagittarius dwarf galaxy is the excellent evidence. After that, Eric Schindhelm tried to convince us that even without any improvement of today's technology we are able to detect 1000 extra-solar down to sub-Earth sized planets within next 10 years. Just simple adjustment of space telescope is needed – a starshade, petal-shaped occulter, that will obscure the light of the central star and after that planets' faint light will be detectable. A principle is the same as a principle of the solar coronagraph. Jim Moran came with a different topic – with the measurement of Faraday rotation in the Galaxy using SubMillimeter Array (SMA). The results suggest that with this instrument we should be able to map what is happening close to the event horizon of the Galactic supermassive black hole. In the next talk, Michael Kramer lectured again about the double pulsar PSR J0737-3039. He showed that behavior of this exotic object perfectly agrees with the theory of general relativity. He also revealed some points of the dynamics of binary pulsars. The Session 1 was finished by David Buckley and his talk about SALT first light and proposed science topics for this telescope.

During the Session 2 mainly cosmology topics were discussed. First, Bianca Garilli introduced the VIMOS VLT Deep Survey (VVDS) project that allows mapping of the large-scale structures and their relations to the age and other properties of many galaxies. Carlos Frenk presented the results of simulations and observations of baryonic oscillations that are complementary evidence to CMB confirming our current models of the evolution of the universe. The signs of such oscillations were clearly found in the distribution of galaxies in deep-field sky surveys (2dF and SDSS). Dedicated simulations as Millenium Simulation done by Virgo Consortium are not only creating beautiful animations, but also predicting the limits of improvements achievable by future observations. Two talks that finished the "Hot topics" session were about recent results obtained by WMAP spacecraft. David Spergel showed new observation with WMAP after three-years run including recent measurements of CMB polarization. In the lively discussion even the funny features like "S" and "H" letters visible in the maps or that multipole "Axis of Evil" (anomalous features of the 2-point angular correlation function on very large angular scales; in particular, the quadrupole and the octupole terms are well aligned with one another) were mentioned. Then Joanna Dunkley showed the best-fit model of WMAP data and concluded that even the simple model surprisingly well fits other available observational data.

The idea of such "hot" sessions is attractive, however we felt that there is still some room for improvements of organization. We even dare to suggest two possible steps – the first is to announce the program already before the start of the conference and the second is to organize these special meetings not during the standard sessions, but rather like invited discourses after the usual program. We think that the superb lecturers and amazing topics presented deserve it. ❐



WMAP 3-year release revealed CMB fluctuations with unprecedented quality – even the letters "S" and "H" (darker blue; in the red ellipse) were unexpectedly revealed :-).



The perfect relativistic laboratory – double pulsar J0737-3039.

Orbiting spots as a model of the polarized variable infrared emission from the centre of the Milky Way

The Galactic centre is one of the most exciting targets in the sky. As has been demonstrated convincingly by the analysis of stellar dynamics, the central stellar cluster harbors a 3.7 million solar-mass black hole located in the position of the compact radio source Sagittarius A* (SgrA*).

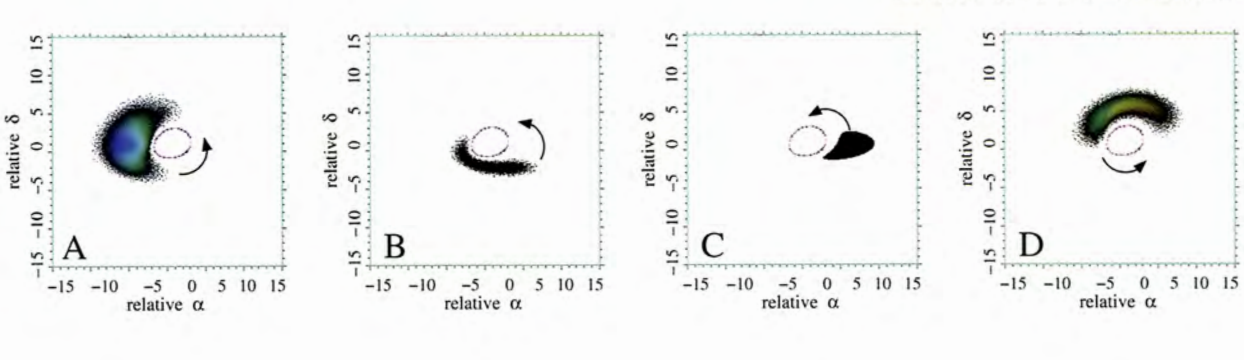
Andreas Eckart, Rainer Schödel, Leonhard Meyer, Michal Dovčiak, Vladimír Karas

Recent near-infrared observations using the instrumentation of the European Southern Observatory (ESO) at Paranal, Chile, have lead to the exciting discovery of highly polarized flare emission from SgrA* (Eckart *et* al. 2006, A&A **455**, 1, and Meyer *et* al. submitted to A&A). The flares exhibit interesting structure. Over three consecutive years, polarized sub-flares show a quasi-periodicity of 20±3 minutes, which is similar to the value of 17±2 minutes found in previous ESO observations (Genzel *et* al. 2003, Nature **425**, 934).

An elegant and currently most preferred model to explain the quasi-periodicity of the polarized flux is that of a faint transient gas disc which gives rise to a "hot spot". The spot orbits around the central black hole, similarly as in the models invoked for the interpretation of X-ray fluctuations from accreting black holes in other galactic nuclei (see Dovčiak *et* al. 2004, ApJS **153**, 205). According to this scheme the temporal variations are explained in terms of relativistic (Doppler and lensing) flux density fluctuations as the spot approaches/recedes the observer and gradually decays (see the computer simulation in the four-image figure below). At the same time the formation of Einstein rings and arcs occurs due to lensing; this diminishes the overall polarization of the hot spot.

The spot model is able to reproduce the observations and allows us to deduce valuable information on the accretion process in the immediate vicinity of the massive black hole. An unexpected surprise of recent NIR polarimetry data is that the position angle of the mean E-field vector on the sky has a value of around 60 degrees. This holds for *all* sub-flares observed until now and suggests a preferred orientation of the overall black hole/disc system in SgrA*. New observations of the polarized flare events are needed to determine how stable the orientation of the polarization vector is. For further details see an upcoming article in the ESO Messenger. ❐

Synthetic images of an orbiting hot spot captured at four instants of time near a black hole (figure produced with help of a code by M. Dovčiak, V. Karas and T. Yaqoob). The apparent shape of the spot is distorted and its colour-coded flux density and polarization are modified by the strong gravitational field near the centre of the Milky Way. The offset from the centre is given in gravitational radii of the central black hole. This model gives an excellent representation of the variations of the polarized infrared emission observed with the ESO instrumentation.



Letter from Robert P. Kraft, IAU President (1997–2000)

Dear Members and Friends of the IAU,

Welcome to Prague, one of Europe's most important cultural centres, the place where Mozart, in 1787, had his greatest success: the first production of "Don Giovanni".

Unfortunately, I am unable to be with you, but send you greetings from the extreme west coast of North America. I think of our world astronomy community often as I walk the 700 meters from my home to the shores of the Pacific, where the California brown pelicans dive for a fishy breakfast and statuesque seagulls stare out into space over the waves. But the calm scene is contradicted by the ironic state of the world: as we discover more and more about the evolution of humankind and of the Universe, just so does the political and social world sink deeper into ignorance. We are in a profoundly dispiriting time, when irrationality, superstition and religious fundamentalism, whether it be from the east or the west, threatens to turn the clock back to a new pre-Enlightenment Dark Ages.

In the face of this, what message does the IAU have for the world? Is it not true that we provide a model for rational and peaceful behavior among our varied national identities? As we struggle to understand the Universe, we compete, but at the same time, we cooperate. We criticize each other, but at the same time, we respect each other. We build an organization in which we share our findings, and where all may speak freely and without fear. Is it too much to hope that the world might begin to take our model more seriously?

May the 2006 GA of the IAU move the frontiers of astronomy forward!

Please, check our **electronic supplement at astro.cas.cz/nuncius** for unique photos from IAU Prague congress 1967 by Boris Komberg, short article about history of astronomy by Wayne Orchiston and remark by Elizabeth Griffin. **"Planet Redefinition Proposal"** was also updated, New contributions by Leo Blitz, Terry Mahoney and Craig Heinke are now available.

(Clarified) announcement: We remind the **participants of the XIIIth GA in Prague in 1967** that a group photo will be taken on Thursday 24 at 9 a.m. in the Congress Hall. Please use the entrance on the 1st floor next to the central stairs.

Today's programme: (wednesday 23/8)

- Symposia S238, S239, S240
- Joint Discussions JD13, JD14, JD15, JD16, JD17
- Special Sessions SPS7
- Farewell Reception (Industrial Palace)

Polarimetry as a tool to search for strong gravity

Until gravitational wave detectors open the new window to the Universe and the expectedly complex effects and annoying noises are filtered out, light is the only agent that brings the evidence of dark bodies a.k.a. black holes.

Jiří Horák, Vladimír Karas, Astronomical Institute, Academy of Sciences, Prague

It has been known for many years that imprints of the gravitational field could be traced in radiation spectra of accreting black holes, but so far only partial information carried out by photons could have been successfully utilised. Polarimetry can provide the lacking constraints on the models, and various processes relevant for the cosmic environment, such as scattering of ambient light and the non-thermal bremsstrahlung/synchrotron emission, should generate a polarized signal.

The idea of X-ray polarization studies providing clues to physics of accreting compact objects has been hovering in the air and in papers since the late 1960s. In fact, in the four-decades old edition of the General Assembly newspaper one reads that *"A joint discussion was held on Monday 28 [1967] afternoon in the House of Artists, with the participation of some 500 persons. H. Friedmann informed the group about measuring X-sources in Scorpio and Sagittarius carried out with the aid of Skylark rockets as well as plans for X-ray apparatus for artificial satellites. R. Giaconni compared the distribution of X-ray sources with the optical and radio models of the Galaxy..."*

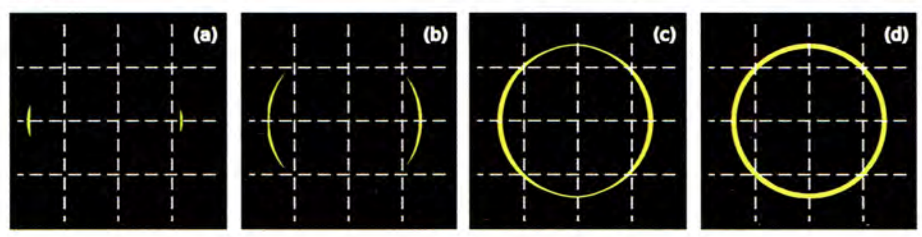
As recently reported (A. Eckart and collaborators, Astronomy & Astrophysics), new near-infrared data provide suggestive evidence for the rapidly changing polarization of Sagittarius A*. The variations are connected with flares that occur on time-scales extending down to the order of ten minutes. (This is comparable with the orbital period near the Galactic Centre black hole.) Broderick and Loeb (Monthly Notices) have demonstrated that the method can be extended to part of the radio band, until the Faraday depolarization prevails at longer wavelengths.

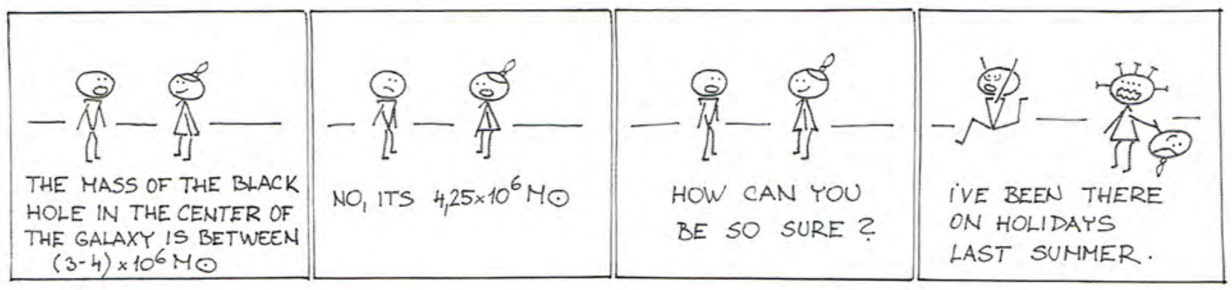
And as argued by E. Costa et al. (astro-ph/0603399), the X-ray polarimetry would be extremely helpful in constraining the physical and geometrical parameters of black holes in which high energy photons originate very close to the horizon.

Our calculations support that latter claim by showing fast variations of polarization which a black hole source should exhibit. Peaks and dips of polarization magnitude appear at moments when Einstein's arcs are temporarily formed. Duration of these fluctuations is given by the dynamical time-scale near the innermost orbit – minutes in case of Sgr A* – and, hence, it carries the information about the black hole mass.

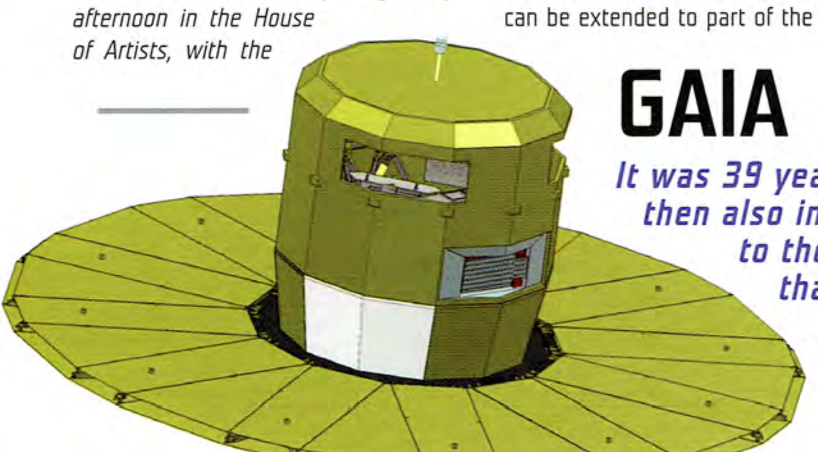
The signal of highly-lensed light rays is admittedly weak (it hardly exceeds one percent of the direct photons) and the right technology to measure its polarization is a riddle. However, the challenge is worth pursuing because of very specific timing properties. Catching these rare photons may be as easy or difficult as capturing a few gravitons from a noisy environment. ❒

Einstein's arcs at four subsequent moments when the geometrical configuration of the light source and the black hole are appropriately tuned with respect to the observer. The magnitude of observed polarization falls sharply as the source moves across the observer plane during the lensing event.





GAIA



It was 39 years ago at the 13th General Assembly of the IAU, then also in Prague, that Hipparcos was proposed as a project to the IAU by Pierre Lacroute. It is thus very appropriate that on Monday August 21 there was a special session on the GAIA mission.

Anthony Brown on behalf of Gaia Science Team and GAIA Data Processing and Analysis Consortium

The GAIA mission was originally proposed in 1993 by Lennart Lindegren and Michael Perryman as a concept for an ESA cornerstone mission in the "Horizon 2000 Plus" programme. After a detailed concept and technology study during 1997–2000 ,GAIA was accepted as a confirmed mission within ESA's scientific programme in October 2000 with a launch date of "not later than 2012". Following the definition phase, which ended early 2005, ESA released the industrial invitation to tender for phases B2/C/D (detailed design, development, launch and commissioning of the GAIA satellite). Two proposals were received; from EADS-Astrium and Alenia-Alcatel. After the evaluation phase EADS-Astrium was selected as prime contractor for the GAIA mission in early 2006. At the same time ESA's Science Programme Committee unanimously approved the GAIA mission and a requested budget. A launch date of late-2011 is currently targeted.

GAIA will rely on the proven principles of ESA's Hipparcos mission to solve one of the most difficult yet deeply fundamental challenges in modern astronomy: to create an extraordinarily precise 3D map of about a thousand million stars throughout our Galaxy and beyond. In the process, it will map their motions, which encode the origin and subsequent evolution of the Galaxy. Through comprehensive photometric classification, GAIA will provide the detailed physical properties of each star observed: characterizing their luminosity, temperature, gravity, and elemental composition. This massive stellar census will provide the basic observational data necessary to tackle an enormous range of important problems related to the origin, structure and evolutionary history of our Galaxy.

GAIA will achieve this by repeatedly measuring the positions of all objects down to 20th magnitude. It will achieve an astrometric accuracy of 12–25 microarcsec, depending on colour, at 15th magnitude (thus providing distances to 10 per cent accuracy at the Galactic centre) and 100–300 microarcsec at 20th magnitude. Multi-colour photometry will be obtained for all objects by means of low-resolution spectrophotometry between 330 and 1000 nm. In addition radial velocities with a precision of 1–15 km/s will be measured for all objects to 17th magnitude, thus complementing the astrometry to provide full six-dimensional phase space information for the brighter sources. GAIA will achieve the complete all-sky survey to its limiting magnitude via real-time on board detection. GAIA's observations thus also cover quasars, near-Earth objects, asteroids, supernovae, etc.

GAIA represents an improvement of several orders of magnitude over Hipparcos in terms of numbers of objects, accuracy and limiting magnitude. This is achieved through the combination of a larger aperture area, the use of much more sensitive CCD detectors (70 per cent quantum efficiency vs. the few per cent of the Hipparcos detector), and the multiplexing capability offered by the latter (Hipparcos used an image-dissector tube and could only observe one star at a time) which together with the mission duration of 5 years contribute to a longer integration time per object. As a result GAIA will collect, over the mission, a hundred times more photons for a 15th magnitude star than Hipparcos did for a 10th magnitude star.

The accompanying figures (courtesy of EADS-Astrium) show the GAIA spacecraft and payload. The image of the spacecraft shows the service module on top of which sits the payload which is hidden from view by the surrounding thermal tent. Below the service model the deployable sun-shield can be seen. This 10-meter diameter shield provides shade and thermal stability to the payload. GAIA will operate in the vicinity of the second Lagrange point (L2).

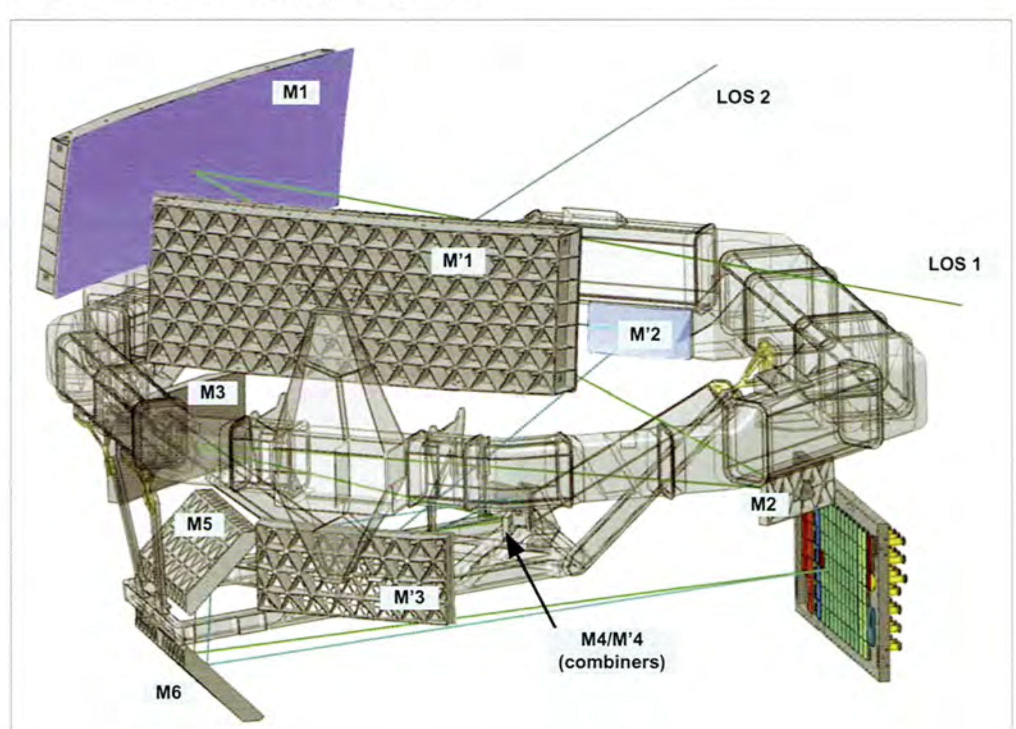
The payload module will carry the scientific instruments of GAIA which have gone through several design changes over the years. Whereas the previous (mid-2005) baseline design of GAIA featured two focal planes separately serving the astrometric and photometric/spectroscopic instruments, the current EADS-Astrium design combines all functions into a single focal plane. GAIA features two telescopes with two associated viewing directions size 1.6 by 0.7 square degrees. The two viewing angles are separated by a highly-stable "basic angle" of 106.5 degrees. The two fields of view are combined into the focal plane covered with 106 CCD detectors. The astrometric field of the focal plane will be sampled by 52 CCD detectors, each read out in time-delayed integration mode synchronized to the scanning motion of the satellite.

The photometric field of the focal plane is sampled by 14 CCDs and will serve GAIA's photometric instrument which consists of two low-resolution fused-silica prisms dispersing all the light entering the field of view. One disperser will operate in the wavelength range 330–680 nm; the other will cover the wavelength range 640–1,050 nm. The dispersion of the prisms will range from 3 to 29 nm/pixel for blue photometric band and from 7 to 15 nm/pixel for red band.

Finally, the spectroscopic field of the focal plane is sampled by 12 CCDs and will serve the Radial Velocity Spectrometer (RVS) instrument. The RVS will provide the third component of the space velocity of each star down to about 17th magnitude. The RVS instrument is a near-infrared (847–874 nm), medium-resolution (resolving power of about 11,000), integral-field spectrographwich will disperse all the light entering the field of view.

In addition to the technical challenge of building the spacecraft and payload the processing of the data collected by GAIA presents a formidable challenge in itself. It is a highly complex task, linking all astrometric, photometric and radial velocity measurements into the so-called global iterative solution. The data processing will be undertaken by the scientific community in Europe which has organized itself into the GAIA Data Processing and Analysis Consortium.

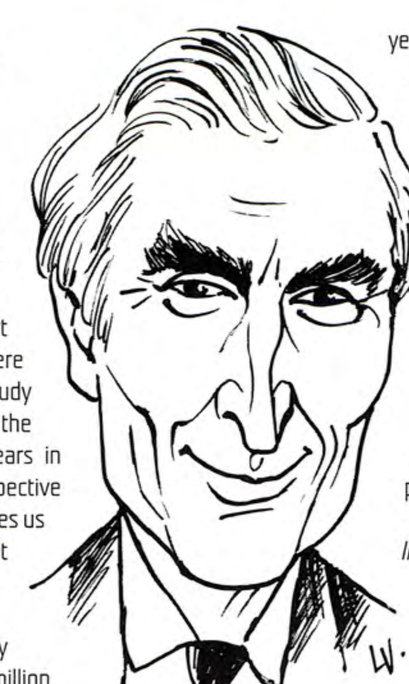
For more information about GAIA visit the website: **www.rssd.esa.int/GAIA**. ❒



Interview with: Sir Martin Rees

Astronomer Royal, University of Cambridge, Cambridge, United Kingdom

Jana Olivová



In your book entitled "Our final century" you offer a rather pessimistic view of the further development of humankind and human civilization. Why? What makes you so sceptical?

I do not think I am too pessimistic, I still think this is the best time for most people in the world to be alive. But in my book I made the point that the 21st century is the first century where the main dangers come from human beings and not from nature. These dangers come from the actions of human beings collectively on the environment and on the atmosphere and on the biosphere. They also come from the fact that individuals are empowered by technology to a greater extent than before. So in our interconnected world we are more vulnerable to individual error or terror.

Astronomy has developed enormously over the past five or six decades and it has also drawn great interest among the general public. People have learned how vast and complicated the Universe is and how lucky we are to be here on this planet. Does that knowledge change people and their view of the Universe and our destiny in it?

I certainly think that the view of our place in the cosmos has transformed over recent decades and there is wide public interest in this, in that cosmology now plays the same role in popular culture that Darwinism and evolution has done for a century or more. And I think this does give us a wide perception of the scale of cosmos. It gives us the idea that there are other worlds perhaps apart from the Earth, there are other locations where there might be life, even intelligent life. The study of planets around other solar systems is one of the most exciting developments in the last ten years in astronomy. I think there is another special perspective which astronomy brings to general culture. It makes us aware that the time lying ahead in the future is at least as long as the time which has elapsed up till now – perhaps infinitely long. Most of us are aware that we are the outcome of an evolutionary process which dates back for several thousand million years. But I think many people tend to think of human beings as in some sense the end of this process, as a kind of culmination. Whereas if you do astronomy you are aware that the Sun is less than half-way through its life and the Universe may have an infinite future ahead of it. And this I think gives us a different perspective on humanity. We are not the culmination. We may be barely even the half-way stage in evolution. If there are any creatures which are around to witness the death of the Sun six thousand million years from now, they will not be humans. They will be as different form us as we are from a single-celled organism, because this is as much time between now and the death of the Sun as that has been for the entire course of biological evolution. So we should think of ourselves as just a state on the way to the emergence of still greater and more marvellous complexity here on Earth and far beyond. And I think in that perspective we perhaps acquire an extra motif for good stewardship of our planet in this century because we would – if we handle things badly – destroy not just the environment for ourselves and our immediate descendants, but the tremendous potentialities for evolution far beyond that time.

In another of your books entitled "Just Six Numbers" you have shown that the constants in nature are incredibly, I dare say almost miraculously, fine-tuned in the way that allows human existence. Why and how did cosmos evolve in such a fine-tuned fashion?

The simple answer is that we do not know. We would not be here if this had not happened, and this relates to the question of whether the laws of nature are in some sense unique or whether there could be other domains of space and time governed by different laws. And one of the biggest challenges in theoretical physics now is to settle the question of whether the fundamental theory will predict uniquely the things like the mass of the electron and mass of the proton and the strength of gravity etc., or whether these numbers important for our existence are in some sense secondary environmental accidents. We perhaps will have to think of the idea of many Big Bangs, not just one, each ending up governed by different laws. So it could be that we will have to extend one stage further the mindset changes that started with Copernicus. We will have to realize that not only is our solar system not unique and our galaxy not unique, but perhaps even our Big Bang was not the only one.

What is the main question which still remains unanswered and which you would like to hear an answer to in astronomy in general or in your field of research in particular?

Well, I think one key question in cosmology is to understand the very beginning of the Universe and to understand the physical laws which prevailed at that time – until we do we will not be able to explain fully why the laws of nature are the way they are and indeed why the universe is accelerating and certain other mysteries. An equal challenge is, of course, to understand the emergence of complexity in the Universe – how it started off from this simple Big Bang but ended up after 13 or 14 thousand million years as the complex cosmos of which we are a part. Those are challenges. But if I can imagine a third one, it is to answer the question whether there is life elsewhere in the Universe: simple life, and even more advanced life. ❒

Left: *Artists illustration of the LOFAR layout and its planned European expansion.*

A new wave in astronomy: Long-wavelength telescopes take off

As announced at Monday's JD12 (Long Wavelength Astrophysics, organized by Joe Lazio), construction has begun for the telescope with the world's largest collecting area – the Low Frequency Array (LOFAR).

Heino Falcke (ASTRON, Dwingeloo), LOFAR International Project Scientist

The telescope is located in the North-Eastern part of the Netherlands, eventually stretching out to its European neighbours in Germany, England, France, Italy, and Sweden. With a target effective area at 60 MHz of more than 0.1 km^2, it is truly a major step forward. Compared to its predecessors it will improve resolution and sensitivity by two orders of magnitudes.

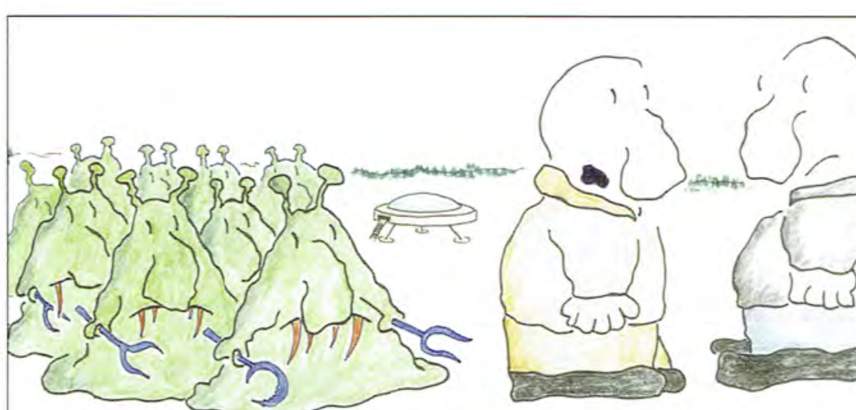
However, this is just the beginning of a new suite of low-frequency telescopes which promise to revolutionize astronomy in general and radio astronomy in particular. Besides the Dutch/European LOFAR telescope, the U.S. Long Wavelength Array (LWA, in the US Southwest) and the U.S.-Australian Mileura Wide-field Array (MWA, in Western Australia) have also received funding and will begin construction in the near future. All three projects actually share a common history and are considered a significant step towards a Square Kilometer Array (SKA).

As discussed at the meeting, the new science to be achieved is far-reaching: from planets (both solar system and extrasolar) to high-redshift galaxies and astroparticle physics. The most significant of all applications certainly is the search for the Epoch of Reionization through studying the 21 cm (1.4 GHz) hyperfine spin-flip transition line of the hydrogen atom in the redshift range $z = 6–11$. All these telescopes are also ideal survey telescopes with a large field of view and unprecedented all-sky radio transient monitoring capability.

All telescopes are realized as phased arrays in which massive steel dish antennas are replaced by a large number of cheap but digitized dipole antennas. Pointing and steering the telescope are purely realized in software without the need for any moving parts (apart from a few fans for cooling). With reference to the 100 ME LOFAR project this means 7,392 individual antennas spread over an area roughly 100 km in diameter with a planned European expansion up to 1,000 km. The LWA is expected to have a similar number of individual antennas spread over a region about 200 km in diameter in New Mexico. Implied data rates for LOFAR are 0.5 Tbit/s so that LOFAR operates one of the Top-10 supercomputers in the world – IBM's Blue Gene/L at the heart of the array.

This opens up completely new imaging capabilities. One extreme example obtained with prototypes (LOPES) was shown in what is probably the fastest movie in astronomy: the time-resolved imaging of a radio flash produced by a cosmic ray airshower hitting the Earth atmosphere. The flash lasted only some 20 ns and was the brightest radio source on the entire sky for that period.

It is expected that this new family of telescopes will revive long-wavelength astronomy and discover a host of new phenomena in the as yet almost unchartered wavelength space. ❒



They are asking, what part of the food chain do we occupy...

The first 13 of eventually 7,392 dipole antennas that will make up the LOFAR radio telescope. The area immediately around the antennas will revert to a nature reserve.

The US Naval Observatory announces publication of the "Double Star CD, 2006.5." This second double star CD contains improved versions of the four catalogs released with the First Double Star CD, a new catalog, and a history of double star astronomy at the US Naval Observatory. Catalog contens include:

- The Washington Double Star (WDS) Catalog, 2006.5
- The Sixth Catalog of Orbits of Visual Binary Stars
- The Fourth Catalog of Interferometric Measurements of Binary Stars
- The Second Photometric Magnitude Difference Catalog
- The Catalog of Rectilinear Elements of Visual Double Stars
- Double Star Astronomy at US Naval Observatory

The Catalog will be described in oral session on Thursday at the Commission 26 meeting and again at a poster at Symposium 240. Request a copy at **ad.usno.navy.mil/wds/cd_request.html** or from Brian Mason or Bill Hartkopf who will have a limited number for distribution.

Following in the footsteps of Brahe, Kepler and Einstein

Alena Šolcová, Michal Křížek, Jana Olivová

We begin our walk at the Betlémské náměstí (Bethlehem Square). From 1402 to 1413, Master (of arts; Mistr in Czech) Jan Hus (John Huss) preached at the Bethlehem Chapel which became the centre of the Bohemian Reformation movement.

Betlémské náměstí is also where scholar, astronomer and physician **Tadeáš Hájek z Hájku** was born in 1525. He is considered as one of the founders of modern stellar and cometary astronomy, renowned especially for his studies of a supernova in 1572 and a big comet in 1577. He was also a personal physician of Emperor Rudolf II.

The minor planet *(1995) Hájek* has been dedicated to him and a crater on the Moon also bears his name in Latin – *Hagecius*.

It was the recommendation of Tadeáš Hájek z Hájku that prompted Emperor Rudolf II to invite **Tycho Brahe** (minor planet *(1677) Tycho Brahe*) to his court. Later Tycho Brahe asked **Johannes Kepler** (minor planet *(1134) Kepler*) to come in Prague. For some time Kepler and Brahe lived and worked at the Chateau in Benátky nad Jizerou. Later they moved to Prague where Emperor Rudolf II established an astronomical observatory at the Royal Summer Palace (Belvedere) for Tycho Brahe. He placed the astronomical instruments he had brought from Denmark there and carried out observations with Johannes Kepler.

While Brahe was first of all an excellent observer (he was said to be the best in the era before the discovery of a telescope), Kepler excelled particularly in theoretical work. He processed data about the movement of Mars gathered by Brahe over the years and derived three (Kepler) laws from them. Two of the laws were formulated and published in Prague in the book Astronomia nova (New Astronomy) in 1609. Kepler wrote at **Karlova Street No. 4/177** in Prague's Old Town where he lived and where two memorial plaques to his honour were later placed. Also a fountain at the

second courtyard of that house bears Kepler's motto: "Ubi materia ibi geometria" (Where there is matter there is also geometry). The third plaque commemorating Kepler is placed on the house at **Ovocný trh 12/573** (near Karolinum), where he lived between the years 1604 and 1607 and where he discovered that the orbit of Mars is elliptical.

Tycho Brahe spent the last days of his life at the so-called **Curti House in Parléřova Street** (Prague 6 – Pohořelec), where he also worked with Kepler. A unique **double monument** with larger than life statues of both great astronomers has been erected there: Brahe carries a sextant and Kepler holds a scroll.

It is quite unusual for a scientist to have three memorial plaques in one city. As far as Prague is concerned, this honour has been paid only to two personalities: Johannes Kepler and to **Albert Einstein** (minor planet *(2001) Einstein*) who arrived in Prague more than three centuries later.

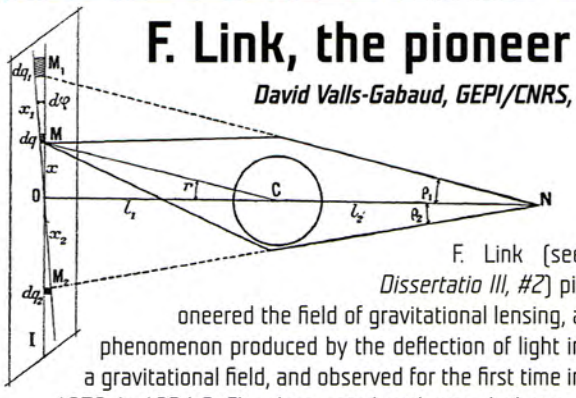
A bronze memorial plaque to his honour can be found at **Staroměstské náměstí** (The Old Town Square) **No. 17/551**. It is a profile of the famous physicist in relief. Above and under it there are inscriptions in Czech and English. The English version reads: "Here, in the Salon of Mrs. Berta Fanta, Albert Einstein, professor at Prague University in 1911 to 1912, founder of the theory of relativity, Nobel Prize winner, played the violin and met his friends, famous writers Max Brod and Franz Kafka."

Einstein also worked and gave lectures at the Institute of Physics of the German University, at the building which now houses the **Faculty of Natural Sciences of Charles University at Viničná Street No. 7** (Prague 2). A plaque with Einstein's portrait in relief and his biographical data has been placed in the entrance hall.

A bronze memorial bust of Einstein can be found on the house at **Lesnická Street No. 7** (Prague 5 – Smíchov) where Einstein lived. ❑

F. Link, the pioneer of gravitational lensing

David Valls-Gabaud, GEPI/CNRS, Observatoire de Paris, France



F. Link (see *Dissertatio III, #2*) pioneered the field of gravitational lensing, a phenomenon produced by the deflection of light in a gravitational field, and observed for the first time in 1979. In 1924 O. Chwolson noted, without calculations, that the deflection can produce fake double stars, and a ring of light when the lens and the source are aligned, but cannot say whether these phenomena can be observed. F. Link realised that there is a formal similarity with lunar eclipses: the refraction of the solar rays through the strong density gradient present in the Earth's atmosphere also produces an effective deflection with no focal distance. Using Eddington's *Mathematical Theory of Relativity*, Link worked out the positions and luminosities of the images formed by a gravitational lens, and his calculations were read at the March 16, 1936 session of the *Académie des Sciences de Paris*, and published in *Comptes Rendus*, **202**, 917. He concluded, correctly, that although the occurrence rate is low, searches must be made towards high density stellar regions. He also carried out the most detailed predictions ever made on the subject (to be superseded only in the 90s), dealing with finite-size effects, limb darkening, the detailed shapes of the images, concluding that these phenomena must be looked for, as they may further test general relativity (*Bulletin Astronomique* **10**, 73, 1937). On April 17, 1936, a Czech engineer, Robert Mandl, payd Einstein a visit at Princeton and convinced him that a gravitational focusing of light could explain the shape of annular nebulae, the origin of cosmic rays and the extinction of biological species by bursts of light focused during stellar eclipses. Einstein made the calculations but concludes that this phenomenon would not be observable, and refused to publish anything on it.

Einstein reluctantly sent a brief note (December 4, 1936 issue of *Science* **84**, 506) which attracted an immense interest in the subject and has often been considered to be the first on this topic, even though it appeared almost 9 months after Link's paper. It was, however, the first to appear in English. Remarkably, Einstein had already thought about lensing phenomena back in 1912, as the notebooks that he used in his train journeys from Prague to Berlin reveal, but he never published his ideas. It remains a mystery why Einstein, who always sought observational verification of his predictions (such as on Brownian motion, and on the gravitational deflection and redshift), was so pessimistic about one of nature's most spectacular phenomena. With the help of A. F. Bogorodsky, G. Tikhov published in 1937 a similar lensing calculation, being fully aware of Link's first paper. Link published further calculations in 1961 (*Bull. Ast. Inst. Czech.* **12**, 132) and (for the first time in English) in 1967 (*Bull. Ast. Inst. Czech.* **18**, 215). His opus magnum, "*Eclipses phenomena in Astronomy*" (1969), contains an entire chapter on gravitational lensing, reviewing the subject and insisting on its importance. He was also aware that Hoag's object could well be the first case of a gravitational lens (it turned out to be a ring galaxy). The microlensing by foreground stars on distant stars along the line of sight was first observed in 1993 and remains one of the best tools to study dark compact objects in our Galaxy, as predicted by Link.

Hoag's object. Credit: NASA and The Hubble Heritage Team (STScI/AURA)

It is therefore fair to say that F. Link deservesto receive unbegrudgedly proper recognition and priority as the pioneer in gravitational lensing. ❑

Brief information

- **Historic Radio Astronomy Working Group** – 2nd meeting on Wednesday all afternoon in the Chamber Room
- **Astronomia.pl** – the most popular website about astronomy in Poland. A small part in English is found at **www.astronomia.pl/english**
- **9th triennial Bioastronomy meeting** will be held in San Juan, Puerto Rico, July 16–20, 2007. The theme of the 2007 meeting is "Molecules, Microbes and Extraterrestrial Life". For further information see **http://www.ifa.hawaii.edu/UHNAI/bioast07.htm.**
- More information regarding the history of **Klementinum** (see section Private walks through Prague in No. 5) can be found in publication "**Astronomie a Klementinum**", published in Czech and English by National Library 2006, price 5 Euro, orders possible at **ivo.mirosovsky@nkp.cz.**

"It is ironic that the astrophysical object which is strangest and least familiar, the black hole, should be the one for which our theoretical picture is most complete."

Roger Penrose

"Age is a matter of mind. If you don't mind it doesn't matter."

University of Cambridge Library (after J. Bičák)

Secret diary of secret agent F.R.Og

August 22: I would never say science is so emotional. I expected a bloodshed during the lunch debate. About the planets, of course. Had to run away, otherwise I'd be forced to intervene. And then I would have to explain this to my boss. 'Sorry, but to save a nursery rhyme, feelings of common people and the peace on the Earth I had to pacify few astronomers.' Obvious, isn't it? Or is it? I thought deeply about this dilemma when an Earthling approached me and said: 'Mr. Astronomer, I'm from a TV, how many planets do you think our planetary system has?' 'Six, of course,' said I and he turned pale and disappeared in the crowd. Oh my, I didn't realize he asked about the Earthlings' system.

NOMENCLATURE FILLER

8. From Confusion to Clarity: Have you pre-registered an acronym for your large survey?

Hélène R. Dickel

The IAU WG Designations wishes particularly to encourage participation of those involved in large surveys or catalogues to ensure that their designations conform to the IAU recommendations before these acronyms become referenced (even informally). To register a new acronym for newly discovered astronomical sources of radiation go to **http://cdsweb.u-strasbg.fr/viz-bin/DicForm**

The Chandra X-ray Observatory has pre-registered the acronym CXO. Check out their Chandra-discovered source naming convention at **http://cxc.harvard.edu/cdo/scipubs.html#NAM**

To see examples of Chandra source names, consult the Interactive Dictionary of Acronyms at **http://cdsweb.u-strasbg.fr/viz-bin/Dic** and search on CXO for all source catalogs which begin with CXO. Click on a particular entry for details such as the meaning of the acronym, reference etc.

Wednesday 23/8

8 °C / 46 °F
morning minimum

22 °C /72 °F
afternoon maximum

Partly cloudy with a shower possible

NW winds 4 m/s (9 mph)

Thursday 24/8

11 °C / 52 °F
morning minimum

23 °C /73 °F
afternoon maximum

Partly sunny

SW winds 4 m/s (9 mph)

Erratum, 6th issue, page 2, Summary of S236: The caption of the figure with Itokawa model should read: "1:2000 scaled model of asteroid Itokawa, presented by M. Yoshikawa". 5th column, 1st paragraph, last sentence should be read: "Japanese spacecraft Hayabusa took two touchdowns on the surface; the first one with totally unexpected duration of thirty minutes." We apologize for this misprint.

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PRAGAE — MMVI 24. VIII. — SERIES TERTIA

Progress on SOFIA, 21 August 2006

Edwin Erichson, Sean C. Casey, Universities Space Research Association, SOFIA, USA

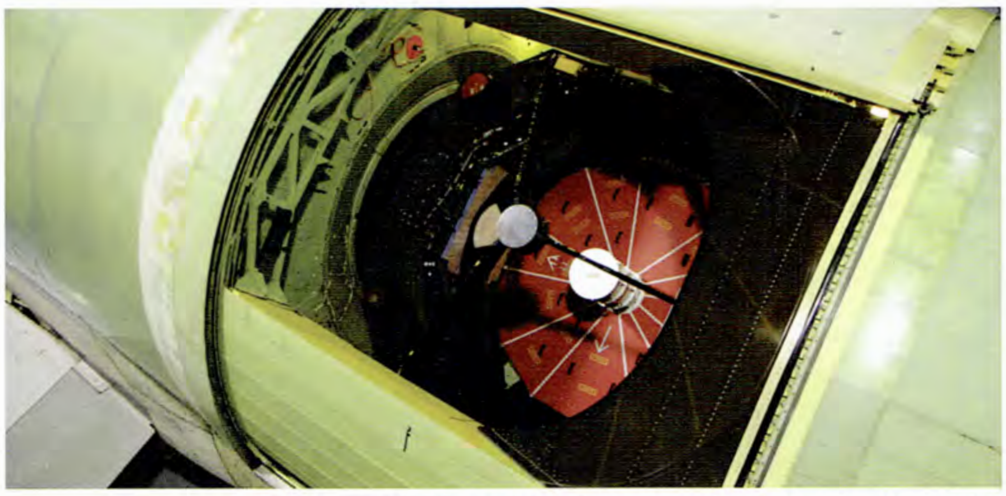
The Stratospheric Observatory for Infrared Astronomy (SOFIA) is the next generation of airborne astronomical observatories. Funded by the NASA (80 %) and the DLR (20 %), SOFIA is scheduled for science flights starting in 2009. The observatory consists of a 747SP modified to accommodate a 2.7-metre telescope with an open port design. Using state-of-the-art technologies, SOFIA will explore the emission of astronomical sources with an unprecedented level of angular resolution (θ [arcsec] = 0.1 × wavelength [μm]) and spectral line sensitivity at infrared and sub-millimetre wavelengths. A 20-year lifetime is envisioned for SOFIA with a base of operation at the NASA Ames Research Center in Mountain View, California. SOFIA will be capable of astronomical observations in both the northern and southern hemispheres.

Progress on the flight system

Since January 2006, significant schedule milestones have been reached: Aircraft structural modifications are complete. Refurbished, higher thrust engines were acquired and installed with German funding from the DLR and the Deutches SOFIA Institut. Rerouted cables to operate the tail control surfaces have been installed and limit-load tested. Functional checks of flight control systems (slats, flaps, ailerons, etc) and landing gear have been completed. The majority of flight-test instrumentation has been installed.

The Ground Vibration Test (GVT) which measures the structural response of the plane to known mechanical excitations was completed in June. Preliminary test results confirm that the modified airframe has the strength and stiffness of the unmodified B747SP. Verification of the GVT results is a critical milestone in certifying that SOFIA is safe for flight.

Minor fuel-tank leaks were corrected, leading to full-power engine run-ups and low-speed taxi demonstrations which were done on Saturday, August 19. The principal remaining tasks for the aircraft system prior to flight testing are: completion of GVT analyses and airworthiness documentation, painting of the aircraft, avionics verification, installation of safety monitoring systems, and flight readiness reviews. With sufficient funding, first closed-door flight is expected early in fiscal year 2007; the first open-door flights are expected about a year later.



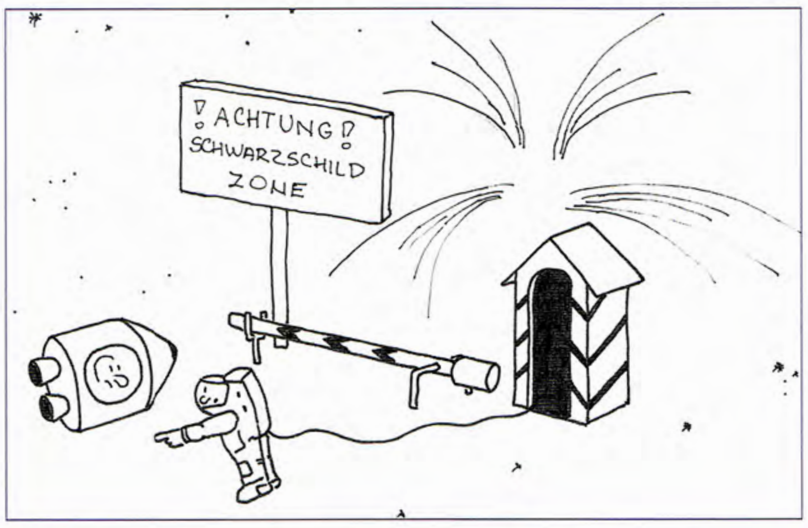
SOFIA 2.5-m telescope (with red cover) in the aircraft, February 2006.

SOFIA taxiing after full-power engine tests in Waco, Texas, August 19, 2006.

Programmatic developments

On July 6, after extensive reviews of the programme, NASA's Administrator Michael Griffin announced that SOFIA should proceed to development completion, with "... the potential for 'Great Observatory' science over its 20-year design life." His remarks are posted at **www.nasa.gov/audience/formedia/speeches/index.html**.

Please visit the SOFIA website: **www.sofia.usra.edu**. A brief programme summary for astronomers is available at **www.sofia.usra.edu/Science/SOFIA_ProgramSummary/04EricksonDustyConf.pdf** ❐



JD11: Presolar grains as astrophysical tools

Anja C. Andersen, Dark Cosmology Centre, Denmark, John L. Lattansio, Monash University, Australia

With the first discovery of surviving presolar minerals in primitive meteorites in 1987 a new kind of astronomy emerged, based on the study of stellar condensates with all the detailed methods available to modern analytical laboratories. The presolar origin of the grains is indicated by considerable isotopic ratio variations compared with Solar System materials, characteristic of nuclear processes in different types of stars.

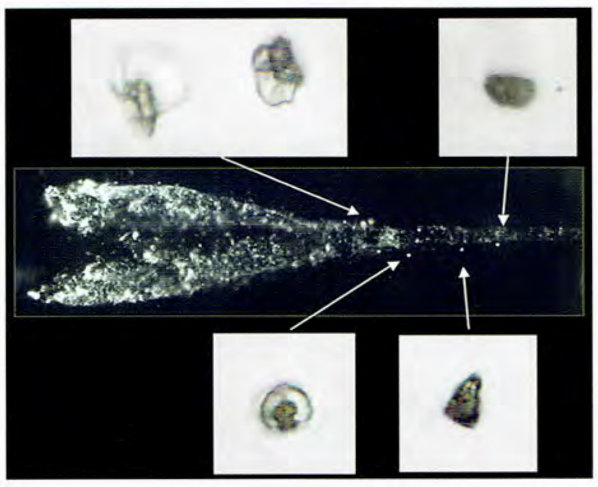
The astrophysical implications of these grains for the fields of nucleosynthesis, stellar evolution, grain condensation, and the chemical and dynamic evolution of the Galaxy has received excellent reviews from the invited speakers and eagerly discussed among the participants between the talks and during the breaks.

The full scientific exploitation of presolar grains is only made possible by the development of advanced instrumentation for chemical, isotopic, and mineralogical microanalysis of very small samples. Unique scientific information derives primarily from the high precision (in some cases < 1 %) of the measured isotopic ratios of various elements in single stardust grains. Known presolar phases include diamond, SiC, graphite, Si_3N_4, Al_2O_3, $MgAl_2O_4$, $CaAl_{12}O_{19}$, TiO_2, $Mg(Cr,Al)_2O_4$, and most recently, silicates. Subgrains of refractory carbides (e.g., TiC), and Fe-Ni metal have also been observed within individual presolar graphite grains. These grain types represent a wide range of thermal and chemical resistance. Many new breakthroughs are expected in the near future as it is now technically possible to extend isotopic laboratory studies to individual particles down to scales of < 100 nm.

The different talks illustrated that the laboratory studies of presolar grains provide crucial contributions to several important areas of astrophysics. For example, studying isotopic compositions of grains that condensed from the ejecta of dying stars provide essential boundary conditions for numerical models of stellar nucleosynthesis. The grains disclose information about nucleosynthesis sites of different elements and the relative abundance of different stellar inputs to the Galaxy (e.g. the supernova II/Ia ratio), as well as constraining the degree of mixing of material from diverse stars in the interstellar medium and the types of minerals produced by stars of different metallicity. The grains also probe the conditions of the solar nebula accretion disk during the earliest stages of Solar System formation.

The results from isotopic studies are currently those that bear strongest on other fields of astrophysics. For one, they allow us to pinpoint the grains' stellar sources among which Red Giant stars play a prominent role. In addition, given the precision of the laboratory isotopic analyses, which far exceeds whatever can be hoped for achieved in remote analyses, they have strong implications for, e. g. the need for an extra mixing process (cool bottom processing) in Red Giants and provide detailed constraints on the operation of the s-process in AGB stars. A non-standard neutron capture process ("neutron burst") may be implied by the small part of the silicon carbide grains which originate from supernovae. The progress in analytical techniques promises more important results in the near future – so stay tuned! ❐

STARDUST sample showing the recovery of grains caught by the aerogel during a space flight. The studies disclosing the fraction of presolar grains present in these samples are ongoing.



Slight changes to the wording of Resolutions 1 and 3 to make their meanings clearer:

Resolution 1:

– Replace "an inertial reference system" with "the Barycentric Celestial Reference System (BCRS)" in *Recommends 4*.
– Add a second note "The time rate of change in the dynamical form factor in P03 is $\dot{J}_2 = -0.3001 \times 10^{-9} \text{century}^{-1}$."
– Change "Japanese Maritime Safety Agency (JMSA)" to "Japan Coast Guard (JCG)" in *institutions should receive formal notification.*
– Change "Naval Astronomical Observatory of Japan" to "National Astronomical Observatory of Japan" in *institutions should receive formal notification*.

Resolution 3:

– *Recognizing 3* becomes: 3. the practical utility of an unambiguously defined coordinate time scale that has a linear relationship with TCB chosen so that at the geocenter the difference between this coordinate time scale and Terrestrial Time (TT) remains small for an extended time span.
– In the *Recommends*, "and remains close to Terrestrial Time (TT) at the geocenter for an extended time span," has been changed to: "and, at the geocenter, remains close to Terrestrial Time (TT) for an extended time span,"
– *Note 2* becomes: 2. The fixed value that this definition assigns to LB is a current estimate of $L_C + L_G - L_C \times L_G$, where L_G is given in IAU Resolution B1.9 (2000) and L_C has been determined (Irwin & Fukushima, 1999, *A&A* **348**, 642) using the JPL ephemeris DE405. When using the JPL Planetary Ephemeris DE405, the defining LB value effectively eliminates a linear drift between TDB and TT, evaluated at the geocenter. When realizing TCB using other ephemerides, the difference between TDB and TT, evaluated at the geocenter, may include some linear drift, not expected to exceed 1 ns per year.
– In *Note 3*, "at the surface of the Earth" has been changed to ", evaluated at the surface of the Earth,"

Today's programme: (thursday 24/8)

- Symposia S238, S239, S240
- General Assembly & Closing Session

Convection in the Sun

The Sun provides us with a wonderful means to observe astrophysical convection at close hand. Recent views of solar convection from the Swedish solar telescope (see Figure 1) possess unprecedented resolution, allowing us to see in incredible detail, the formation and dissipation of granules.

Shravan M. Hanasoge, Stanford University, USA

We witness convection everyday in the form of commonplace activity, like when a liquid is heated in a pan. In contrast to this sort of (laboratory) convection, astrophysical convection lies in a different parameter space, with the Reynolds and Raleigh numbers in the astrophysical case estimated at many orders of magnitude larger than in the laboratory case. In addition to this, properties of convection zones in stellar interiors are controlled by the complicated interaction between nuclear fusion in the core, the star's composition, size and age.

Structure of Solar convection zone

The solar core (extends up to 0.2 $R_\odot$, where $R_\odot$ is the solar radius) generates vast quantities of energy through the process of nuclear fusion via the p-p mechanism. Radiation acts to transport the heat flux from the edge of the solar core to 0.7 $R_\odot$. In the case of the Sun, the convection zone extends from about 0.7 $R_\odot$ to the solar photosphere. The region around 0.7 $R_\odot$ is the start of the ionization zones of many heavy elements (for example, oxygen and nitrogen), resulting in a local increase in the opacities. Radiation becomes much less effective in this region, creating convective instabilities that snowball into convection. Convection thus takes on the task of transporting energy when radiation is no longer able to do so.

Because the most abundant elements (hydrogen and helium) are completely ionized over most of the solar interior, the deep convection zone is only marginally convectively unstable. As one proceeds towards the surface, the local temperature starts falling, resulting in encounters with partially ionized species (for example, the various helium and heavier element ionization zones). The upper-most layers of the convection zone (a little below the photosphere) are highly convectively unstable because of the start of the hydrogen and helium ionization zones.

Above this region and in the atmosphere, the local density is extremely low, therefore the photosphere and atmosphere become optically thin. In this situation, not only does radiation turn into the primary mode of energy transport but layers in this region become convectively stable (because there is no longer a need to support convection). Curiously, when we see granulation, a manifestation of solar convection, we are actually witnessing upper surface convective drafts that overshoot into these convectively stable layers.

Ionization zones play a critical role in influencing the location and extent of convection zones. Atoms and molecules in the process of being ionized can cripple radiative heat transport processes by absorbing and scattering large quantities of photons. In order to maintain a thermal equilibrium in the absence of effective radiative processes, other heat transport mechanisms like conduction and convection must come into play. Conduction is inefficient (in the solar convection zone) because of the relatively long timescales, leaving convection the only viable option.

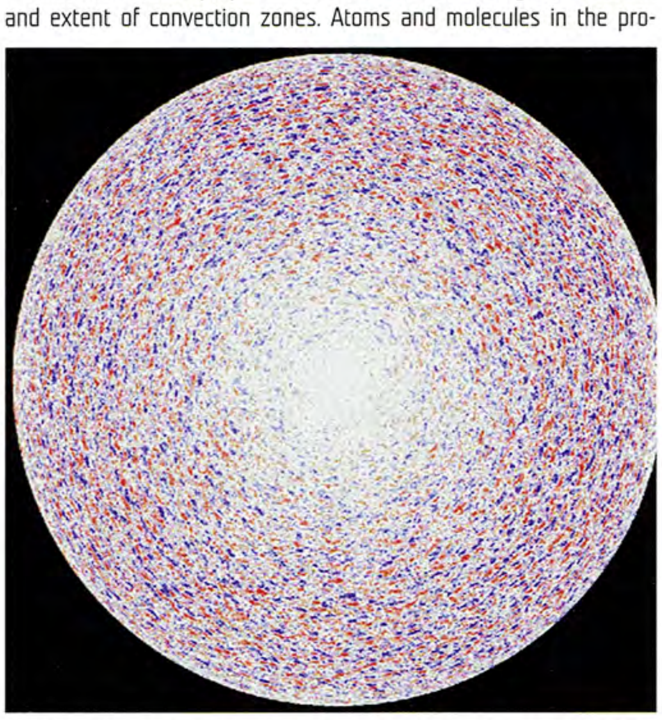


Fig. 2. Supergranules litter a de-rotated full disk image of the Sun (taken with MDI/SOHO)

The magnitude of the heat flux in need of being transported is another factor that affects the formation of convection zones. For example, the core temperature of certain massive stars is so high that the CNO cycle becomes the predominant source of energy. It is known that the energy generation in the CNO fusion cycle is extremely sensitive to temperature, varying as the sixteenth power of temperature. Consequently, the energy producing core is a very small sphere that produces an incredible amount of heat flux. At such large values of heat flux, radiation alone is unable to transport the heat flux, resulting in the layers outside the core become convectively unstable.

Fig.1. Solar granulation, taken with the Swedish telescope

Mostly supergranulation

It is well known that the solar power spectrum shows a peak at around l = 120, corresponding to a scale of approximately 30 Mm, the average size of a supergranule. It is believed that supergranulation (also mesogranulation and the much debated giant cell convection) is a manifestation of large scale coherent convective behaviour. Apart from granules at scales of 1 Mm, convective structures at two distinct scales, mesogranules at 7–10 Mm and supergranules at 30 Mm, make an appearance. Lifetimes of mesogranules are of the order of a few hours, while supergranules (see Figure 2) have lifetimes of approximately 24 hours. The uncomfortable and still unanswered (or inconclusively at best) questions of how and why meso- and supergranules appear and the governing mechanisms behind these structures are still subjects of controversy.

Why 30 Mm?

Modeling a supergranule is a Herculean task, requiring the intricate physics of radiation, ionization, turbulent convection, shock formation and dissipation, magnetic field effects etc. While it has only recently become feasible to compute the full physics of supergranulation, several researchers (Simon, Title, & Weiss; Mark Rast) have attempted to answer existential questions regarding supergranulation by performing kinematical simulations. In these simulations, numerous ‚granules', modeled by finite sized fluid mechanical constructs (like a source-sink pair), that possess a lifetime of somewhere between 5 and 10 minutes are placed at random distances from each other. By introducing specific rules such as: "Given that these granules are too close to each other, they must merge" or "If a granule decays, it is replaced by another granule at a random location" and so on, it has been observed that these "granules" start behaving in a coherent manner and larger scales emerge as a consequence of their interaction. As expected, these larger scales are sensitive to the rules that govern granule placement, decay etc. of ‚granules' and are inconclusive for the reason that they do not include the full physics.

Traveling wave convection

Supergranules seem to exhibit the interesting phenomenon of traveling wave convection. Gizon, Duvall & Schou were able to establish that supergranules have a traveling wave component with a phase speed of roughly 66 m/s, thus possessing the property of pro-grade super-rotation. Recently, Green & Kosovichev, using stability analyses, have shown that subsurface radial shear is a probable cause of the traveling wave-like behaviour.

Bob Stein and collaborators are currently involved in the task of simulating a supergranule; perhaps they will soon be able to answer the questions of how and why.

Numerical simulations surface convection

The solar near-surface layers are both physically and numerically difficult to model. The Reynolds and Raleigh numbers are very high, creating a highly multi-scale situation. Not only must radiative effects be taken into account, but the rapid drop in fluid pressure renders magnetic field effects significant. Together with difficulties in choosing appropriate boundary conditions, this multi-phenomena, multi-scale problem is very challenging. Nordlund and Stein's pioneering efforts in the area of numerical computations of solar surface convection have proved quite successful. Results (such as emergent intensity, line profiles etc.) from their calculations are practically indistinguishable from high resolution data of solar convection (see Figure 3). To a high degree of precision, they are able to recover a large number of spectral lines and splittings thereof, p mode eigenfrequencies and are able to match acoustic wave production rates. More recently, magneto-convection simulations have been performed by Stein and Nordlund, and the MPI, Lindau – University of Chicago group (MURAM).

It is curious to note that in contrast to the sun, where the Reynolds number is estimated to be of the order 10^{12}, the Reynolds number of these simulations only go up to a few thousand. The Raleigh number of the simulation is also many orders of magnitude smaller than in the Sun. This leads to the interesting question of how such excellent agreement is obtained when the parameter regimes are so different. It might point to the possibility of the lack of small scale turbulence. There are multiple reasons to explain this excellent agreement between simulations and data, and the seeming lack of small scale turbulent activity, as discussed by Spruit. One reason is the rapid decrease in density, which results in a flow expansion that subsequently 'dilutes' the effect of tightly coiled, small scale vorticity. Another reason is the extremely low gas density in the atmosphere that places a tight restriction on the stress that the solar surface can take.

Simulations of interior convection

Anelastic simulations of interior convection by Gilman and Glatzmeier; and Miesch *et al.* are another set of milestones in computations of convective activity. Note that the interior presents an entirely different set of challenges that must be dealt with appropriately: a large difference in density between the surface and the bottom of the convection zone and a wide range of length and timescales. The anelastic approximation succeeds in narrowing the range of timescales so as to allow computations of interior convection in a reasonable period of time. The simulations go up to only about 0.97 $R_\odot$, and consequently do not resolve the convective activity at the surface.

Interior convective cells possess turnover times of about a month in contrast to the timescale of 10 minutes at the surface. The estimated thermal timescales of these convective cells is of the order of 10^5 years. This presents serious numerical issues and solving the full problem with current computational abilities is not yet possible.

Interior convection is thought to play an important part in the distribution of angular momentum and the consequent differential rotation that the outer convective envelope exhibits.

Conclusions

We have gained many valuable insights into the nature of convection through close observations of the sun. As demonstrated by the work of Nordlund and Stein, the state of art in convection simulations is sophisticated enough that we are able to compare simulations with actual data and expect to get excellent agreement. Indeed, it is remarkable that we can look at a pan of heated water and say with confidence: "That's probably how the Sun works too!"

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8. Compressible convection in a rotating spherical shell, Gilman & Glatzmeier, ApJS 1981
9. Three-dimensional Spherical Simulations of Solar Convection. I. Differential Rotation and Pattern Evolution Achieved with Laminar and Turbulent States, Miesch, Elliott, Toomre, Clune, Glatzmaier, & Gilman, ApJ 2000

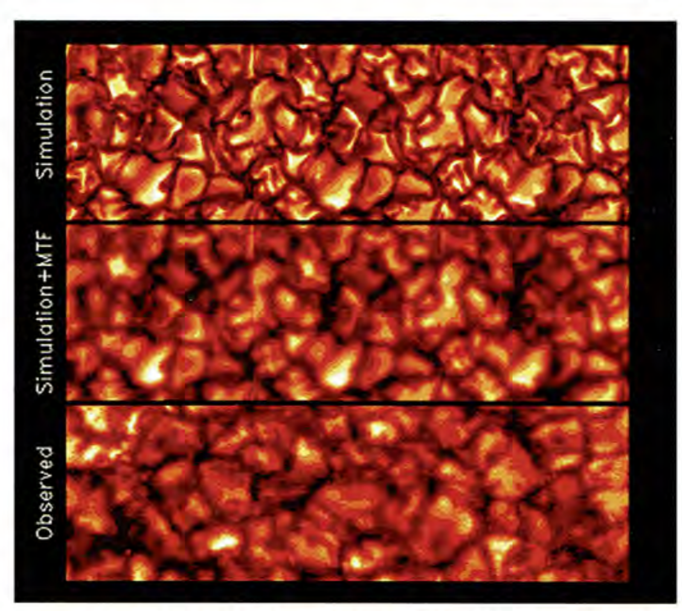
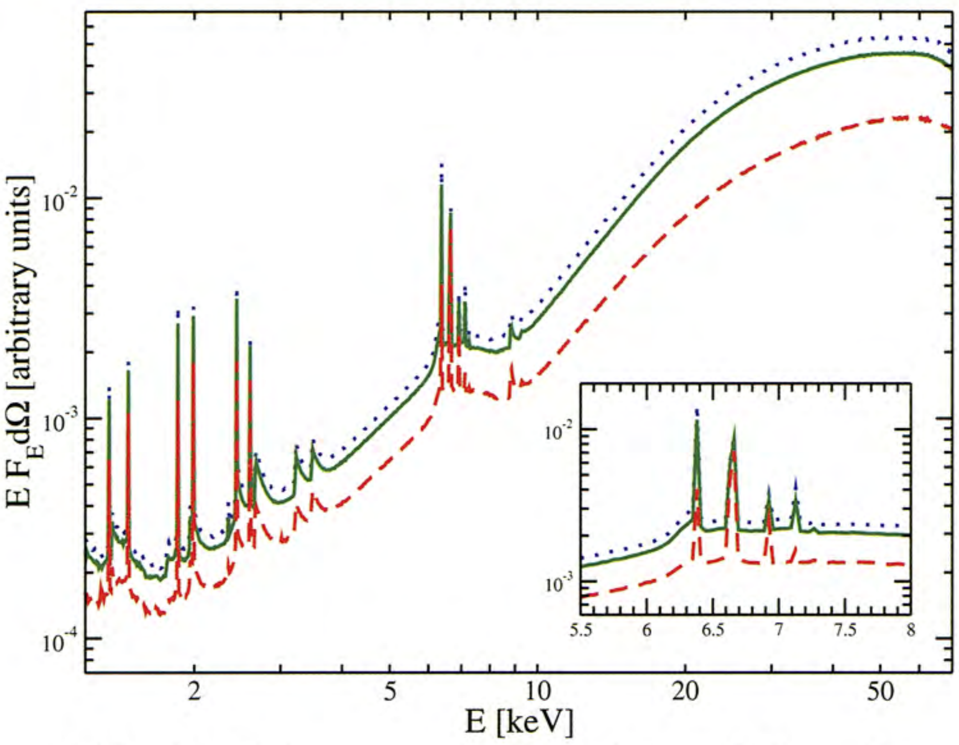


Fig. 3 Comparison of simulations with data (from simulations by Nordlund and Stein).



X-ray spectrum as computed for a spot orbiting around a rotating black hole at a distance of 18 gravitational radii. The spot arises on the disk surface following an intense irradiation by a flare. The mass of the black hole is 108 solar masses and its Eddington accretion rate is 0.001 in dimensionless units. Different curves distinguish observer's line of sight inclination: i = 13 deg (blue), i = 39 deg (green), and i = 71 deg (red). The inset enlarges the resolution near the iron K alpha line.

Weighing massive black holes with spots?

Black holes have only two parameters: masses and spins (we disregard the charge because astronomical black holes are thought to be almost neutral) so it might seem to be quite simple to characterize the black holes which reside in various objects. The reality is far more complex and the measurement of the mass and angular momentum of black holes is a hot issue.

Bożena Czerny, Michal Dovčiak, Anne-Marie Dumont, René Goosmann, Vladimír Karas, Giorgio Matt, Martine Mouchet, Agata Różańska

Various methods have been developed, aimed either for stellar-mass black holes in Galactic sources or for massive black holes in centers of galactic nuclei. However, all approaches inherit certain important assumptions that lead to systematic uncertainties, on top of the simple measurement errors. A good illustration of the issue is the vivid discussion of the ultraluminous X-ray sources: do they contain intermediate black hole masses or are they super-Eddington ~ 10 solar-mass objects? The way out is to develop independent methods and check the consistency of the results.

The existence of transient hot spots on the surface of an accretion disk offers an interesting opportunity for black-hole mass and spin measurements of massive black holes. Such spots are likely to form due to the sudden magnetic-field reconnection events in the accretion disk corona, similarly as happens in the case of the solar corona. Field reconnection generates hard X-ray emission which irradiates the disk surface and creates the hot spot. The radiation of the spot consists of the continuum emission and emission lines, in particular a strong iron line complex in the X-ray band. On their way toward an observer the line photons follow the complicated trajectories as described by general relativity, so both the mass and the black hole spin leave imprints that can be searched in the observed spectra. This kind of analysis can be performed with present-day technology.

The shape of the line detected by X-ray instruments allows us, in principle, to determine the black hole mass, the black hole spin and the inclination angle of an observer with respect to the disk surface. This basically simple idea is not so simple in practice. Usually not a single spot but rather hundreds of them coexist on the disk surface. Unfortunately, the current X-ray observations are still orders of magnitude away from the spatial resolution necessary to individually resolve separate flares. Also the locally emitted radiation is not a single monochromatic line but a whole complex of lines formed by ions at various ionization states. However, we can overcome these difficulties by addressing the time-dependent issue and by performing detailed modeling of both the local (intrinsic) emissivity of the gas and the time-dependent light propagation as described by general relativity. Such advanced models are currently under study – an example is shown in figure. The method is applicable in practice to massive black holes since it is necessary to follow the time evolution of a single flare, with the lifetime frequently shorter than the local Keplerian time close to an inner edge of the disk, ranging from milliseconds for Galactic black holes to minutes and hours for active galactic nuclei. In another article of Nuncius Sidereus III (#6), Ramesh Narayan describes a different way towards similar goals: measuring parameters of stellar-mass black holes.

Current instruments allow for just a limited applicability of the method because they still suffer from limited resolution and the actual number of photons per flare lifetime is small. Future missions with surface areas 100–200 times larger will bring spots into a full light. ❐

A search for life in the universe

Jayant V. Narlikar, Inter-University Centre for Astronomy & Astrophysics, Pune, India

While the more glamorous programme of contacting the extraterrestrials (ETs) through radio messages goes on, here is an alternative to finding if we are alone in the universe. This alternative is less ambitious but may still provide the answer sooner.

A century or so ago Arrhenius had suggested that life maybe travelling across space in microbial form, an idea that was followed up in the 1970s by Fred Hoyle and Chandra Wickramasinghe. Known as 'panspermia', these viruses and bacteria were proposed by them as being ubiquitous, occupying vast stretches of interstellar space. Some of them may travel towards the Earth, riding piggyback in frozen mantles on comets. As they approach the Sun, the comets develop tails which may sometimes brush the upper reaches of the Earth's atmosphere. These events according to Hoyle and Wickramasinghe (H&W) help transfer the microorganisms to the Earth, since they would descend to the Earth's surface eventually. Indeed H&W suggested that such input served as seeds for life on Earth: so we may all be ETs!

The panspermia hypothesis was severely criticised on the grounds that the panspermia would not survive UV, X-ray or γ-ray radiation in space. This criticism has been countered to some extent by laboratory experiments showing that the bacteria mutate and learn to survive even if subjected to radiation doses. So can we test the H&W hypothesis by direct experiment.

Such attempts are being made and in 2001, a payload attached to a balloon was sent up to a height of 41 km above the Earth's surface to collect samples of air. The National Balloon Facility at Hyderabad, India was used. The samples were brought down to Earth and analyzed by biologists. The entire process of collection and analysis was performed with the highest regard to avoiding contamination. Biological analyses by labs, one in Hyderabad, and the others in Cardiff and Sheffield, UK, showed evidence of living cells and bacteria in some of the samples. The question is where are they from?

Some bacteria show unusual resistence to UV-radiation. All are known species although there are some differences from their known terrestrial counterparts. While all this is consistent with the H&W hypothesis, can one definitely rule out that these bacteria reached 41 km height from the surface of the Earth? As of now we do not know of any process that could transport terrestrial material to such heights; even volcanic ash does not rise above 25 km.

Clearly further experimentation is needed. A second balloon flight was arranged last year the results from which are being analyzed.

This work is being supported by the Indian Space Research Organization. ❐

The COROT mission

Ian Roxburgh, University of London and LESIA, Observatoire de Paris

COROT (COnvection, ROtation and planetary Transits) is a high-precision long-duration photometry satellite mission, devoted to detecting planets around other stars and to measuring the oscillations of stars. It is led by the French Space Agency (CNES) with the participation of Austria, Belgium, Brazil, Germany, Spain, and the European Space Agency (ESA). Launch is scheduled for November this year from Baikonur.

Planets around other stars will be detected by measuring the small decrease in light from a star as a planet transits in front of the star blocking out a small fraction of the light. The science goal is to detect and characterise the properties of large terrestrial-like and more massive gaseous planets around other stars, and so advance our understanding of the formation and evolution of planetary systems.

The oscillation properties of stars will be determined from long duration measurements of the light from a star, which, when analysed by taking a power spectrum of the observed time series of the flux, will yield the oscillation frequencies and line widths of the oscillation modes. The oscillation frequencies of a star are determined by its interior structure and hence this will enable us to test and advance our understanding of stellar evolution.

There is also a guest investigator programme for the use of the seismology data for non-seismology goals, and the planet search data for objectives other than searching for planets. COROT has a 28-cm off-axis telescope with an 8 square degree field of view and CCD camera. The camera has 4 CCDs two of which, in each field of view, are devoted to measuring on the order of 12,000 stars mostly of spectral types A, F, G, K and magnitudes 11–16 to search for planets; the other two are devoted to monitoring of the order of 10 brighter stars with magnitudes in the range 5–10, of many spectral types and luminosity classes, to study their oscillation properties. COROT should yield unprecedented precision on oscillation frequencies with errors 0.1–0.3 μHz, giving the actual frequencies to a precision of 1 part in 10,000.

COROT will stay on one field of view for up to five months and observe up to six such fields. Three in the direction of the galactic centre and three in the anti-centre direction. Additionally it will spend intervals of up to one month on other fields during the change over from centre to anti-centre direction. Some of these one-month observations are open to the guest investigator programme.

It is an exciting time at the dawn of a revolution in stellar and planetary physics, and the IAU community impatient that delays in the successfull launch be resolved expeditiously. ❐

2006 Grote Reber Gold Medal Awarded to Professor B. Y. Mills – *K. I. Kellermann*

The 2006 Grote Reber Gold Medal was awarded to Professor Bernard Mills, one of the early pioneers of radio astronomy, in a special ceremony during the August 17 meeting of the Interdivisional WG on Historical Radio Astronomy. Mrs. Crys Mills received the medal on behalf of her husband who was unable to attend. Prof. Mills was honored for his innovative contributions to the development of radio telescopes and for his pioneering investigations of the radio sky which led to the first estimates of the radio galaxy luminosity function and helped to define their spatial distribution. The Grote Reber Medal was established by the Trustees of the Grote Reber Foundation to honor the achievements of Grote Reber, and is administered by the Queen Victoria Museum in Launceston, Tasmania in cooperation with the U.S. National Radio Astronomy Observatory, the University of Tasmania, and the CSIRO Australia Telescope National Facility. The medal is awarded for lifetime innovative contributions to radio astronomy. Nominations for the 2007 Medal may be sent to Martin George, Queen Victoria Museum, Wellington St, Launceston, Tasmania 7250, Australia or by e-mail to: **martin@qvmag.tas.gov.au** to be received no later than Nov. 15, 2006. ❐

From the hill of Galileo to the borders of the Universe: The International Year of Astronomy

Franco Pacini, IAU President (2000–2003)

The first astronomical observations were made by Galileo around the end of 1609: with his small telescopes (now conserved in the Museum of History of Science in Florence) he was able to show that the Moon is covered with mountains, craters, plains. A few weeks later, early in 1610, he saw that Venus had phases like the Moon; Jupiter was surrounded by four little "stars", its satellites; Saturn had "ears"; the Milky Way was composed of a multitude of weak stars.

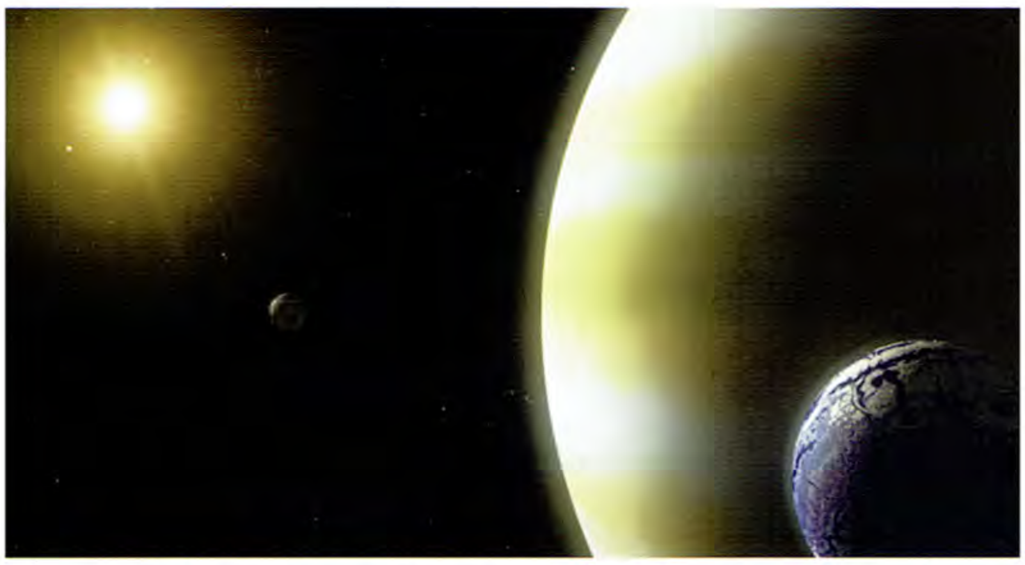
Galileo's observations demonstrated that the Earth is not the only world in the Universe. The importance of this discovery in the history of human civilization is probably without comparison because of its implications for science, philosophy and religion. His findings were condemned by the Church and Galileo was confined in exile in a country house where he spent the last eleven years of his life (1631–1642). This house, named "Il Gioiello" (The Jewel) is located very close to the Arcetri Observatory, in the

outskirts of Florence and it has been recently restored. It has also been proposed that, next to this house of Galileo and to the Arcetri Observatory, a neighbouring castle be transformed into an interactive Science Center devoted to contemporary astronomy. These realizations on the Arcetri hill would form a sort of "City of Galileo" and a tribute to this great scientist.

Galileo also advocated the need for scientists to communicate their discoveries in a way which everybody can understand, in practice by using the Italian language and not Latin. We can almost say that he was an early supporter of the need of scientific communication.

Three years ago, in Sydney, the General Assembly of IAU voted a resolution requesting that UNESCO and the United Nations declare 2009 The Year of Astronomy. On behalf of IAU, the Italian Government put this request on the floor of the UNESCO Assembly where this initiative was unanimously endorsed in October 2005. As a next step the Year of Astronomy will be discussed by the U.N. General Assembly later this year and, hopefully, approved.

Some years ago, in a document of the US National Academy of Sciences, there was a statement comparing the development of astronomy in the 20^{th} century with the discoveries which occurred at the time of Galileo. The Year of Astronomy should be an ideal occasion to communicate to the general public the beauty and the importance of contemporary astronomy, and show how our science has been a fundamental component of the various civilizations which developed in all parts of the world.



Left: *Illustration courtesy of NASA/JPL*

Extrasolar giant planets and brown dwarfs (as seen from Arizona)

Extrasolar Giant Planets (EGP) and Brown Dwarfs, often commonly referred to as Sub-stellar Mass Objects, are among the most fascinating topics in present-day astronomy.

Ivan Hubeny, University of Arizona

Although people have suspected for centuries (for instance, Giordano Bruno in the 16^{th} century) that extrasolar planets should exist and it seemed quite natural that less massive and less luminous objects than late M dwarfs may exist, mankind had to wait till 1995 when the first bona fide discoveries of both those classes of objects were announced. Interestingly enough, both discoveries (51 Peg b for planets, and Gliese 229b for brown dwarfs) were announced on the very same day! Today, there are about 200 extrasolar planets and over 100 brown dwarfs discovered and confirmed, and this number will certainly grow rapidly in the coming years.

Soon after these discoveries, several groups around the world initiated an effort to model these objects in order to understand their physical and chemical nature. While with brown dwarfs the spectra were taken already in the initial years, there seemed to be little hope to observe spectra of EGPs any time soon, essentially because it is very hard to achieve a sufficient instrumental sensitivity to extract light from the planet in the glare of the central star. Nevertheless, already in 2000 the first planetary transit (of the now famous planet HD 209458b) was observed, and since the transit depth was found to be somewhat different in and out of the Na I D lines, this in fact gave the first "spectrophotometric" information about an EGP atmosphere. And, in 2005, another milestone was reached when by observing secondary eclipse spectra of two EGPs, HD 209458b and TR-ES-1 and subtracting them from the out-of-eclipse spectra, one in fact could obtain the first true spectroscopic information about these objects.

Our group in Arizona has embarked on a systematic effort of modeling atmospheres of EGP's and brown dwarfs (which in fact are the same objects from a physical point of view; they differ only by their origin, and by the fact that planets must, by definition, be in the vicinity of a star, and are thus irradiated by it). Since I joined the group in 2002, we have modified my stellar atmosphere computer program TLUSTY designed originally for much hotter stars, and combined it with an extensive package of state equation solver in the presence of molecules and condensates, and molecular opacities that were being developed for several years at the University of Arizona.

There were many numerical challenges: an efficient and stable treatment of convection, effects of strong irradiation, a necessity of treating various cloud species, with a self-consistent cloud position and particle sizes, and an interplay between clouds and convection (which on Earth sometimes leads to hail, tornadoes, and other violent phenomena, so it is not surprising that this is numerically challenging under much more extreme conditions, even with various simplifications).

A public release of the secondary eclipse observations for both systems was scheduled on March 24, 2005.

Our group obtained preprints of both articles a few days before the release, so we took our models computed for the known basic parameters of the system (radii of the parent stars and planets, stellar spectral types, and the planet-star distances; we did not do any specific fitting, or tweaking the parameters), and prepared a short paper to ApJ letters to show the theoretical analysis of these data. We planned to submit it also on March 24, but when the date was approaching we were not sure whether we should hurry and submit it, or wait a few more days and submit it a bit later. But we finally decided to work faster, and submitted it indeed on 24^{th}. This proved to be a good decision, because the following day we found out that a competing group in NASA Ames had also submitted a paper on 24^{th}! It illustrates that this is indeed quite an active field.

Recently, we submitted another paper dealing with predicted spectra of other transiting planets which were already observed, but data were not reduced yet, so we made predictions about how the spectra should look, and now we are waiting with trepidation to see how they will actually look. However, the agreement between the observations and theory for the 2005 eclipses were already surprisingly good, taking into account an early age of the field, and all the uncertainties in the theoretical description. This indicates that the young field of modeling EGP and brown dwarf atmospheres is on the right track, and has a bright and exciting future ahead. And, from the personal point of view, it is now a good time to be a theorist, because unlike in the mature field of stellar spectroscopy where the theory is still hopelessly behind observations, we are ahead, and our predictions are appreciated even by observers who may use them to better design future observations. ❐

JD16: Nomenclature, precession and new models in Fundamental Astronomy – applications and scientific contribution to astronomy

N. Capitaine, J. Hilton, J. Vondrák

This Joint Discussion covered both concluded works and prospects for the future.

The main purpose was to discuss recent and future IAU resolutions on reference systems. The International Celestial Reference Frame (ICRF) and its realization, the International Celestial Reference System (ICRS), were adopted by the IAU at its 23^{rd} General Assembly in 1997. At the 24^{th} IAU GA in 2000, a number of additional Resolutions were passed concerning the definition of the celestial and terrestrial reference systems and transformations between them. These resolutions contain several new concepts. Implementation of these resolutions requires a consistent and well defined terminology that is recognized and adopted by the astronomical community. Working Group for Nomenclature for Fundamental Astronomy was to make related educational efforts for addressing the issue to the larger community of scientists. Two Resolutions on new terminology and an improved definition of Barycentric Dynamical Time (Resolutions 2 and 3) submitted to the IAU 2006 General Assembly were discussed.

Discussion of the IAU 2000A precession-nutation at the 25^{th} IAU GA in 2003, revealed a requirement for a new precession model that was both dynamically consistent and consistent with the IAU 2000A nutation model and an improved definition for the ecliptic. The Division 1 Working Group on Precession and the Ecliptic was created to address these requirements. This WG has selected a new, high-accuracy precession model to replace the IAU 2000 precession. A proposal to adopt this precession model has been submitted to the IAU 2006 GA (Resolution 1). This resolution has been presented and discussed along with proposals for next generation models.

Other improvements in astrometric models and catalogues were discussed. Effects such as Earth rotation, nutation, light deflection, and relativistic transformations, with potential for various scientific applications were presented, emphazing the recent progress in observations (Earth dynamics, spacecraft observations and planetary ephemerides, time synchronization and navigation in deep space). Presentations about future space astrometric missions, like GAIA and SIM, were also discussed.

The complete program including the list of posters is available on the JD16 web page at **syrte.obspm.fr/iauJD16/** ❐

Galaxies win!

If, at some moment, you are feeling strong enough to lift your abstract book, please open it and notice that, by a wide margin, S235 on galaxy evolution, attracted the largest number of submissions (477). Star formation (S237) was second with 249 abstracts, third binary star (S240) with 220, and black holes (S238) fourth with 181.

Very possibly, more events on galaxies, large scale structure, and cosmology should have been scheduled. Your Division Presidents, who recommended the current program will pass on this small discovery to their successors, who will recommend Symposia and Joint Discussion for 2009.

Your job, of course, is to put forward proposals for exciting JDs and Symposia programs. Indeed if your favorite topic is not on the program here, it may be because there were no proposals.

Virginia Trimble,
Outgoing President of Division XII

United Nations and the International Heliophysical Year

The organizers of the Heliophysical Year (IHY) and the United Nations Committee on the Peaceful Use of Outer Space (UNCOPUOS) have joined hands to promote heliophysical science activities throughout the world by deploying scientific instruments in the developing countries.

Nat Gopalswamy, International Coordinator, IHY, NASA's Goddard Space Flight Center, USA

The IHY 2007 program is an international collaborative effort to understand the external drivers of planetary environments in the solar system. This will be a major international event of great interest to all the nations in the world. The IHY 2007 will coincide with the fiftieth anniversary of the International Geophysical Year (IGY) held during 1957–1958. IGY produced an unprecedented level of understanding of Earth's Space Environment, and witnessed the start of the Space Age with the birth of the discipline of Space Science. For the first time, it became possible to study the cosmos with *in situ* observations. IHY is the logical step to expand our focus to include the heliosphere in which Earth and Sun have a central place. During IGY 1957, humans were sticking their heads above Earth's atmosphere; during IHY 2007 they will stick their thumb into the local interstellar medium. This is indeed true because the Voyager 1 spacecraft recently crossed the termination shock enclosing the solar system and is getting ready to venture into the local interstellar medium. The ultimate objective of IHY is to set up collaboration that utilize ground and space based assets to further the science achievements in all heliophysical disciplines: solar physics, polar physics, geophysics, space physics, and heliospheric physics with a strong emphasis on cross-disciplinary science.

One might wonder what is "Heliophysics". This is a new word coined to broaden the concept "geophysics," extending the connections from the Earth to the Sun and interplanetary space. It represents the universal physical processes within the heliosphere. Remember, the only thing we knew about space was the ionosphere before IGY. One of the first major achievements of the space age was the discovery of Earth's magnetosphere by James Van Allen using the Explorer 1 mission. Van Allen witnessed the rapid expansion and maturity of the space exploration and passed away the week before this IAU General Assembly at the age of 91. The discovery of the ubiquitous solar wind by Gene Parker in 1958 led to the concept of the heliosphere as a region pervaded by the solar wind. The subsequent discovery of coronal mass ejections (CMEs) by NASA's OSO-7 in 1971 demonstrated that the changes on the Sun have serious consequences throughout the heliosphere.

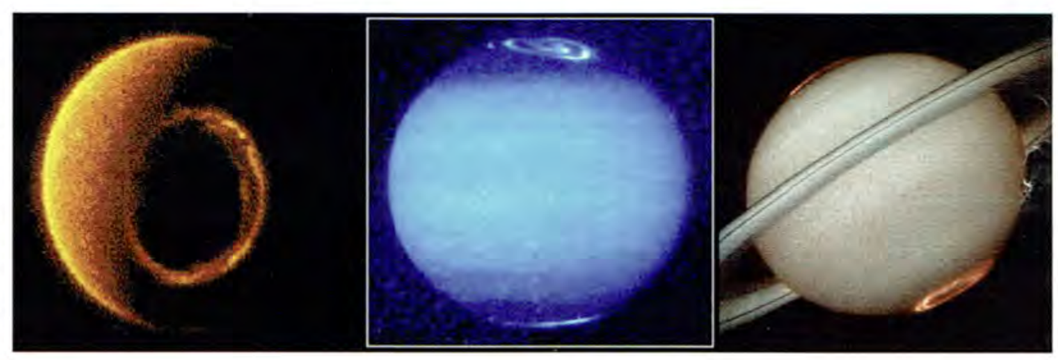
The IHY-UN joint venture is known as the United Nations Basic Space Sciences (UNBSS) initiative. Under this program, scientists from developed countries or those who are willing and able, donate instruments to study heliophysical processes to developing countries. These instruments will be used for scientific research and for university level education for young people from developing counties. These deployments will serve as nuclei for a sustained development of scientific activities in the host countries.

The UNBSS program is one of the four key elements of IHY: Science (coordinated investigation programs or CIPs conducted as campaigns to investigate specific scientific questions), Instrument development (the IHY/UNBSS program), Public Outreach (to communicate the beauty, relevance and significance of space science to the general public and students), and the IGY Gold program (to identify and honor all those scientists who worked for the IGY program).

The UNBSS is not new to the astronomy community. This program is in existence since 1991 and facilitated deployment of telescopes for astronomical research and education in developing countries. Since 2005, this program has focused on deployment of instruments suitable for heliophysical studies. Currently, about a dozen instrument concepts have been approved. Deployment of radio telescopes has started at three locations in the world to continuously monitor radio bursts from the Sun related to CMEs. H-alpha flare monitor telescopes will also monitor mass motions, waves, and visible emissions related to CMEs. Chains of magnetometers will be deployed in Africa to augment the existing chains in the developed world to study the dynamics of geospace plasma changes during magnetic storms and auroral substorms as a response to various solar wind changes. Instrument networks are being established in Africa that will monitor ionospheric disturbances; other plans include mapping of the ionosphere above Africa using inexpensive GPS receivers. In addition to these Sun-Earth connection experiments, an international space weather network is being planned, which will utilize the connection between the solar system and our Galaxy via cosmic rays. Ground-based instruments to detect secondary particles (neutrons, muons) from galactic cosmic rays reaching Earth's atmosphere and can identify the passage of CMEs at Earth by monitoring the intensity of these secondary particles.

The IHY/UNBSS program is also linked to the other elements of IHY: the instrument networks will participate in the CIP campaigns, thus contributing to the global science. It is also related to the outreach program because students get trained in operating and using the instruments. Another element of the outreach program are the IHY schools on universal physical processes in the heliosphere. Host scientists and their students will be invited to attend these IHY schools, so that they can be exposed to the broader aspects of heliophysics.

The IHY/UNBSS program is a unique opportunity for enhanced international collaboration in understanding the external processes that affect Earth's environment and human society. With the availability of electronic communication and data transfer, it is a lot simpler to coordinate observations from space and ground than it was possible in 1957. The IHY/UNBSS program can enhance the investigations of instrument donors by providing additional data from remote locations. Observations from these instruments will be used not only by the instrument provider but also by the host, thus enhancing the science return. Involvement of students will build the next generation scientists and explorers and draw them from the extended global pool. ❑



One of the best examples of universal heliophysical process: planetary aurora, physical processes in vastly different environments: Aurora from Earth (left), Jupiter (middle) and Saturn (right). IHY will study universal processes in the solar system such as this (image credit: NASA).

Visualization of the black hole spacetimes

Pavel Bakala, Stanislav Hledík, Zdeněk Stuchlík, Silesian University, Opava, Czech Rep.

Black hole as a gravitational lens: two images of Saturn seen by a static observer.

Dramatic optical effects appear in the vicinity of black holes. Computer visualization of these effects is still a challenge. We have developed a new computer code solving this "virtual astronomy" task: What would be the view of the Universe for observers near a black hole or a compact star? Optics in strongly curved spacetimes is markedly different from the flat spacetime optics such as we experience it in our everyday life. By using a general relativistic description of propagation of light, our code displays distortions of the optical projection, multiple images of objects in the distant universe, Einstein rings, the change of color caused by gravitational frequency shift, location of circular photon orbits, and other characteristics of strong gravity.

The recent cosmological observations indicate accelerated expansion of universe caused by dark energy which acts as an effective cosmological constant. This can be described by the Schwarzschild–de Sitter spacetime, and we employed this spacetime in our computations. We investigated the dependence of the optical projection on the value of the repulsive cosmological constant. The black hole can be observed as a black region on the observer sky. The ray-tracing core of the code can be used for modelling other optical effects in strong gravity: light-curves, power spectra and spectral line profiles of the radiation of rotating neutron stars with hot spots on the surface.

Computer-distorted image of the galaxy M104 'Sombrero' lying behind the black hole as seen by a radially falling observer at a distance of 10 gravitational radii from the black hole horizon.

Description of the code and examples can be found in Proceedings of the recent Workshop on Black Holes and Neutron Stars (Opava 2005), available also in NASA/ADS Abstract Service. ❑

Deceased members of the Union

The IAU General Secretary regrets to report the following names of Individual Members of the IAU whose death has been communicated to the IAU Secretariat since the General Assembly in Sydney in July 2003.

Oddbjørn Engvold, IAU General Secretary

John G. Ables, Tateos A. Agekjan, Ko Aizu, Lawrence Hugh Aller, Gennadij V. Andreev, Horace W. Babcock, John N. Bahcall, James Gilbert Baker, Norman H. Baker, Vassilios Barbanis, Arvind Bhatnagar, Richard G. Bingham, J. G. Bolton, Hermann Bondi, Semion Ya Ag Braude, Nina M. Bronnikova, Anton Bruzek, William Buscombe, Bruno Caccin, Alastair G. W. Cameron, Henri Camichel, John H. Carver, Vittorio Castellani, Joseph W. Chamberlain, Nikolaj S. Chernykh, Yves Chmielewski, Rafael Cid Palacios, G. Colombo, Alan H. Cook, Pierre Cugnon, N. Dallaporta, Leverett Davis Jr, John Alan Dawe, Willem de Graaff, T. de Groot, Juan J. de Orus, Chr. de Vegt, Aleksandr N. Deutsch, Lorant Dezso, Jerzy Dobrzycki, Geoffrey G. Douglass, Robert A. Duncan, Richard B. Dunn, Nikolai Dzubenko, Hans Elsaesser, Donald J. Faulkner, Walter A. Feibelman, Michel C. Festou, Mikhail S. Frolov, Igor A. Gerasimov, Daniel Gerbal, Robert Glebocki, Nüzhet Gokdogan, Thomas Gold, Friedrich Gondolatsch, Shumo Gong, S. I. Gopasyuk, Vitalij G. Gorbatsky, Fumihiko Hagio, Anton Hajduk, R. Glenn Hall, Emilios Harlaftis, Gerald S. Hawkins, Wulff D. Heintz, Helmut Wilhelm Hellwig, Hartmut Holweger, Reiun Hoshi, Charles Latif Hyder, George R. Isaak, Theodor S. Jacobsen, Tadeusz Jarzebowski, Mihkel Joeveer, Zdenka Kadla-Mikhailova, Henry Emil Kandrup, Boris L. Kashscheev, Sidney Kenderdine, Vera L. Khokhlova, Michael J. Klein, I. G. Kolchinskij, N. S. Komarov, Vladimir A. Kotelnikov, John D. Kraus, L. Kresák, Petr G. Kulikovskij, Barry James LaBonte, Trudpert Lederle, Michael James Ledlow, Vojtěch Letfus, Jacques R. Levy, J. Virginia Lincoln, Alexander M. Lozinskij, Per E. Maltby, Gyorgy Marx, Janet Akyz Mattei, Cornell H. Mayer, Paul J. Melchior, Marie-Odile Mennessier, Klaus Metz, Rolf Mewe, Harry C. Minnet, Ljubisa A. Mitic, Vasilij I. Moroz, Philip Morrison, Mirta B. Mosconi, Andreas B. Muller, C. A. Muller Jr., Sergij Musatenko, Saken O. Obashev, Franco Occhionero, J. Beverley Oke, Mikhail Orlov, J. Oro, Ludwig F. Oster, Lucia Padrielli, John L. Perdrix, Charles L. Perry, Alain Peton, Jack H. Res. Fel. Piddington, A. Keith Pierce, Girolamo Pinto, John Polygiannakis, Jason G. Porter, John M. Porter, Neil A. Porter, Kevin H. Prendergast, Helen Dodson Prince, Yurij P. Pskovskij, Tamara B. Pyatunina, Gibson Reaves, James Ring, Ralph Robert Robbins, Brian J. Robinson, Marcello Rodono, Douglas H. Sampson, Hans Schmidt, Egon H. Schroeter, William M. Sinton, Akira M. Sinzi, George M. Sisson, Humphry Montague Smith, Mattheus A. J. Snijders, Gunnar Sorensen, Arnold A. Stepanian, Gerard A. Stevens, Jürgen D. Stock, Ronald Cecil Stone, Aleksandr A. Stotskii, Winardi Sutantyo, Peter A. Sweet, J. T. I. Tavares, Volodymyr Telnyuk-Adamchuk, Dirk Ter Haar, Richard Q. Twiss, Anne B. Underhill, Seppo I. Urpo, J. van Nieuwkoop, Paul Verbeek, Franco Verniani, Jean-Pierre Vigier, Yurij I. Vitinskij, Richard L. Walker Jr., Dennis Walsh, Willem Wamsteker, Lai Wan, James A. Westphal, Fred L. Whipple, Raymond E. White, John R. Winckler, Kiyoshi Yabuuti, Boris F. Yudin, Shigeru Yumi, D. Zulevic.

Interview with Jocelyn Bell Burnell: A Woman and pulsars

Jana Olivová

It can be said, I think, that your discovery of pulsars has changed astronomy. How has the discovery influenced your own scientific career?

It made it possible for me to have a scientific career. At the stage when I was a young woman, it was expected that women stopped work when they got married. And they certainly stopped work when they had children. And so women did not have careers unless they stayed single. I wanted both to have a family life and the career. And it was quite difficult, but I judged that if I had not had the discovery of pulsars as a young woman, I would not have been able to continue and I would not be here in Prague today.

Has the situation changed for women since that time?

Yes. I think it has changed since then. I see in Britain my generation as being at the turning point, the change-time, because women older than I did not expect to have careers, women younger than I do expect to have careers, and it has been my generation that has brought about that change. That has been at the cutting edge. So some things have changed but I think not enough and not fast enough yet.

Since the discovery of pulsars you have worked in many fields of astronomy. Which of them did you find the most exciting?

I have been very fortunate. I have had to change field many, many times because my husband moved for his job many, many times. And each time he moved I moved as well and nearly always to a different branch of astronomy. So I worked in gamma ray astronomy, X-ray astronomy, infrared astronomy, millimetre astronomy, and radio astronomy. I moved to X-ray astronomy just as the subject was booming and I worked on a very exciting satellite. I moved to infrared astronomy just as the subject took off, I was in at the beginning of millimetre wave astronomy. So I have had a lot of excitement. My moves in some ways have been very well timed.

You have discovered pulsars while doing research into quasars. Now you are focusing on microquasars. Do you expect you can make such a surprising discovery again?

No, I do not think one should be expected to make two discoveries of that magnitude in a life-time. Many people do not even make one. And that has perhaps been one of the downsides of making a discovery like that so early in your career because people then say: OK, what next? And it is very hard to follow that.

So does the Universe still keep some surprises for you?

Yes, many surprises. And surprisingly, the field of pulsars still has many, many surprises. It is perhaps even more exciting and more active than it has ever been in the past. And that I do find surprising, because it is 40 years! And after forty years you might expect the subject to be settling down, to be interesting, but to be mature. Pulsars – whoops! Excitement! Surprise! Innovation! It never stops!

What exactly are those surprises that the pulsars still hold for you?

Well, some of the most exciting results they have recently discovered are a double pulsar, a binary system where both stars are pulsars. Very fortunately this binary system is almost edge-on, the orbital plane is close to the line of sight. So we are seeing forms of eclipse as the two pulsars orbit each other. And that is very interesting. They are discovering a number of transient objects, some of which seem to be pulsars, but pulsars which only give one pulse every ten, every twenty, every fifteen periods – and the spacing between the pulses is different each time. And it looks as if there are a lot of those as well. So at a stroke we have doubled the pulsar population in the galaxy. There are interesting results on the masses of neutron stars coming in, we are finding some neutron stars that are much lighter, less massive, than we had previously found – and also some that are heavier. These high-mass and low-mass neutron stars will really stretch our understanding of what the neutron stars equation of state is, what it is made of, how it is structured. So many, many fascinating results are still coming in.

Scientific work also brings disappointments. What was the greatest disappointment you suffered in your career?

I cannot think of a single one, but certainly I found it quite frustrating that I kept having to change field as my husband moved for his job. And the way I would get jobs was to write a begging letter to an institution in the area where we were going to live. And then you have got the kind of job that you get when you write a begging letter. I became much more powerful when I was able to apply for jobs because of WHAT they were, not WHERE they were. So being a woman with responsibilities for a family has been frustrating. I think that is perhaps the main negative that I remember in my life.

Have those frequent changes in your field of research brought you more positive, or more negative experiences?

It brought many positive things. It means I have experience of all these different kinds of astronomy. So at meetings like this one I can go and attend talks on a whole range of topics and have some background. So that is really good. It also means I have ex-colleagues all across the spectrum, all around the country. The downside is that each time you change your field of research you have to learn the new field. And of course this affects your publication rate, your output. So there were positives and negatives. And I think it is hard to choose which is dominant; there are both there in my life.

I think that every person has his or her wishes for what he or she would like to achieve. What is your greatest wish in your profession?

Well, I am now officially retired, and so the time for wishes is past. I am very much enjoying this phase of life, I have a visiting position at Oxford University which is very lively, very dynamic group, and I am enjoying having the freedom to work on what I choose, to accept invitations to lecture, if I choose – or not if I do not. So I am very satisfied with life as it is. ❐

SPS5: Astronomy for the developing world

Proposal to establish a Third-world Astronomy Institute comes nearer to reality

John Hearnshaw, University of Canterbury, New Zealand

Special session 5 took place on Monday and Tuesday and covered all aspects of astronomy in developing countries. There were 16 invited talks, 25 contributed oral talks and about 20 posters. The presenters came from 37 different countries, and many of these were from developing countries. What is more, 280 people registered their interest in participating in the session, and these came from 61 countries, which represents an impressive global participation and world-wide interest in developing astronomy in many countries which are just entering into education and research programs in astronomy.

A highlight of the first session on Monday was the first invited talk by Jayant Narlikar (India), when he outlined his dreams of establishing a Third-world Astronomy Institute or Network (TWAI or TWAN). This would be an institute modelled on the International Centre for Theoretical Physics in Trieste and a place where astronomers from developing countries could go on short visits and enjoy world-class facilities for astronomy research, education and conferences. This goal appears to have come a step closer with the agreement to establish such an international centre at IUCAA (the Inter-University Centre for Astronomy and Astrophysics in Pune, India), with the support of the director of ICTP in Trieste. The support of the IAU for this initiative from the incoming president, Catherine Cesarsky, was warmly received. SPS5 had talks from astronomers in all the major regions of the developing world, including Latin America, the Far East, central Asia, Africa, and eastern Europe. It was impressive how many positive accounts of new programs in teaching and research were presented.

One theme was the relation between IAU Commission 46 (Astronomy teaching and development) and other agencies such as the UN Office for Outer Space Affairs, COSPAR, the program for the International Heliophysical Year 2007 and the Japanese ODA program (which donates small telescopes to developing countries). All these collaborative programs were discussed at the session, and hopefully a high degree of co-ordination between these programs will ensue.

Other international projects such as ADS and various Virtual Observatory projects in developing countries will have a major impact on astronomy in developing countries in the near future. In fact their influence is already having a big impact.

Although many astronomers in developing countries still struggle to do research and obtain financial support for facilities and international conference travel, the impression left from SPS5 is that much progress is being made. Commission 46 is reaching out to help many astronomers across the globe; a real difference is being made, and there is a feeling amongst many astronomers from developing countries that they are now part of a world-wide global community.

It is to be hoped that these trends can continue. ❐

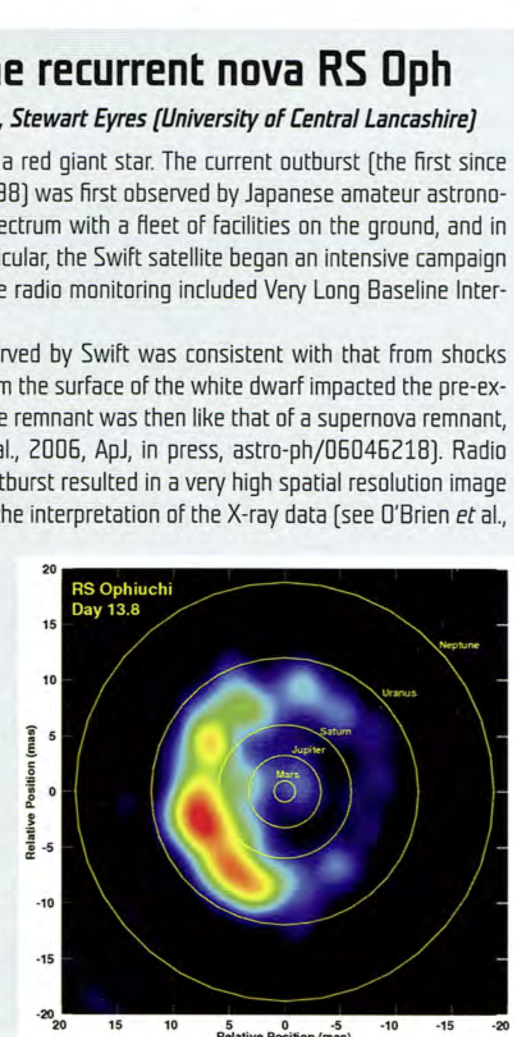
The 2006 outburst of the recurrent nova RS Oph

Mike Bode (Liverpool John Moores University), Stewart Eyres (University of Central Lancashire)

RS Oph comprises a white dwarf in orbit with a red giant star. The current outburst (the first since 1985, but at least the sixth recorded since 1898) was first observed by Japanese amateur astronomers on Feb 12th. Observations across the spectrum with a fleet of facilities on the ground, and in space, were initiated within a few days. In particular, the Swift satellite began an intensive campaign of X-ray and UV-optical observations. Extensive radio monitoring included Very Long Baseline Interferometry with both the VLBA and EVN.

In the first month, the X-ray emission observed by Swift was consistent with that from shocks arising as the high velocity material ejected from the surface of the white dwarf impacted the pre-existing wind of the red giant. The evolution of the remnant was then like that of a supernova remnant, but evolving extremely rapidly (see Bode *et* al., 2006, ApJ, in press, astro-ph/06046218). Radio interferometry taken only 14 days after the outburst resulted in a very high spatial resolution image of the expanding shock wave, consistent with the interpretation of the X-ray data (see O'Brien *et* al., Nature, **422**, 279 and attached illustration).

Around a month after outburst, the nature of the X-ray emission changed radically, with a new soft X-ray source dominating the spectrum. This new emission most likely originates from the revealing of the nuclear burning source on the white dwarf surface. It had been proposed that the white dwarf in this system is very near the Chandrasekhar mass above which it would undergo a supernova explosion. One of the major questions that is still to be answered is whether or not mass is gradually being added to the white dwarf so that it is moving inevitably towards this limit. Continuing analysis of these observations will help to answer this very important question. In June 2007, a conference dedicated to this remarkable object will be held at the University of Keele, UK. ❐



VLBA image of RS Ophiuchi taken at 6 cm 13.8 days after outburst showing non-thermal emission associated with shocks moving through the red giant wind. RS Oph lies at a distance of 1600 pc. Superimposed are the sizes of the orbits of the outer planets of our Solar System at this distance to give the impression of the spatial scales being probed by these observations.

Future asteroid impact threats

The current highly successful Spaceguard Survey of Near Earth Asteroids (NEAs) will soon be supplemented by new, more powerful surveys. While the probabilities for an impact in the next four decades remain low, many of the newly discovered asteroids may appear, for a time, to pose a significant threat of impact. Astronomers thus face two challenges. In addition to the technical problem of calculating the many asteroid orbits, we also need to develop better ways of communicating the impact risk to the public.

David Morrison, NASA Astrobiology Institute

Today the Spaceguard Survey is seeking to find 90 % of the Near Earth Asteroids with diameters greater than 1 km by the end of 2008. Asteroids larger than 1 km pose the greatest threat because an impact this large affects the entire planet, not just the country where the impact takes place. There are approximately 1,100 NEAs this large, and Spaceguard has found approximately 800 of them to date. Such surveys should allow any impact threats to be identified decades in advance, enough time for mitigation strategies.

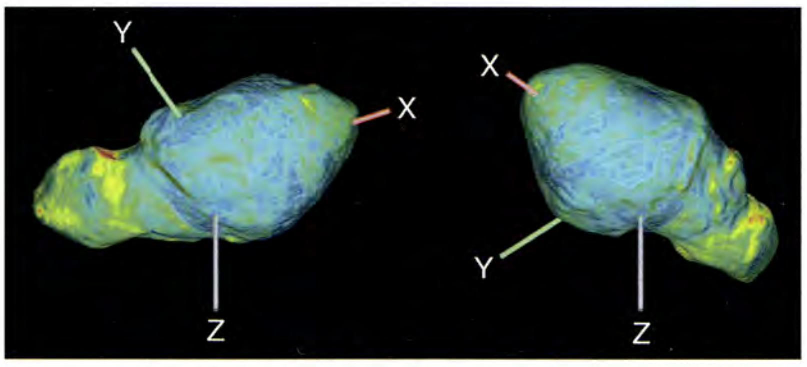
In the United States, there is increasing interest in extending the Spaceguard Survey to smaller asteroids, which hit Earth more frequently. Several committees of the U.S. National Academy of Science have recommended construction of large search telescopes to extend the completeness limit to 300 m NEAs. Most recently, the U.S. Congress has given NASA increased responsibility for dealing with potentially hazardous NEAs and has asked for a plan for a Spaceguard Deep Survey down to 140 m diameter. NASA's response is expected to consider both space-based and ground-based searches. The congressional mandate is to find 90 % of these sub-km NEAs by 2020.

The shift from emphasis on the NEAs larger than 1 km to the sub-km NEAs will have important implications. The number of NEAs larger than 140 m is approximately 100,000, and there may be as many as a million that are as large (60–70 m diameter) as the object that produced the Tunguska explosion in 1908. Discovery rates in the new surveys will have to be 100 times faster than the current Spaceguard System, and the orbit calculations and archiving of data will scale in the same way.

There is likely to be increased interest in the characterization of NEAs, and of space missions (such as Don Quixote) to investigate them, stimulated by the higher discovery rate. However, because so many of the new objects will be faint, the pressure will be upon the largest telescopes, where observing time (especially unscheduled time to observe a newly discovered NEA) is at a premium. There will also be increased opportunity and demand for ground-based planetary radar investigations.

The rate of discovery of "interesting" NEAs (such as Apophis and 2004 VD_{17}) that might be noticed by the public and the media may increase from about once per year to once per week. We can expect dozens of discoveries that appear, from preliminary orbits, to pose a potential threat. (For every NEA that collides with Earth, there are 100 that have a 1 percent chance of collision.) Both astronomers and the media will need to develop better ways of communicating the risk without raising unrealistic public concerns.

Recognizing this communication challenge, the IAU has created a small committee of experts to advise the IAU President and General Secretary concerning impact threats. Though this committee, we hope that the IAU can play a more visible part in placing the impact hazard in perspective. We must strike a balance between minimizing public concern while recognizing that the NEA survey can, at any time, identify a real asteroid on a collision course with Earth.



Radar-derived shape of near-Earth asteroid Toutatis. Credit: S. Ostro, JPL

The IAU EC Advisory Committee on "Impact Threats to the Earth" consists of: David Morrison (NASA Ames Research Center) (Chair), Richard P. Binzel (Dept Earth/Planetary Science, MIT), Andrea Carusi (IASF-INAF, Rome), Andrea Milani (University of Pisa – NEODys team), Don Yeomans (NASA/JPL/Caltech SENTRY team).

Women in Astronomy Working Lunch

Monday 21 August, 2006 – *Anne Green*

The second Women in Astronomy Lunchtime Meeting was held on Monday 21 August with more than 250 participants. The meeting was hosted by the WG for Women in Astronomy, established at the 2003 IAU-GA, and was attended by the current President, the Presidents-Elect for this and the next GA, the General Secretary and Vice-Presidents, many senior astronomers, as well as students and young astronomers. We congratulated incoming President, Catherine Cesarsky, the first woman to hold the position.

Lunch was preceded by a Business Meeting attended by an overflow audience of participants. One important issue is the collection of global statistics and the wider community will be surveyed with a concise and consistent set of questions relevant to all countries. For this, we need National Representatives who will take responsibility for obtaining the statistics. Many surveys already exist and new ones are planned.

IAU gender statistics give an incomplete picture, but we cannot be satisfied with recent numbers showing 13 % women of 8,000 members in 39 countries, although an encouraging 22 nations recorded an increase since the previous GA.

The meeting theme was "Career Development for Women" with keynote speakers Dr Sunetra Giridhar of the Indian Institute of Astrophysics, Bangalore, and Dr Patricia Knezek, Deputy Director of the WIYN Observatory, Arizona. Participants received a flyer with the 1992 Baltimore Charter for Women in Astronomy, IAU statistics and five suggested topics for discussion at tables and in the Plenary session. A summary of comments follows:

1. Unequal Opportunity – has discrimination gone underground? Many participants want more flexible criteria for appointments, for more women in senior positions and for the visibility of women at conferences to increase. Sadly, subtle discrimination is still a problem at several institutions.

2. Mentoring & Self-confidence – do women network effectively? Many young women astronomers expressed the need for role models and effective mentoring and strategies to build self-confidence. Anecdotal evidence suggests women base applications on their achievements rather than on their potential (a more male approach).

3. Family responsibilities – is there an easier time for having children? Many noted that the provision of childcare at workplaces and conferences is critical. While maternity leave is now frequently offered, childcare at conferences and workplaces is often lacking. Women are still (generally) the primary caregivers with greater vulnerability for research disruption and mobility limitations.

4. Dual careers – equal advancement of two careers is extremely difficult. Lack of mobility affects women more than men. How can we encourage more options for partners? Can we embrace non-standard career paths as acceptable? The two-body issue is seen as problematic for many women.

The following action items will be submitted to the incoming IAU Executive, with the WG keen to assist: ensure adequate representation for women on Science Organising Committees and as invited speakers for Symposia and make the provision of childcare at meetings, either supplied or paid for, a priority. Finally, the meeting was an excellent if brief opportunity to exchange ideas and experiences, made possible through generous support from the US IAU National Committee for Astronomy and the NOC of the Prague GA, for which we are greatly appreciative. See you again in Rio!

SPS3: The Virtual Observatory in action – new science, new technology, and next generation facilities

Andy Lawrence, Francoise Genova

The development of the Virtual Observatory (VO) is one of the very few truly global endeavours of astronomy. The IAU General Assembly is therefore a natural place to assess the status of the VO and present its progress to the community. Three years ago in Sydney, a Joint Discussion presented dreams, visions, and early technical progress. Projects from around the world had just formed the International Virtual Observatory Alliance (IVOA). This year in Prague it was therefore exciting to hold a full three day Special Session, where scientists from all over the world described working systems, presented early science results using VO tools, and held vigorous debates on both the opportunities and pitfalls before us.

The VO is and must remain science-driven, but technical solutions are what makes the vision achievable. The heart of the concept is the agreement of standards – for data, for description of services, for how software modules bolt together. The IVOA constructs and debates these standards, but they are then approved and held by the IAU. The standards and protocols need to be simple enough that busy data centres and other service providers will implement them but strict enough that we can actually achieve our vision of "data at your fingertips". Unless data is published through VO interfaces, then there is no VO. We had several talks from data centres and from national projects about the progress and the difficulties in achieving this. Much of the debate was about striking the balance between risk and sustainability. It was widely agreed that the centrality of data centres on future astronomy, and the need to fund them properly, is not yet fully appreciated by funding agencies, or indeed by astronomers in general.

New astronomical facilities and big survey projects, as well as holders of large and diverse existing archives, all seem to realise that this is the way science will be done in the future, and so their plans must accommodate the VO – and unlike three years ago, scientists representing these projects even seem to understand what "VO compliant" actually means! As well as implementing specific access protocols, it means providing "science ready data" and standardised tools for exploring and analysing the data. Some of the most fascinating talks were about such science tools – multi-dimensional plotters, spectral fitters, image stackers, on-demand reduction pipelines – and technical advances that enable these tools to interoperate. These tools are being written by scientists from outside the VO projects, a sure sign that the VO is taking off.

As VO-ready datasets and VO-aware tools emerge, the first astronomers are beginning to do VO-enabled science. This was perhaps the most exciting part of the meeting, with talks on quasars, brown dwarfs, asteroids, solar flares, and more. Of course, this still comes from a keen band of "early adopters", and there was much feedback that systems and tools need to be easier to use. National projects, summer schools, helpdesks, and so on can all help; but it seemed clear that the concept was going to work. We only have a few years to impress people; if the VO works, it will soon be invisible. There isn't really a thing called the VO. Its just a consistent and transparent way of doing things. One problem is that it may then be hard to track useage statistics and convince our paymasters that it is a success.

Two interesting concerns emerged during the meeting. The first is that a new breed of "data scientists" is emerging, equivalent to astronomers who specialise in developing new instruments. It is important for the future of astronomy that the work of these data scientists is credited, and that they have a sensible career track. The second concern is data quality. Because the VO enables people to easily access, analyse, and combine a wide variety of previously specialised data, there is a danger that much naive nonsense will result. Some suggested that only the best datasets should be "allowed in", or that the IVOA should be the "data police". Majority opinion agreed that this is both impractical and against the spirit of the VO; but it is a problem that the IVOA must address. The solution must be in agreeing on the ways that data and resources are characterised, so that people or software can make judgements on data quality. We look forward to meeting in Rio to see what the VO will have matured into.

Final Version of Resolution on the Definition of a Planet

At the second session of the General Assembly which will be held 14:00 Thursday August 24 in the Congress Hall, members of the IAU will vote on the resolutions presented here. There will be separate sequential votes on Resolution 5A and Resolution 5B. Similarly, there will be separate votes on Resolutions 6A and 6B. Resolution 5A is the principal definition for the IAU usage of "planet" and related terms. Resolution 5B adds the word "classical" to the collective name of the eight planets Mercury through Neptune. Resolution 6A creates for IAU usage a new class of objects, for which Pluto is the proto-type. Resolution 6B introduces the name "plutonian objects" for this class. The Merriam-Webster dictionary defines "plutonian" as: *Main Entry: plu•to•ni•an – Pronunciation: plü-'tO-nE-&n – Function: adjective – Usage: often capitalized – : of, relating to, or characteristic of Pluto or the lower world.* Resolutions Committee members will be available at the IAU Exhibit (situated in the exhibition area, 2nd floor of Congress Hall, Foyer 2) from 13:00–13:30 today (Thursday). However, only minor corrections can be accommodated at this stage. A French version of the Resolutions will be available at the door.

IAU Resolution: Definition of a Planet in the Solar System

Contemporary observations are changing our understanding of planetary systems, and it is important that our nomenclature for objects reflect our current understanding. This applies, in particular, to the designation 'planets'. The word 'planet' originally described 'wanderers' that were known only as moving lights in the sky. Recent discoveries lead us to create a new definition, which we can make using currently available scientific information.

Resolution 5A

The IAU therefore resolves that planets and other bodies in our Solar System be defined into three distinct categories in the following way:

(1) A planet[1] is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and (c) has cleared the neighbourhood around its orbit.

(2) A dwarf planet is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape[2], (c) has not cleared the neighbourhood around its orbit, and (d) is not a satellite.

(3) All other objects[3] orbiting the Sun shall be referred to collectively as "Small Solar System Bodies".

[1] The eight planets are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.
[2] An IAU process will be established to assign borderline objects into either dwarf planet and other categories.
[3] These currently include most of the Solar System asteroids, most Trans-Neptunian Objects (TNOs), comets, and other small bodies.

Resolution 5B

Insert the word "classical" before the word "planet" in Resolution 5A, Section (1), and footnote 1. Thus reading:
(1) A classical planet[1] is a celestial body . . .
and

[1] The eight classical planets are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

IAU Resolution: Pluto

Resolution 6A

The IAU further resolves:
Pluto is a dwarf planet by the above definition and is recognized as the prototype of a new category of trans-Neptunian objects.

Resolution 6B

The following sentence is added to Resolution 6A:
This category is to be called "plutonian objects."

Discussion on Resolution 5B

250 words for

Compromise. Achieving a planet definition has been all about compromise. There are two equally valid descriptions of what should be the principal criterion for defining a planet. One is dynamical, an object that has "cleared out its zone." The other is based on the physical nature of the body itself. The pendulum of argument has swung both ways during the General Assembly discussions. But now it has swung too far.

Resolution 5B is all about finding the middle ground. Using qualifiers gives equal status to both points of view and leaves open the possibility to define other types of planets in our Universe. Resolution 5B restores the "global and cultural points of view" that the Planet Definition Committee had responsibility to achieve. The public recognizes Mars, for example, as a "planet" not because it has cleared out its zone, but because it is a fascinating world.

To illustrate why Resolution 5B is cultural, and not silly semantics, consider how you must answer two questions: How many planets are there? Is Pluto a planet? A vote in favor of 5B yields: "There are 8 classical planets and many dwarf planets yet to be discovered" and "Pluto is a planet, but in the dwarf planet category." These answers highlight and communicate the tremendous revolution of new discoveries in our outer Solar System. Further, it saves enormous public backlash by still being able to say the words "Pluto is a planet, but". Do not underestimate the global cultural importance of these first four words. The word "planet" deserves to be shared equally.

250 words against

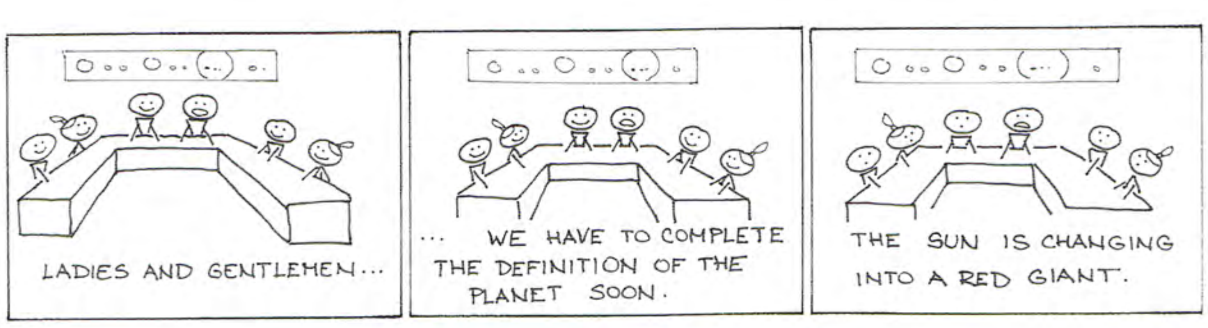
Resolution 5B represents a small but significant change to Resolution 5A.

The key issue is the definition of "planet". Resolution 5A is close to the version agreed by consensus on Tuesday evening where it was made clear that three distinct categories of objects orbiting the Sun were being defined: planets, dwarf-planets, and small bodies. The logical implications from the rules of grammar cannot be ignored. By using the name "planet" with two different adjectives "classical" and "dwarf" a larger category of planets is implied. This contradicts the first paragraph of both Resolutions 5A and 5B and transforms three distinct categories into two (planets and small bodies) and two sub-groups of planets.

To the question "is Pluto a planet?" the two resolutions give different solutions – "Yes" for 5B and "No" for 5A. To the question "How many planets are there?" Resolution 5A gives 8, Resolution 5B currently gives 12 and soon at least 50.

The total number of planets may not matter to scientists, it is critical for education and the dissemination of science. For scientists, it is relevant that dynamical and cosmogonical criteria, which are now the source for the definition of planets, would in Resolution 5B be relegated to a secondary role. In Resolution 5A the arguments from geophysics and from dynamical astronomy are given equal weight. Such a balanced solution had received very strong support in the meeting of Division III (Planetary Systems Science) and the Planet Definition Information Meeting.

Resolution 5B is misleading and should be rejected.



Brief information

- **C46: Teachers Day – Olomouc**, the historical Moravian centre of cultural and scholarly tradition (university, old astronomical clock) is the site of an annual meeting "Fare of physics invention". The opening day August 28 is reserved for reports and discussions on highlights of the 26th GA. More than 100 Czech physics teachers and several C46/41 members will participate.
- The international conference "**Galaxies in the Local Volume**" will be held in 2007, July 8 to 13, at the Australian National Maritime Museum (ANMM) in Darling Harbour, Sydney. More information at **www.atnf.csiro.au/research/LVmeeting/** and from Baerbel Koribalski, **Baerbel.Koribalski@csiro.au**
- **2006 IAU General Assembly podcast** – Astronomers from Jodrell Bank Observatory interview those at the conference about their experiences. Each interview is edited and published on the same day and stored in our archive at **www.jodcast.net/archive/.** Contact: **jodcastfeedback@jb.man.ac.uk.**
- You can watch today's **General Assembly online** at **www.astronomy2006.com/tv** from 14:00.

Please, check again our **electronic supplement to No. 9** available at **astro.cas.cz/nuncius** for articles by Alexander Gusev and Natalia Petrova about Russian project "Moon 2012+", by Heino Falcke about long-wavelength telescopes on the Moon, by Irina Kitiashvili about pulsar PSR B1828-11, by Wayne Orchiston about history of radioastronomy, by Carolina Odman about UNAWE project (astronomy for underprivileged children) and a scientific biography of Kees de Jager and his friendship with Zdeněk Švestka written by Helen Sim There were also minor corrections done in "**Planet Redefinition Proposal**" supplement.

"Nothing is so firmly believed as what we least know."
Michel de Montaigne (1533–1592)

Secret diary of secret agent F.R.Og

August 23: I love Earthlings. Metaphorically! They're so poetic and naive. How lovingly they speak about black holes and how beautiful surroundings they create for them. They even make movies about them. I don't have a heart to tell them how we, at rybníček, talk about black holes. "Supermassive black-hole waste damp not massive enough!" "Stellar-mass black holes destroyed the interstellar road!" No, Earthlings are not yet ready for the reality. By the way, I begin to think my mission here will fail. My boss will not be happy. I'm afraid the NRAO magic cube won't satisfy him, he's so narrow-minded. And has no children.

NOMENCLATURE FILLER

9. From Confusion to Clarity: *\objectname* and *\object* are useful tools when publishing

Hélène R. Dickel

The Astrophysical Journal (and Supplement), Astronomical Journal, and Astronomy & Astrophysics kindly request that authors use the ***\objectname*** (for ApJ, ApJS and AJ) and ***\object*** (for A&A) LaTeX command to link the astronomical objects discussed in their work to the general interest tools developed in the community. At that time, you should provide the reference for the designation of the object or source. For further details, refer to the Instructions to authors of the particular journal.

Thursday 24/8
9 °C / 48 °F morning minimum
25 °C / 70 °F afternoon maximum
First sunny, then becoming overcast with some rain
SSE winds 3 m/s (7 mph)

Friday 25/8
8 °C / 46 °F morning minimum
20 °C / 68 °F afternoon maximum
Cloudy with rain mainly in the evening
WSW winds 4 m/s (9 mph)

Dissertatio cum Nuncio Sidereo III is the official newspaper of the IAU General Assembly 2006. Contacts: **e-mail** – nuncius@ig.cas.cz, **address** – Nuncius Sidereus III, Kongresové centrum Praha, a.s., 5. května 65, 140 21 Praha 4. **Editor-in-chief**: Jiří Grygar, **deputy editor**: Petr Lála, **secretary**: Pavel Suchan, **assistant secretary**: Kateřina Vaňková **editors**: Soňa Ehlerová, Daniel Fischer, Jana Olivová, Michael Prouza, Petr Scheirich, Michal Sobotka, Michal Švanda, **technical editors**: David Ondřich, Jan Verfl, **English corrector**: John Novotney, **cartoonists**: Ladislav Šmelcer, Lubomír Vaněk. **Published by**: Icaris, Ltd., Nám. dr. Holého 8, 180 00 Praha 8. **Printed by:** Apolys, Ltd., Kolbenova 40, Praha 9. Any views expressed in articles are those of the authors and do not necessarily reflect the views of the Editorial Board or IAU. **Online version:** www.astronomy2006.com/ga-newspaper.php.

D I S S E R T A T I O C V M
NVNCIO SIDEREO III 10

PRAGAE — MMVI 25. VIII. — SERIES TERTIA

Closing Session of the XXVI^th IAU General Assembly

Petr Lála

The XXVI^th General Assembly was formally closed yesterday, during its Second session and Closing Ceremony in the main Congress Hall. First, a few pieces of Medieval music were performed and introductory remarks by the outgoing IAU President Ron Ekers were made. This session was more exciting than expected, particularly because of the voting on new IAU Resolutions. There were last minute changes (most of them dutifully reported in previous issues of the Nuncius Sidereus III), not only in the controversial Resolution 5 on the "Definition of a Planet in the Solar System", but also in some other Resolutions. As a consequence, the voting lasted longer than anticipated and the final result is:

– **Resolution 1** (Adoption of the precession theory and definition of the ecliptics): *adopted.*

– **Resolution 2** (Supplement to the IAU 2000 Resolutions on reference systems): *adopted.*

– **Resolution 3** (Re-definition of Barycentric Dynamical Time): *adopted.*

– **Resolution 4** (Endorsement of the Washington Charter for Communicating Astronomy with the Public): *adopted.*

– **Resolution 5A** (Principal definition for the IAU usage of "planet") - *adopted with ammendments* that the definition does not include satellites and in the definition the words "dwarf planet" should be used with inverted commas .

– **Resolution 5B** (Adding the word "classical" for the eight planets) - *rejected by a large majority.*

The IAU has the pleasure to announce the constitution of its Executive Committee 2006–2009.

Officers:

– President: **Catherine J. Cesarsky**, European Southern Observatory, Garching-bei-München, BRD, ccesarsk@eso.org

– President-elect: **Robert Williams**, Space Telescope Science Institute, Baltimore, USA, wms@stsci.edu

– General Secretary: **Karel A. van der Hucht**, SRON Netherlands Institute for Space Research, Utrecht, the Netherlands, K.A.van.der.Hucht@sron.nl

– Assistant General Secretary: **Ian F. Corbett**, European Southern Observatory, Garching-bei-München, BRD, icorbett@eso.org

Vice-presidents: **Beatriz Barbuy**, Departamento de Astronomia, IAG, Universidade de São Paulo, São Paulo, Brazil, barbuy@astro.iag.usp.br, **Cheng Fang**, Department of Astronomy, Nanjing University, Nanjing, Jiangsu, China PR, fangc@nju.edu.cn, **Martha P. Haynes**, Department of Astronomy, Cornell University, Ithaca, NY, USA, haynes@astro.cornell.edu, **George K. Miley**, Leiden Observatory, Leiden University, Leiden, the Netherlands, miley@strw.leidenuniv.nl, **Giancarlo Setti**, Department of Astronomy, University of Bologna, Bologna, Italy, setti@ira.inaf.it, **Brian Warner**, Astronomy Department, University of Cape Town, Rondebosch, South Africa, warner@physci.uct.ac.za

Advisers: **Ronald D. Ekers**, Past President, CSIRO, Australia Telescope National Facility, Epping, NSW, Australia, rekers@atnf.csiro.au, **Oddbjørn Engvold**, Past General Secretary, Institute of Theoretical Astrophysics, University of Oslo, Blindern, Norway, oddbjorn.engvold@astro.uio.no

Jocelyn Bell Burnell and her didactic model

– **Resolution 6A** (Definition of Pluto as a "dwarf planet" and prototype of a new category): *adopted* (237 votes yes, 157 no with 30 abstentions)

– **Resolution 6B** (The name of the new category of objects should be "plutonian objects"): *rejected* (183 votes for, 186 no). The name will be selected by standard IAU procedure.

Some other results of the GA are reported elsewhere in this issue.

In addition to three new member countries (Lebanon, Mongolia and Thailand), which were admitted at the First GA session, 925 new Individual Members were admitted. This brings the current number of IAU Individual Members to 9785. Also a new composition of Committees, including the Executive Committee, was approved. The date and venue of the XXVII^th IAU General Assembly (3–14 August 2009, Rio de Janeiro, Brazil) were confirmed and selection of Beijing, China for the XXVIII^th GA on 12–25 August 2012 was announced.

At the end of the Ceremony, GA was addressed by several officers and guests. Some addresses are reproduced elsewhere in the newspaper. ❐

EDITORIAL

The preparations for NS III started in October 2004 when I was entrusted by the NOC to repeat my editorship job in August 1967. Based on my previous experience I was able to offer the potential members of the new editorial board a challenging opportunity of having 7-days-a-week 16-hrs shifts during the course of the General Assembly. I also stressed in advance that the editorial work will be run in a noisy environment with last-minute demands to change the contents, length and layout of their contributions. Finally, the editors should be ready to accept unjust critique of their work by a capricious editor-in-chief and to sustain bitter objections from the authors and GA participants.

To my surprise all 16 people (see the list of the Editorial Board) to whom I addressed such promising offer, agreed and cooperated enthusiastically from the date of our first board meeting in May 2005. We were also much stimulated by the positive response of almost all distinguished astronomers from whom we requested contributions to Nuncius in advance of the GA.

In this happy mood we encountered Day 0 (Aug 9, 2006) when in the premises of the Learned Society of the Czech Republic in downtown Prague we started composing issue No. 1, because we wanted copies of Numero Uno to be available upon the onset of registration in the Prague Congress Centre on Saturday noon, Aug 11. I was almost astonished that the completion of the PDF file to the printers was smooth and fast due to the very exceptional abilities of our team of technical editors and also due to the obliging attitude of all editors. Thus I became confident that we would be able to serve the IAU GA participants well and I dared to display the first issue also on our website.

After moving our equipment to the Congress Centre on August 10 we had our first opportunity to communicate in person with the IAU officers and secretariat. Thus, I realized almost at once that we have to stretch the size of the newspaper in order to accommodate all the obligatory stuff (plus some jokes, of course). Inspired by the award of the Gruber Cosmology Prize to COBE people I contemplated for a while applying the already proven cosmological inflation to Nuncius III as a vehicle to overcome the pitfall but soon I realized two obstacles: firstly the information density of the newspaper would be somehow diluted and secondly, my knowledge of theoretical physics is so poor that I do not known how to avoid the runaway outcome of inflation. This ignorance could adversely affect the timing of the next General Assembly in Rio (there are some rumours here in Prague that Rio is also a very beautiful town).

It seems to me as a small miracle that contrary to this theoretical stalemate the unstretched Nuncius complied with most demands of the IAU participants by publishing relevant contributions although part of the valuable information is displayed only in the electronic Supplement. I am, however, assured by our webmaster that all material will be available on the address: ***astro.cas.cz/nuncius*** *at least for a year, and possibly until the onset of shell nuclear burning in the Sun.*

It is my pleasant duty to thank all contributors for their manuscripts, to our publisher, Icaris, Ltd. and to the printers, Apolys, Ltd. for smooth cooperation and high quality layout of the newspaper and last, but not least, to the wonderful team of Nuncius III that made my task so easy and pleasant.

Jiří Grygar

History of IAU G.A. Newspapers 1958–2006

(after A. Blaauw: Archives of the IAU, Kapteyn Inst., Groningen 1999, p. 35)

1958	X.	Moscow	COSMOS
1961	XI.	Berkeley	IAU News Bulletin
1964	XII.	Hamburg	Daily News Bulletin
1967	XIII.	Prague	DISSERTATIO CUM NUNCIO SIDEREO II
1970	XIV.	Brighton	The Assembly Times
1973	XV.	Sydney	ASTRONOMY 73
1976	XVI.	Grenoble	La Gazette d'Uranie
1979	XVII.	Montreal	Montreal METEORE
1982	XVIII.	Patras	ASTROCOSMOS
1985	XIX.	Delhi	Mandakini
1988	XX.	Baltimore	IAU TODAY
1991	XXI.	Buenos Aires	Cruz del Sur
1994	XXII.	The Hague	The Sidereal Times
1997	XXIII.	Kyoto	The Sidereal Times
2000	XXIV.	Manchester	Northern Lights
2003	XXV.	Sydney	Magellanic Times
2006	XXVI.	Prague	DISSERTATIO CUM NUNCIO SIDEREO III

Today's programme: (friday 25/8)

❍ Symposia S238, S239, S240

ADDRESS BY THE INCOMING GENERAL SECRETARY

Three years as AGS, and what's next

Dear colleagues and friends,

The secret of any success as AGS in surveying the preparations for the IAU Scientific Meetings and its Proceedings Series is communication with the organizers of these meetings, and with the editors of their proceedings. Communication is time consuming, can be disappointing occasionally, but most of the time communication is rewarding, gratifying and most constructive. As IAU AGS in the past three years, communication had to be my middle name. Sharing information should not be considered a waste of time, nor a threat, but a necessity and a blessing.

That is why the IAU EC has created the concept of the IAU Editorial Board, which started its activities at the beginning of 2004. The IAU Editorial Board served and serves as a communication and support platform for all IAU Symposium (and till the end of 2005 IAU Colloquium) Proceedings' Editors, where they can exchange experience and ask for advice, whenever necessary, in their efforts to ensure that:

– all papers published in the IAU Proceedings are of highest possible quality; and

– the IAU Proceedings are being published within six months after the event.

The IAU EB in each calendar year comprises as Working Members the Chief Editors of the IAU Symposia of that year, assisted by four Advisers and by the AGS as chair. The Working Members are encouraged to share editing experiences with each other within the EB. The EB provides a sense of community by seeing and observing each other perform. In this way, the goal of having the IAU Proceedings published within six months after the event has almost been achieved in 2004 and 2005, the first two years that we are working together with our new Publisher, Cambridge University Press. In 2004–2005 the average production time was 7.5 months. We hope that, due to the hard and efficient work of the Editors of all nine Symposia held in 2006, six of them during this GA, we will get closer to the desired six-months production time, while maintaining the highest possible scientific quality.

Are the IAU Symposia still of relevance in a time when almost every day somewhere on this planet a new astronomical meeting starts? We think they are:

– the IAU receives annually 2–3 times more proposals for IAU Symposia than can be accommodated financially by the available nine IAU Grants of CHF 25000 per Symposium;

– the IAU Symposia cover broad topics, attract broad communities, including talented astronomers from less privileged countries through the IAU Grants just mentioned.

The eight IAU Symposia and Colloquia in 2004 attracted 1229 participants, of which 303 participants from 48 countries have received IAU grants. The nine IAU Symposia and Colloquia in 2005 attracted 1,648 participants, of which 253 participants from 39 countries have received IAU grants. Thus together, the 17 IAU Symposia and IAU Colloquia held in 2004 and 2005 attracted 2877 participants, more than in any single IAU General Assembly. Some 20 % of the participants received IAU travel grants.

In 2005, the IAU also accommodated two Regional IAU Meetings (RIM), an Asian-Pacific RIM, and a Latin-American RIM, which together had 559 participants, of whom 65 participants received IAU grants. The triennium 2003–2005 has been quite busy publishing-wise: 38 Proceedings of IAU Symposia, Colloquia and Regional IAU meetings have seen the light. As to all the above mentioned matters of IAU Symposia and Regional IAU Meetings, my successor Ian Corbett, with your help, will see to it that we maintain and improve our current level of performance.

Communication has to be my middle name also as your IAU General Secretary. You may remind me of that anytime. The next three years will be as important for the IAU as any other three years. My communication with you will be through

– the frequently updated IAU web site;

– the Highlights and Transactions of this GA;

– the regular IAU Information Bulletin;

– the electronic IAU Newsletter;

– the frequent contacts with the Presidents of our 12 Divisions, 37 Commissions, and 85 Working/Program Groups whom you have voted into office, and with the National Representatives;

– maintaining support for our educational activities in International Schools for Young Astronomers (ISYA) and Teaching for Astronomical Development (TAD); among many other activities.

As a special issue for the coming three years, the IAU has taken upon itself to be the leading organization of the International Year of Astronomy 2009. The main purpose of that concept is Communication with the Public: sharing with the community at large what we do, why we do it, and explaining why this is of relevance for all human beings.

Thank you, Oddbjørn Engvold, for showing me the way in the past three years.

Thank you, Ian Corbett, for taking over the responsibilities as AGS.

Thank you, IAU members, for giving me your vote of confidence. It will be my pleasure serving you and communicating with you for another three years, until our great community gets together again, in Rio de Janeiro, 2009.

Karel A. van der Hucht, Prague, 24 August 2006
IAU AGS 2003–2006, IAU GS 2006–2009
SRON Netherlands Institute for Space Research, Utrecht
Sterrenkundig Instituut Anton Pannekoek, Universiteit van Amsterdam

Summary of Symposium S238: Black Holes

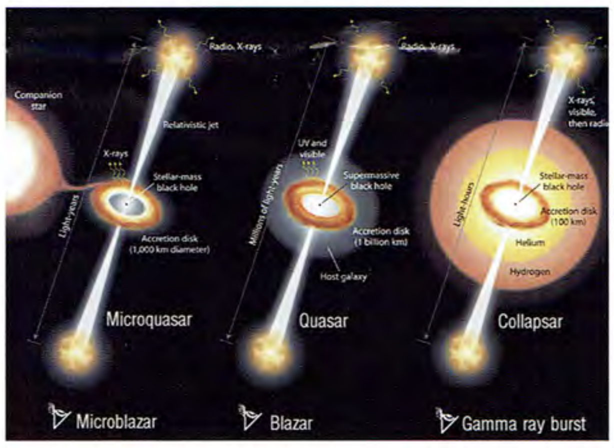
Felix Mirabel, European Southern Observatory, Chile

Black holes are now widely accepted as real physical entities that play an important role in several areas of modern astrophysics. The interaction with their surroundings produces analogous phenomena in AGN and stellar black hole binaries. The scales of length and time of the phenomena are proportional to the mass of the black hole, and the whole phenomenological diversity that takes place around black holes can be described by the same physical concepts. However, the observed phenomena exhibit an enormous complexity, and synergy between research on stellar mass and supermassive black holes has become essential for our understanding of the underlying physics.

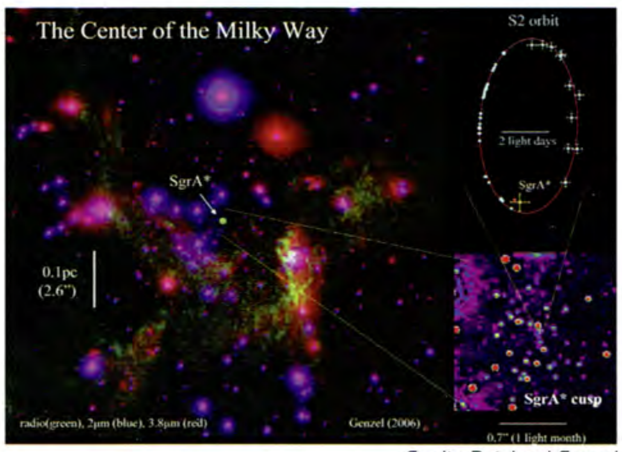
Current physics suggests that compact objects in stellar binaries with mass functions larger than 4 solar masses must be black holes. There are about 20 known objects with such mass functions which are believed to be the tip of an iceberg. In fact, it is estimated that in the Milky Way alone there should be at least 1000 dormant black hole X-ray transients, while the total number of stellar-mass black holes could be as large as 100 million. Gamma-ray bursts of long duration are believed to take place when stellar black holes are formed by core collapse of massive stars. Their observation should shed light on the poorly understood mechanisms of stellar-mass black hole formation.

Dynamics is the most direct method to determine the mass of astrophysical compact objects, and therefore, the best evidence for the existence of a black hole. The most clear evidence for a supermassive black hole has been obtained by the motion of stars around the dormant black hole of 3–4 million solar masses at the center of our Galaxy. These stars are distributed in two randomly inclined disks of 0.04 pc and 0.5 pc radii. The unexpected discovery of a massive compact cluster of massive stars in the central parsec of our Galaxy poses new questions and may open new horizons for our understanding of massive black hole formation and its relation with massive star formation.

Supermassive black holes are ubiquitous at the centers of galaxies. Their mass is correlated with the mass of the host galaxy, and in particular with that of the stellar bulge. This indicates that massive black holes and host galaxy formations are tied together. The most massive black holes have been discovered at $z > 6$ implying that they assembled very early, in less than one billion years after the Big Bang. On the other hand, supermassive black holes of lower mass have formed more slowly by merging at $z < 3$, the peak accretion rate occurring rather late, at $z \sim 0.7$. The kick velocity due to gravitational recoil in merging massive black holes would displace the merged black hole from the dynamic center of the host galaxy. In dwarf galaxies the estimated kick velocity is larger than the typical escape velocities of 10–20 km/s, resulting in the ejection to the intergalactic medium of a population of naked, massive runaway black holes.



Credit: Mirabel & Rodriguez, Sky & Telescope (2002)



Credit: Reinhard Genzel

The existence of black holes of intermediate mass remains an open question. From the spectral properties of ultraluminous X-ray sources in nearby galaxies it has been suggested that some of these sources contain black holes of hundreds and perhaps thousands of solar masses. However, no dynamic evidence from objects orbiting around such black holes has so far been found. Why have observations in our Galaxy – where the mass functions of compact objects can be determined – not revealed a black hole of intermediate mass? Black holes may exist but are difficult to find.

Sgr A* accretes at low mass rates, and quasi-periodic flares on scales of tens of minutes have now been observed at X-rays, infrared, submillimeter and radio waves. At longer waves the flares are polarized up to 10 %. From the time lag at longer wavelengths it has been proposed that these flares could be synchrotron self Compton emission from adiabatically expanding clouds. It is unclear whether these expanding plasma clouds in Sgr A* are rotating blobs in the accretion disk or collimated expanding jets as seen in microquasars.

Black holes are the simplest objects in the universe. They are defined by only three parameters: the mass, the spin and the electric charge. Because much of the radiation emerges within 6 gravitational radii they provide a unique opportunity to probe gravity in the strong-field regime. The radius of the ultimate stable orbit depends on the rotation of the black hole, and knowing the mass, distance and inclination, the spin can be derived. Another way is the skewed fluorescence iron line. Using these methods it has been found that extreme Kerr black holes are present in microquasars and AGN. Whether there is a general correlation between spin and jet power remains an open question.

At present, black hole astrophysics is in an analogous situation as was stellar astrophysics in the first decades of the XX[th] century. At that time, well before reaching the physical understanding of the interior of stars and the way by which they produce and radiate their energy, empirical correlations such as the HR diagram were found and used to derive fundamental properties of the stars, such as their mass. Today, in black hole astrophysics several correlations among observables are being found and used to derive the mass and spin, which are the fundamental parameters that describe astrophysical black holes. ❒

Summary of Symposium S239: Convection in Astrophysics

Jean-Paul Zahn, Observatoire de Paris-Meudon, France

Convection occurs in most objects that populate our Universe whenever radiation is insufficient to carry the heat from where it is produced to the "surface" where it escapes into space. In general, convection involves a wide range of spatial and temporal scales – experts call this turbulence – which makes it rather difficult to model. For this reason convection remains one of the major uncertainties when modelling stars and planets, and this is partly true also for accretion disks. However, substantial progress has been achieved during the past years, both in the numerical simulation of convective regions and in the observation of convective flows by various new techniques.

There was thus a need to present and to discuss the most recent results, and that is why Friedrich Kupka and Ian Roxburgh organized this symposium in Prague, exactly 30 years after an IAU colloquium which was held in Nice in the frame of the XVI[th] General Assembly.

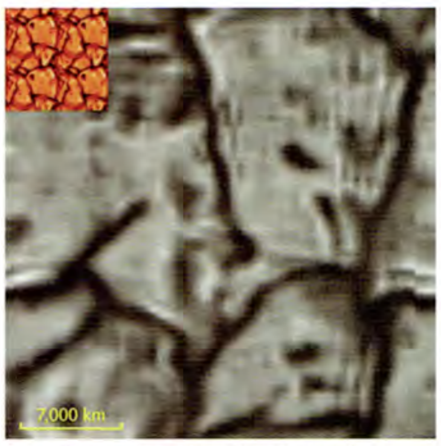
Eric Graham presented there the first 3D calculations of stratified convection, but nobody dreamed then that numerical simulations would reach by now such a high level of realism, which was demonstrated again during this symposium. Some are designed to describe the upper layers of stars, including the photosphere, and involve explicitly the transfer of radiation. Their great success is to render perfectly the solar granulation, as was illustrated in yesterday's issue of Nuncius Sidereus III. Moreover, these local codes reproduce with great accuracy the observed line profiles, and dispense with the ad hoc introduction of the so-called microturbulence.

K. L. Chan and J. Trujillo Bueno during Symposium S239

On the other hand, codes that are tailored for deeper convection operate on a global scale and in spherical geometry. They reproduce correctly the differential rotation of the solar convection zone, as revealed through helioseismology, with the equator rotating faster than the poles, and the angular velocity remaining almost constant with depth. More and more, such global codes are being applied to other stars: to brown dwarfs where they account for the formation of dust, to pre-supernovae where they include nuclear burning, to giant stars in which the convection zone extends over multiple scale heights, to A-type-stars where convection occurs in the core, etc.

However these 3D simulations are much too heavy tools to build models for the purpose of describing stellar evolution, and that is why the mixing-length approach is still widely used. What else can one do? A few, led by D. R. Xiong and V. Canuto, still believe in a 1D approach, and they strive to go beyond this crude mixing-length recipe by developing a treatment that is inhomogeneous in the horizontal directions and non-local in the vertical ones. This procedure involves various closure approximations that need to be justified by comparison with laboratory experiments, geophysical measurements or high-resolution calculations. So far the results have been somewhat disappointing, but there is a hope that the situation will improve if one succeeds in taking better account for the plume-like flows, which advect heat rather than diffusing it.

A much discussed problem during this symposium was that posed by the new abundance determinations of CNO in the Sun, carried out by M. Asplund and collaborators. By fitting the observed line profiles to those predicted with their 3D radiation hydrodynamic code, they found that these elements are up to twice less abundant than previously determined through classical 1D atmosphere calculations. Part of the correction is also due to better atomic data and to a non-local thermal equilibrium treatment. This revised metallicity puts the Sun on a level comparable to that of other solar-type stars in its neighbourhood, whereas before it appeared somewhat to be an exception. But this lower metallicity implies a lower opacity in the solar interior, and hence a smaller depth of the convection zone, which is in conflict with the depth inferred from helioseismology. What is to blame? The new abundances seem trustworthy, and the problem lies probably, as John Bahcall was already claiming, with the neon abundance, which is not determined directly from line profiles but deduced from the Ne/O ratio observed in the solar corona.



Comparison of simulation of surface granulation on the Sun (inserted frame) and Procyon A. Credit F. Robinson.

Although the symposium was dedicated to convection, there was much talk also about the mixing in radiation zones, which has been revealed by various observations. Convective penetration may be responsible for part of this mixing, but in most cases a deeper mixing is required to explain the observations. One plausible cause is the mixing due to rotation, either through large-scale meridional circulation or through turbulence produced by the shear of differential rotation. Such rotational mixing accounts rather well for the properties of massive stars. But it cannot alone explain the uniformly rotating radiative interior of the Sun, which requires a more efficient transport process. It was recently shown by C. Charbonnel and S. Talon that the gravity waves emitted at the base of the convection zone are indeed able to extract the angular momentum from the solar interior as the Sun is spun down by losing matter through its magnetized wind. When applied to old metal-poor stars, this mechanism produces exactly the depletion of lithium that is needed to reconcile the observed abundance with that produced by the Big Bang, according to the results of WMAP.

But for many solar and stellar physicists, the most spectacular manifestation of convection is of course magnetic activity. Much effort has gone into explaining how the magnetic field is produced in late-type stars. The current paradigm is the so-called alpha-omega dynamo first proposed by G. Parker, where a poloidal field is sheared into a toroidal field in the tachocline. The toroidal field thereafter is twisted somewhere above into a poloidal field, thus closing the loop. So far it has not been possible to render the cyclic behaviour observed in the Sun and many other stars, presumably because the computational domain was restricted to the unstable region. But the situation is improving rapidly since the stable tachocline has been included, by J. Toomre and his collaborators, and their first results show that the field seems to conform there to the alpha-omega scheme.

I have been quoting only theoretical advances, and only a few of them, but these have been achieved mainly because the observations impose more and more stringent constraints. Helioseismology is a wonderful tool, as was demonstrated by Alan Title in his brilliant Invited Discourse. Without it, we wouldn't know the depth of the solar convection zone, we would have no hint of the interior rotation of the Sun, there would be no tachocline. And local seismology is now producing maps of the convective flows below the surface.

Asteroseismology looks as promising, with COROT soon to be launched, and no doubt it will give us many surprises, which we shall discuss in the next symposium on astrophysical convection. ❐

Address at closing ceremony by the incoming President

We started this conference, in magnificent Prague, with a lovely rendition of "What poor astronomers are they", from John Dowland. I would like to close it with my motto: "what lucky astronomers we are": we lead purposeful and interesting lives. Look at this General Assembly. We have just had two weeks of passionate discussions. From black holes, dark energy, NEOs, to the meaning of the width of a spectral line or of a glitch in the radio emission of a pulsar, detection limits for extra solar planets, confusion limits in the infrared, the definition of a planet, every celestial object, every concept, every observation, every prediction got scrutinized, debated, refined... until next time. Among astronomers, there are no national barriers; we all share the Universe. And thus, the Union- the IAU, is not a vain word; it embodies one small and distinctive part of humanity, completely absorbed in the study of the heavens. I really love the feeling of togetherness in intellectual adventure and path finding, enhanced by our continuous arguing and squabbling. This is why I am not so much proud, as deeply happy that you have elected me President of the IAU.

In the next three years, we will not have only the fortunate fate of astronomers to celebrate. We will be commemorating, in 2009, the 400th anniversary of Galileo's first observations with a telescope, which brought about a fundamental change in our perception of the universe. We have decided through a resolution passed at the last General Assembly, at the initiative of Franco Pacini, that 2009 would be the International Year of Astronomy. UNESCO has endorsed our resolution and we hope that soon the UN will follow through. This offers an ideal opportunity to highlight astronomy's role in enriching all human cultures, to promote astronomy in the developing nations, to inform the public about our latest discoveries, and to emphasize the essential role of astronomy in science education. Individual countries will be undertaking their own initiatives, considering their own national needs, while the IAU will act as catalyst and coordinator of 2009 IYA on the global scale. We plan to liaise with, and involve, as many as possible of the ongoing outreach and education efforts throughout the world, including those organized by amateur astronomers. One interesting example is a programme geared at small children primarily in developing countries, "Universe Awareness". There will also be international events, at the General Assembly in Rio de Janeiro, as well as an opening and a closing event. 2009 is also the year of the 90th anniversary of the IAU, and on July 22 will come about the longest duration total solar eclipse of the 21st century. More celebrations! We welcome your involvement and your ideas. Let us all together make this exceptional year an astounding success.

Catherine Cesarsky

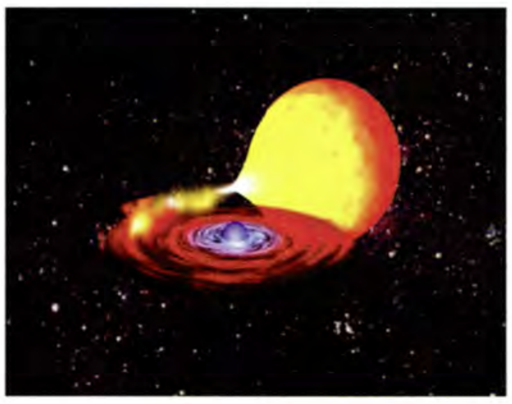
Summary of Symposium S240: Binary Stars as Critical Tools & Tests in Contemporary Astrophysics

Petr Harmanec (Charles University, Czech Republic), Edward Guinan (Villanova University, USA)

Symposium 240 has brought together some 500 people involved in all aspects of binary and multiple star research, from very long period, common proper motion pairs and other "fragile" binaries to short period contact binaries and star/brown-dwarf/planet systems, with the aim of exploring interests common to all binary star researchers. Sponsored by Division IV and Commissions 26 (Binary and Multiple Stars) and 42 (Close Binary Stars), the symposium has also received support from Division V, as well as seven other commissions and three working groups.

It was fitting that such a meeting be held in the Czech Republic, since much of the pioneering work on binary and variable stars has been carried out in Central and Eastern Europe for over a century. As the first joint meeting of the "close and wide" binary communities in recent memory, it was also deemed appropriate to jointly dedicate the symposium to outstanding representatives of both of those worlds: Mirek Plavec of the Czech Republic (who attended the opening session) and the late Charles Worley of the United States.

Major advances in instrumentation and techniques were obvious from a number of contributions. For example, many spectroscopic binaries can now be resolved via interferometry and adaptive optics. And thanks to vastly more sensitive detectors and larger telescopes even faint eclipsing binaries are now routinely studied in several nearby galaxies such as the Magellanic Clouds and the Andromeda Galaxy. These extragalactic binaries are now being used to secure accurate distances to these galaxies and more reliably define the extragalactic distance scale.



HIPPARCOS results have been published and widely-studied, and the next generation of astrometry satellites (such as GAIA) now under development promise results on orders of magnitude greater in both precision and quantity. Speckle interferometry and adaptive optics have replaced visual micrometry as the routine methods of measuring visual binaries, while long-baseline interferometry has now produced a significant body of results for close binaries with a promise of the resolution of many spectroscopic binaries during the next few years. Interferometric results from the HST/FGS have become more plentiful leading to exciting results and breakthroughs. It was obvious from several contributions that the new techniques and an increase in the angular resolution led to the discovery that multiple systems are much more numerous than believed earlier.

Methods for high-precision radial-velocity measurements, developed originally to detect extrasolar planets, in combination with sophisticated techniques of spectral disentangling and ultra-precise photometry from satellites are dramatically increasing accuracy in the determination of stellar masses, radii and distances.

Similar tremendous advances continue in other areas as well. Variability-induced motion and other detection methods are being used to mine the SDSS database for new binaries, and may be used with GAIA and SIM data as well. Superior infrared detectors and techniques are revolutionizing the study of pre-main sequence binaries and binaries with cool star and brown dwarf components. Ever more accurate radial velocity techniques have further blurred the distinction between the traditional spectroscopic and visual separation/period regimes and yield accurate stellar masses across the spectral range.

Not even envisioned a decade ago were the variety and ubiquity of substellar companions, including L- and T-dwarfs, brown dwarf pairs, and exoplanets. Following initial discoveries of these objects in the mid-1990's, an explosion of advancements has occurred in these fields. We now have two new classes of spectral types, along with evidence that the frequencies of substellar versus stellar companions are profoundly different. Some 190 exoplanets have been discovered during the last decade, and within the next several years hundreds of additional exoplanets will be discovered by the COROT and Kepler missions. Many of these exoplanets have been found within binary systems, leading to considerable speculation about the role of binarity in planet formation. There are even suspicions that the typical exoplanet has an orbital and cosmogonical history different from that of our own solar system planets. Both the techniques for discovery and theoretical origins for these new classes of stellar systems overlap with the interests of the traditional binary and multiple star community. ❐

The symposium S240 was dedicated to two outstanding astronomers:

Mirek J. Plavec (*1925), Ondřejov Observatory 1957–1970, then UCLA, Los Angeles; initiated studies of interacting close binaries by solving the so-called Algol paradox (left)

Charles E. Worley (1935–1997), U.S. Naval Observatory, expert on visual double stars, author of two catalogues of orbits of visual double stars (right)

A Message for the Next

When in 2003 we visited the Consulate of the Czech Republic in Sydney with some IAU EC members, the journey to the next GA IAU in Prague had already started. We knew already that it would happen since the previous GA in 2000 in Manchester. We took some first steps of the trip even before Sydney, but the main difficult slopes to the very top of the mountain were undiscovered, being hidden in the foggy future.

The next three years were interesting and full of new experiences. Long lasting marches across the plain areas of selection and contraction of the GA venue, which should be able to accommodate all the different individual events of the conference, were changing with somewhat steeper slopes of formation of the main frame of the program, and again adjusting to the capacities and equipment of the venue.

The rather difficult part is to estimate how many participants will come. This valley is already on much steeper slopes: It is an open system and you have to guess more than two years in advance the number of participants, which is the results of inflow from the top and outflow from below, always changing in proportion to different circumstances starting from the diseases, monetary situation, up to actions of terrorists. Another difficult part is to fix the registration fee more that a year in advance without solid information on the real expense and on eventual subsidy. Even now, at the time of the GA in Prague, we still do not know what the result will be.

There are nice aspects to climbing up the GA mountain: this is the preparation of the program for the individual events. It was very educational for me; I want to thank my co-chairs and other SOC members for the rather smooth and effective cooperation. Here is the part of the journey where you start seeing the new horizons, which are invisible from below. Finally, when the GA opens, you feel as you are on the very top, since all the difficult climbing is done and you may just enjoy the beautiful view of a complex, smoothly functioning organism.

I want to express my deep thanks to General Secretary of the IAU Oddbjorn Engvold and the IAU secretariat in Paris headed by Monique Orine. The GA IAU in Prague would not be possible without an excellent cooperation with all NOC and LOC members, in particular with the deputy chair of the NOC Jan Vondrak and chair LOC Cyril Ron. May I also express my thanks to Zuzana Tesarova, Monika Senderova, Zina Peckova and the outstansing staff of CBT, as well as to ICARIS.

All the best to our Brazilian colleagues for climbing up the next mountain: the GA IAU in 2009 in Rio de Janeiro.

Jan Palouš, Chair, National Organizing Committee

Tančící dům (The Dancing House)

David Ondřich

Standing on the corner of Resslova Street and Rašínovo nábřeží riverside, right against the bridge Jiráskův most, Praha's most controversial architectural creation of the 1990's rises above Vltava river. Resembling sillhouettes of two dancing people, often called Ginger & Fred (after two famous dancers, Ginger Rogers and Fred Astaire), probably the best known contemporary building in Praha indicates through its smooth curves the characteristic art style of its two architects, **Frank Gehry** and **Vlado Milunić**.

The building was constructed in the gaping hole that was left empty since 1945, when an American bomb destroyed the original residential building during air-raid on February 14, 1945. Reasons for this strike on Praha remain mostly unresolved, the most often-heard explanation is that it was related, through a lapse, to the firebombing of Dresden. After the Velvet Revolution, in the early nineties, Vlado Milunić initiated attempts to build some multi-functional building in the place, with café and library. It quickly became clear that the major problem will be to find an investor for such building. After some negotiations, the Dutch insurance company Nationale-Nederlanden supported Milunić, imposing one condition: an internationally renowned architect had to collaborate on the project. Eventually Frank Gehry became involved in the design of the building.

Work on the design began in 1992 in Geneva, the construction took place in 1994, and the building was finished in 1996. Soon after the first draft of the design was published, almost immediately public opinion became divided, and the building become most discussed architecture in Praha in the nineties. The uniqueness of the building is underscored in many details, it is said that all windows in the building have a different size one from another, all used material has its natural color – the glass, the concrete, the stainless steel. The building provides offices, luxury restaurant, and training center in its seven stories.

While some say the Dancing building is a new jewel in Praha's architecture, others are arguing that the building is kind of kitsch, reminiscent of a crushed can of beer. Anyway, it is said to be the only building in the world, where you can look under the skirt when you walk in. ❑

Vlado Milunić (*1941) – Croatia-born architect who lives in the Czech Republic and works in his own Studio VM in Praha. His works include multi-functional buildings, residential homes, and social settlements. One of his latest work is sanitary facility of a hospice in České Budějovice.

Frank Owen Gehry (*1929) – Canadian-American architect known for his sculptural approach to architecture, called the King of Pop Architecture, and also "the other Frank" (to be distinguished from Frank Lloyd Wright), recipient of numerous prizes, medals, and honorary doctorates. His most famous works include the Guggenheim Museum in Bilbao (Spain), Walt Disney concert hall in Los Angeles, the Experience Music Project in Seattle, and many others.

The next IAU General Assembly, the XXVII[th] will be held in Rio de Janeiro, Brazil, in 2009, under the auspices of the Ministry of Science and Technology and the Brazilian Astronomical Society. Our community is very honoured to host this important meeting which we hope will even more promote astronomy in the country, while at the same time will lead to a broader knowledge of the science that is done in Brazil.

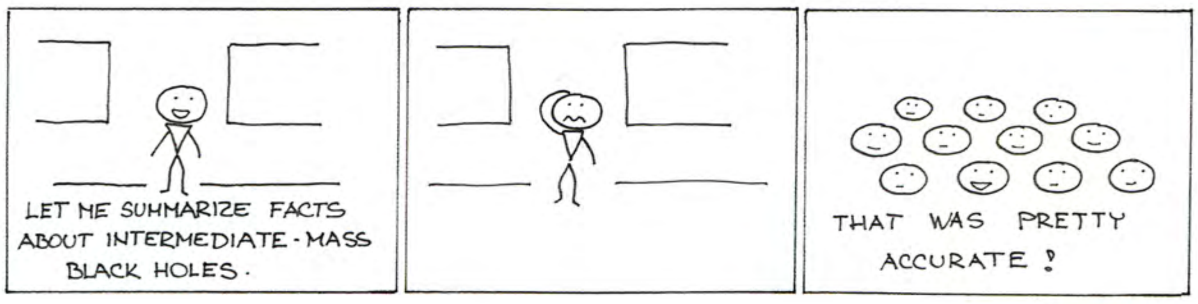
Official astronomical activities in Brazil date from 1827 with the creation of the National Observatory in Rio de Janeiro. Later on astronomy activities were begun in the state of São Paulo with the foundation of the São Paulo Observatory (renamed Instituto Astronômico e Geosífico of the University of São Paulo). Nowadays professional astronomers in Brazil are located all over the country, mainly in the capitals of the states of Minas Gerais, Rio Grande do Sul, Santa Catarina, Rio Grande do Norte, Espirito Santo and Bahia. Astronomical research has also developed in other federal institutes such as the Laboratório Nacional de Astrofísica, Instituto de Pesquisas Espaciais and Instituto Tecnológico da Aeronáutica.

Astronomical research in Brazil received a large boost forward in the 70's with the operational debut of several telescopes, including the radio-telescope at Itapetinga, and the 1.6-m National Optical Telescope. Presently we are entering into a new phase, thanks to our participation in the Gemini and SOAR consortiums. Many international meetings have been held in Brazil, among which we can mention 7 IAU Symposia and 2 IAU Latin America Regional Meetings.

Last but not least, the 2009 IAU-GA will occur in Rio de Janeiro, a city well-known by its breath-taking scenery, surrounded by a lush rain forest and awesome granite mountains, complemented by beautiful beaches and deep blue sea. The weather is hot and tropical nearly all year round and slightly cooler during the months of June through August, when typical temperatures range from a chilly 18 °C to a warmer 28 °C. In addition, it is considered one of the world's prime destinations, particularly because of its exotic and vibrant culture and the warm hospitality of the "Cariocas" (Rio people). Rio, however, is not only a tourist city. The great concentration of scientific and technological activities also characterizes Rio as one of the most important centers in Brazil and Latin America.

So, make sure you don't miss the next IAU General Assembly: Great science and a great time is waiting for you!

Daniela Lazzaro



The last brief information

- *I wish to thank all the many colleagues and friends who assisted me when I was taken ill during the Farewell Event on Wednesday evening. It appears that the combination of standing still and consuming a "glass or two" of wine at the same time (perhaps aggravated by the earlier dance-floor twirls with Virginia Trimble and Jana Tichá) caused a precipitous drop in my blood pressure. I wish to thank in particular Mary Rowan-Robinson and Jo Pounds (my "parents" for the trip to the Nemocnice), Ann Fitzsimmons, Vojislava Protitch-Benišek and NOC Chairman Jan Palouš for their concern.* Brian G. Marsden
- This is the **last issue** of the Nuncius Sidereus III. Thank you for your support and attention. Again this number is accompanied by electronic supplement available at **astro.cas.cz/nuncius** that contains summary of SPS2 by Rosa Maria Ros, article about life in Ondřejov by Shinsuke Abe, two articles by Daniel Fischer - about Pan-STARRS and about vision of European astronomy and special video "Very happy meeting" featuring J.-C. Pecker & L. Perek. Electronic supplements and PDF versions off all issues will be available at the same website at least for one year from now.

Secret diary of secret agent F.R.Og

August 25: I' m done! My identity was revealed, my secret diary was published. What am I to do? Too known to secret services, too unknown to science. Such a shame, I cannot return to my home rybníček. It seems I have to stay on Earth... sigh... Wake up, F. R. Og, there is still hope left. After all, rybníček is only a SIRGOG while Earth is a planet. Maybe science is not for you but science fiction is. Yes. I will go where no F.R.Og has gone before.

NOMENCLATURE FILLER

10. From Confusion to Clarity: Journal referees as stewards of good designations – ***Hélène R. Dickel***

When you are refereeing a paper for an astronomical journal, pay close attention to the source-nomenclature and point out any confusing designations to both the author and the editor so they may be corrected prior to publication. Without such action, non-standard designations propagate through the literature and cause headaches for other astronomers, name-resolvers, Data Centres, and the Virtual Observatory.

Recapitulation – **Save this list!**

i. Join the *Vanguard* in moving from confusion to clear designations by following these tips:
ii. Consult the *How to refer to a source or designate a new one*;
iii. Provide a *paper trail* by giving the complete designation, precise coordinates, and a reference for your source(s);
iv. Do ***not*** *shorten* an existing designation;
v. Designations are just names. If they are based on coordinates, remember to *truncate* the coordinate part. Do ***not*** *alter* an existing designation;
vi. Remember to *include* the ***J*** when appropriate.
vii. Make use of the *name resolvers* to check whether you have the correct designation for your source.
viii. *Pre-register* the acronym for your new, large, source catalog to be sure the designations conform to the IAU recommendations.
ix. Use the ***\objectname*** or ***\object*** command in your paper
x. *Safeguard* good designation practices when refereeing a paper.

Friday 25/8	**12 °C / 54 °F** morning minimum; **21 °C / 70 °F** afternoon maximum	Rain, clearing in the evening	WSW winds 4 m/s (9 mph)
Saturday 26/8	**13 °C / 55 °F** morning minimum; **20 °C / 68 °F** afternoon maximum	Cloudy with a shower	W winds 5 m/s (11 mph)
Sunday 27/8	**11 °C / 52 °F** morning minimum; **20 °C / 68 °F** afternoon maximum	Cloudy with a shower	W winds 3 m/s (7 mph)

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