Cycle 11 Abstract catalog (based on Phase I submissions)
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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9350
Title: Intergalactic HeII absorption in CSO 118 = HS 1157+3143
PI: Dieter Reimers
PI Institution: Hamburger Sternwarte

We propose to observe the HeII Gunn-Peterson effect in the z = 3 quasar CSO 118, which has been discovered in our SNAPSHOT survey to have a transparent line of sight. The aim is in particular to extend our knowledge about HeII reionization which has been observed to take place in the range z = 3.1 to z = 2.8. While existing and future FUSE observations will cover the redshift range z < 2.9, redshifts above 2.9 have been covered by HST with only 2 lines of sights.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9351
Title: Determining Hubble's Constant from Observations of Cepheids in the Host Galaxy of SN Ia 1994ae
PI: Adam Riess
PI Institution: Space Telescope Science Institute

We propose to determine the luminosity of the type Ia supernova (SN Ia) 1994ae by observing Cepheids in the host spiral galaxy NGC 3370. Modern CCD photometry has yielded an extremely tight Hubble diagram for SNe Ia with a precisely determined intercept (i.e., Delta H_0/H_0 ~ 1) measurement of the true Hubble constant is still limited by the calibration. The HST calibration of all but a few SNe Ia observed to date is significantly compromised by the systematics of photographic photometry and host galaxy extinction, as well as by the photometric uncertainties associated with WFPC2. In contrast, SN 1994ae is one of the very best-observed SNe Ia with CCD photometry. The exquisite B, V, $R, and I light curves are well-sampled beginning 10 days before maximum brightness, and they indicate little reddening. From our supernova photometry and the current provisional SN Ia calibration we would

find a distance of 30 +/- 2.1 Mpc, well within the range where ACS can accurately observe Cepheid light curves and distinguish Cepheids from nonvariable stars.

Proposal Category: GO
Scientific Category: Cosmology
ID: 9352
Title: The Deceleration Test from Treasury Type Ia Supernovae at Redshifts 1.2 to 1.6
PI: Adam Riess
PI Institution: Space Telescope Science Institute

Type Ia supernovae (SNe Ia) provide the only direct evidence for an accelerating universe, an extraordinary result that needs a rigorous test. The case for cosmic acceleration rests on the observation that SNe Ia at z ~ 0.5 are ~ 0.25 mag fainter than they would be in a universe without acceleration. A powerful and straightforward way to assess the reliability of the SN Ia measurement and the conceptual framework of its interpretation is to look for cosmic deceleration at z >= 1. This would be a clear signature of a mixed dark-matter and dark-energy universe. Systematic errors in the SN Ia result attributed to grey dust or cosmic evolution of the SN Ia peak luminosity would not show this change of sign. We have demonstrated proof of this concept with a single SN Ia, SN 1997ff at z = 1.7, found and followed by HST. The results suggest an early epoch of deceleration, but this is too important a conclusion to rest on just one object. Here we propose to use HST for observations of six SNe Ia in the range 1.2 <= z <= 1.6, that will be discovered as a byproduct from proposed Treasury programs for high-latitude ACS surveys. Six objects will provide a much firmer foundation for a conclusion that touches on important questions of fundamental physics.

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9353
Title: Direct imaging of the progenitors of massive, core-collapse supernovae
PI: Stephen Smartt
PI Institution: Institute of Astronomy

Modern supernovae searches in the nearby Universe are discovering vast numbers of SNe which have massive star progenitors (Types II, Ib and Ic). The extensive HST (and ground-based) image archives of galaxies within ~20 Mpc enables their individual bright stellar content to be resolved. As massive, evolved stars are the most luminous single objects in a galaxy, the progenitors of core-collapse SNe should be directly detectable on pre-explosion images. Within the last year we have set direct mass limits on the progenitors of two SNe Type II-P by analysing pre-explosion archive images and follow up HST exposures. We have now identified six other recent, nearby SNe which have WFPC2 archive exposures of the site taken before explosion. Additionally, our Cycle 10 SNAP program will double the WFPC2 image archive of nearby galaxies which significantly increases the chances of having multi-colour photometry of pre-explosion sites for future SNe. In this Cycle, we request time on two fronts. Firstly we require imaging of the six SNe with existing pre-explosion data in order to perform exact astrometry of the SNe positions to around 0.05". Secondly, as a follow on from our two successful Cycle 10 programs, we request ToO status for any nearby core-collapse SN which explodes during Cycle 11 and which has pre-explosion HST images. The goal of this proposal is to directly identify the progenitor stars of core-collapse SNe.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9354
Title: Saturn's Atmospheric Structure at Solstice
PI: Erich Karkoschka
PI Institution: University of Arizona

We propose to image Saturn near its solstice with the same 22 WFPC2/NICMOS filters which we imaged Saturn near its equinox about six years ago. Additionally, we propose to use the ACS/HRC with its high ultraviolet throughput and its superior spatial resolution. All filters span a wavelength range of a factor of 10, they cover methane band strengths over several orders of magnitude, and they include the center and wings of the hydrogen dipole absorption near 2 Mum. Thus, they probe many atmospheric levels over five scale heights. The 22 WFPC2/NICMOS filters have proven to provide an excellent probe of Saturn's vertical aerosol structure. The spatial resolution yields several hundred resolution elements in latitude which can be grouped

into 10-15 distinct zones. The best viewing of Saturn high southern latitudes occurs at its winter solstice which happens during Cycle 11. The three spacecraft which have visited Saturn flew by near Saturn's equinox, and Cassini will miss the solstice too. HST acquired comprehensive data of Saturn near its last equinox in 1995. The proposed observations will expand this data set to Saturn's solstice and thus provide a unique record of its seasonal variation.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9355
Title: Test of Efficient Subsampling for NIC3 by Smearing Images of Jupiter
PI: Erich Karkoschka
PI Institution: University of Arizona

Several camera/filter combinations of HST do not sample the point spread function with a sufficiently small sampling interval to retrieve the full spatial resolution possible at the wavelength of the filter. This is especially true for the NIC3 camera. Dithering observations by sub-pixels is the standard solution. However, the extra overhead time of dithering can be too long to make dithering feasible for many solar system targets where rotation or relative motion is noticeable during the overhead time. I suggest to test a new method where a single exposure yields 10 dithered images which provide sufficient subpixel information to recover the whole spatial capabilities of HST. I suggest to test this method with Jupiter imaged by eight NIC3 filters. The same eight filters of NIC1 or NIC2 provide the standard for comparison with still exposures. The method lets Jupiter smear across NIC3 by about three pixels during the whole exposure by changing HST's tracking rates. Each interval between readouts of NIC3 provides a dithered image. It is difficult to predict how well the reduced NIC3 images will compare with the still NIC1 images with respect to spatial resolution, but one orbit of HST can test the method. If this method works well, it could be applied to many other future observations.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9356

Title: SNAPSHOT survey of the Planetary Nebulae population of the Galactic Bulge
PI: Albert Zijlstra
PI Institution: Department of Physics

The spectacular structures seen in HST images of planetary nebulae (PNe) are generally accepted as originating from hydrodynamical interactions between stellar winds: the interacting-stellar wind model (ISW). Traditionally, the shaping is thought to occur after the star becomes hot enough to ionize the PN. But recent HST images indicate that the shaping may occur earlier, and the newer GISW model puts the shaping during the pre-planetary nebula evolution. The relative importance of both models is not known: GISW shaping will account for some fraction of PNe, but estimates range from 15--100 during the PN phase, especially for the youngest PNe. We here propose an HST SNAPshot survey of compact PNe in the Galactic Bulge, to test these predictions. The Bulge provides the only PNe population for which progenitor masses are known and nebular ages can be measured. In support of these HST measurements we have already measured velocity fields and emission line fluxes. The survey will give an unbiassed sampling of morphologies, and allow evolutionary sequences to be determined to test the ISW versus the GISW model. By-products of the survey will be the determination of nebular masses, diameters and filling factors. We will also obtain the White Dwarf mass distribution in the Bulge, and the initial-final mass function for low-mass stars.

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Proposal Category: SNAP
Scientific Category: Hot Stars
ID: 9357
Title: Towards a global understanding of accretion physics --, Clues from an UV spectroscopic survey of cataclysmic variables
PI: Boris T. Gaensicke
PI Institution: Universitaets-Sternwarte Goettingen

Accretion inflows and outflows are fundamental phenomena in a wide variety of astrophysical environments, such as Young Stellar Objects, galactic binaries, and AGN. Observationally, cataclysmic variables (CVs) are particularly well suited for the study of accretion processes. We propose to carry out a STIS UV spectroscopic snapshot survey of CVs that fully exploits the diagnostic

potential of these objects for our understanding of accretion physics. This survey will provide an homogenous database of accretion disc and wind outflow spectra covering a wide range of mass transfer rates and binary inclinations. We will analyse these spectra with state-of-the-art accretion disc model spectra (SYNDISK), testing our current knowledge of the accretion disc structure, and, thereby, providing new insight into the so far not well understood process of viscous dissipation. We will use our parameterised wind model PYTHON for the analysis of the radiation driven accretion disc wind spectra, assessing the fundamental question whether the mass loss rate correlates with the disc luminosity. In addition, our survey data will identify a number of systems in which the white dwarf significantly contributes to the UV flux, permitting an analysis of the impact of mass accretion on the evolution of these compact stars. This survey will at least double, if not triple, the number of high-quality accretion disc / wind outflow / accreting white dwarf spectra, and we waive our proprietary rights to permit a timely use of this database.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9359
Title: The Old Star CS 31082-001, the Age of the Universe, and the Nature of the r-process
PI: Roger Cayrel
PI Institution: Observatoire de Paris

We propose to observe the newly discovered r-process-element enhanced star, CS 31082-001 (Fe/H ~ -2.9), in order to determine abundances of the heaviest stable elements, using absorption lines that are only reachable in the near UV. This star is the only halo star for which a uranium detection has been reported, and for which the U/Th chronometer has been used to specify an age limit. In order to improve the accuracy of the age determination from U/Th we require abundance estimates of the daughter nuclides --Pb & Bi-- for which only upper limits have been obtained from ground-based observations. Such estimates will provide crucial constraints on the initial production ratio of U/Th, resulting in a more strict lower limit on the age of this star's progenitor, hence on the age of the Universe. Measurements of 3rd-peak neutron-capture elements, such as Pt, Os, Ir, and Au, all with lines in the 2400-3100 Angstrom range, will expand our knowledge of element synthesis in

the early Galaxy. Our recent ESO-VLT data indicate that the neutron-capture elements in this star exhibit different enhancements as compared with the previously known "r-process star" CS 22892-052, an apparent anomaly that must be resolved. CS 31082-001 is the ideal HST target in its class -- it is 4-times brighter than CS 22892-052, and less affected by molecular line blending. Consequently, these HST data will become the reference in all future studies of similar stars.

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Proposal Category: SNAP
Scientific Category: Galaxies
ID: 9360
Title: Paschen-alpha Imaging of a SIRTF-Selected Nearby Galaxy Sample
PI: Robert Kennicutt
PI Institution: University of Arizona

We propose to carry out a NICMOS snapshot survey in the Paschen-alpha (PAlpha) emission line and H-band of the sample of galaxies being observed at 3.5 -- 160 microns as part of SIRTF Nearby Galaxies Survey (SINGS) and a related guaranteed time survey of starburst galaxies. The PAlpha images, accessible only from HST, will be combined with groundbased HAlpha imaging to measure the extinction in the star-forming centers of these galaxies, and obtain robust, extinction-corrected maps of the massive star formation rate (SFR). The PAlpha data by themselves will provide reliable `extinction-free' SFRs, and a cross-calibration of the (dust--affected) HAlpha-- and UV--based SFRs. The PAlpha--based SFR measurements will extend the SFR-vs.-gas density law (Schmidt--law) to surface densities at least 30 times higher than what is accessible using HAlpha--based SFR measurements alone, bridging the gap between normal galaxies and IR--luminous starbursts. Furthermore, the combination of the HST PAlpha images with the SIRTF images and spectra, as well as ancillary ground--based UBVRIJHK images and GALEX UV images being obtained as part of the SINGS project, will provide a definitive study of the radiative transfer of starlight and dust heating in star--forming galaxies. The processed NICMOS images will be incorporated into the public SINGS Legacy Data Archive, to enable scores of follow-up studies by the astronomical community at large.

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Proposal Category: GO
Scientific Category: Stellar Populations

ID: 9361
Title: Searching for Primeval Galaxies: the promising case of SBS 1415+437
PI: Alessandra Aloisi
PI Institution: The Johns Hopkins University

Do primeval galaxies exist in the local Universe? The best candidates are extremely metal-poor (Z <=sssim 1/20 Z) blue compact dwarf (BCD) galaxies whose photometric and chemical properties are consistent with a stellar population younger than 100 Myr. SBS 1415+437 (Z = 1/21 Z) is the closest candidate: its proximity (d = 11.4 Mpc), detailed spectroscopic knowledge of its HII regions and low metal content, used to infer the primordial ^4He abundance, make it the best target for this investigation. We propose to take deep exposures of SBS 1415+437 with the ACS in the F814W and F606W filters. This instrument has resolution and magnitude limits allowing us to reach and resolve with the required accuracy individual stars 1 mag below the tip of the red giant branch (RGBT). If present, these stars will provide a clear sign of an old stellar population (with ages >~ 1 Gyr) and an independent distance indicator. If absent, this will unambiguously show that the system has started to form stars only recently and can be considered the first robust case of local primeval galaxy. We propose to take exposures in the F658N (HAlpha Lambda6563) and FR505N (HBeta Lambda4861) filters to study the morphology of the ionized gas through HAlpha emission and map the dust content with the HAlpha/HBeta ratio in order to solve the age-dust degeneracy of the photometry by constraining reddening effects.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9362
Title: STIS Observations of the Intrinsic UV Absorption in the Dwarf Seyfert Nucleus of NGC 4395
PI: Steven Kraemer
PI Institution: Catholic University of America

The Sd IV dwarf galaxy NGC 4395 is one of the nearest (d ~ 4.2 Mpc) and least luminous (L_bol ~ 10^41 ergs s^-1) examples of Seyfert 1 galaxies. Furthermore, it is the only known example of an active nucleus within a bulgeless, extreme late-type galaxy. This unique object possesses all of the

classic Seyfert 1 properties in miniature, including broad and narrow emission lines and highly variable X-ray emission, presumably powered by a small (few x 10^4 M) black hole. Furthermore, we have discovered evidence for blueshifted, intrinsic absorption lines in the UV (C IV LambdaLambda1548.2, 1550.8), while X-ray spectra show the presence of bound-free edges from O VII and O VIII. We propose HST/STIS echelle observations to determine the properties (ionization states, column densities, velocity coverages, covering factors) of the intrinsic UV absorbers in NGC 4395. Due to the high covering factor of its narrow-line emission, NGC 4395 offers the best case for testing the connection between the absorbers and the narrow-line region (NLR). Furthermore, an empirical comparison of its absorption properties with those in higher luminosity active galactic nuclei (AGN) will provide valuable constraints on dynamical models of the absorbers, which make predictions that are strongly dependent on luminosity and/or central black hole mass.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9363
Title: Ultra Low Surface Brightness Galaxies
PI: Nelson Caldwell
PI Institution: Smithsonian Astrophysical Observatory

Extremely low surface brightness galaxies have been detected in the Virgo cluster, which are 2 magnitudes fainter than any previously known in that cluster or even in the Local Group. ACS images of three of these should resolve stars at the giant branch tip, and allow us to determine distances, mean metal abundance of the stars, and rough ages. Confirmation of the nature of these galaxies will provide evidence that dark matter halos are pervasive in the universe, extending to galaxies with stellar densities 6 times lower than currently known. These resolved stars would be the most distant yet observed accurately by HST.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9364
Title: The Parallaxes and Proper Motions of Two Nearby Neutron Stars
PI: David Kaplan

PI Institution: California Institute of Technology

We propose to measure the parallax of two nearby neutron stars to the highest possible level of accuracy, 0.5 mas. The primary goal is to determine the neutron-star radius at infinity with better than 1km precision, and therewith obtain a direct constraint on the equation of state of matter at supra-nuclear density. The required flux and temperature determinations are easiest for the so-called isolated or radio-quiet neutron stars because of their apparently completely thermal spectrum. We argue that the importance of the possible results warrants a study to the best possible level of the best possible sources, and request 24 orbits for the two brightest isolated neutron stars, RX~J1856.5$-$3754 and RX~J0720.4$-$3125. We will also determine whether the enigmatic RX~J0720.4$-$3125 is an old magnetar or an accreting source, based on its luminosity and proper motion.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9365
Title: Spectroscopy in the Inner Region of the 3C 48 Host Galaxy
PI: Alan Stockton
PI Institution: Institute for Astronomy

As far as we are aware, there is only one host galaxy continuum feature in a luminous QSO that is bright enough for practical STIS spectroscopy: this is the bright peak ~1" NE of the well-known quasar 3C 48. This feature (3C 48A) is enigmatic, with an apparently distorted morphology. It may be the distended nuclear region of one of the galaxies in this major merger. It might, instead, possibly be the result of interaction of the compact-steep spectrum radio jet with ambient material; but this seems unlikely because the correspondence between the radio and optical morphologies is not very good. We also know from ground-based and HST imaging that 3C 48A is overwhelmingly dominated by continuum radiation, not line emission, and the colors seem to be inconsistent with stars as young as the probable age of the radio jet. Our previous high S/N ground-based spectroscopy of 3C 48 covered most regions of host galaxy beyond ~2" from the QSO. From this spectroscopy and spectral synthesis models, we have been able to determine mean ages for recent

starbursts in various parts of the host galaxy as well as the velocity field of the stars. By tying the proposed STIS spectroscopy of 3C 48A to our existing spectroscopy of the host galaxy, together with archival PC images, we expect to be able to determine the nature of this unusual inner structure and its role in the evolutionary history of 3C 48.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9366
Title: H_2 Imaging of Proto-Planetary Nebulae: Probing the Dynamics and Morphology
PI: Bruce Hrivnak
PI Institution: Valparaiso University

H_2 emission provides an excellent probe of the physical conditions in planetary nebulae (PNs) and also in proto-planetary nebulae (PPNs), objects in transition between the asymptotic giant branch (AGB) and PN phases. It is thought that the shaping of the PN occurs when a fast wind interacts with the remnant of the AGB progenitor during the PPN phase. The study of shock-excited H_2 in PPNs will allow us to study this process. We request HST/NICMOS H_2 and complementary K and H broad-band images of 13 PPNs with a range of spectral types of the central star. We presently have very high-resolution (~100,000) H_2 spectra for 7 of these, which we will use with the high-resolution images to study the velocity structure of the fast wind. We will also explore the relationship between the presence of H_2 and a bipolar shape for the nebula, as has been found in PNs. However, the role of the equatorial torus is expected to be different in these two cases, and in the PPNs it is expected to collimate the wind rather than shield the molecules. Thus the H_2 in the PPNs is expected at the ends of the lobes rather than in the torus. Radiatively-excited H_2 emission appears to be common in PPNs with central stars of B spectral types; this appears to be a transitional stage in the evolution of the H_2 in the nebula which these images will help us to better understand.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9367
Title: Unique Opportunities to Search for the Optical

Counterparts to High-Z Damped LyAlpha Systems
PI: Cyril Hazard
PI Institution: University of Pittsburgh

The galaxies responsible for damped LyAlpha absorption in QSO spectra are difficult to observe against the strong background QSO emission. We propose to detect even low luminosity galaxies associated with QSO absorption line systems out to redshifts as high as z = 1.8 by observing them in the shadow cast by an even higher redshift damped LyAlpha absorber. As a result the galaxy will be observed free of contamination by the background AGN and of the uncertainties which arise when image processing techniques are required to remove the AGN emission. We propose two approaches. In the first we will attempt to detect a z = 1.8634 system seen in the optical spectrum of a high-z BL Lac object in the shadow of two higher-redshift systems seen in the same optical spectrum. In the second only the higher redshift shadowing LyAlpha system is seen in the optical spectrum and the presence of the lower-redshift systems at z = 0.713 and z = 1.0466 are inferred from the presence of strong MgII, SiII and FeII absorption lines.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9368
Title: Spectrophotometry of Procyon A: Testing Metal Opacities
PI: Carlos Allende-Prieto
PI Institution: University of Texas

Metal opacity shapes the near-UV spectrum of late-type stars, which dominate intermediate and old stellar populations. Learning the details of how metal opacity blocks the light in this spectral region is of capital importance to understanding the energy balance in the atmosphere of these stars and, ultimately, building reliable models to interpret observed fluxes. The model atmospheres most used in spectroscopic analyses of individual stars and at the core of population synthesis codes are based on calculations of photoionization cross-sections from the 70's, when better data have been available for a long time. We implement modern cross-sections in our calculations of synthetic fluxes and model atmospheres, but the models need to be confronted with observations. Detailed absolute fluxes for stars of known effective temperatures and angular diameters can constrain the opacities

directly from observations. So far, such high-quality UV observations are available only for the Sun, and this leaves some room for ambiguity between line and continuum opacity. Observations with identical quality are possible with STIS for a second nearby late-type star: Procyon A. This star is indeed the only relatively unevolved late-type star for which an extremely precise determination of its angular diameter is available.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9369
Title: A Direct Test for Dust-driven Wind Physics
PI: Alex Lobel
PI Institution: Smithsonian Astrophysical Observatory

We propose to perform with STIS a critical test of the physical mechanism of wind acceleration by dust drag in cool stars. Spatially resolved spectra of the circumstellar environment of Alpha Ori (M2 Iab) will directly test if radiation pressure onto dust grains provides the momentum that causes the high mass-loss rates (up to 10^-6 M_odot yr^-1) observed in asymptotic giant branch and red supergiant stars. Terminal gas outflow velocities of 13-14 km,s^-1 are observed in Betelgeuse's circumstellar dust shell. However, the smaller chromospheric outflow velocities (below 6 km,s^-1), point to an extended region in the circumstellar environment where the wind accelerates. Stellar wind theory suggests radiation pressure onto dust grains as the driving mechanism that drags the gas outflow to these high terminal velocities. Dynamic radiative transport calculations that fit the star's 9.7 Mum silicate dust emission indicate that this wind accelerating region is located between 0.78" and ~3". We propose to use STIS to obtain a high-resolution spatial and spectral raster scan across this region. These data can only be obtained for this unique nearby supergiant with the exceptional capabilities of the STIS. An increase of the observed asymmetry of the self-absorbed Mg ii h line (which forms in an expanding gas shell) with distance from the star, will directly confirm (or reject) the theory of dust-driven wind acceleration in cool stars.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9370

Title: The Optical Counterpart of an Ultraluminous X-Ray Source
PI: Joel Bregman
PI Institution: University of Michigan

Ultraluminous X-ray sources (ULX) are non-nuclear sources in normal disk galaxies that are second only to AGNs in point-source luminosity. These enigmatic objects are thought to be intermediate mass black holes (10^3 -10^4 M), and this can be verified by a direct mass determination, which requires knowledge of the mass of the secondary and the period of the binary system. The first step in determining the mass of ULXs is the optical identification of the secondary and for the ULX in NGC 5204, the optical counterpart is a compact blue object at V = 20.3. This counterpart, with M _V=-8.7, is either a very tight cluster of O stars, a megastar, or a background BL\Lac object. We can distinguish between these possibilities with UV spectroscopy and imaging, and for the first time, determine the mass of the secondary in a ULX system.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9371
Title: A Definitive Test of the Nature of SN 1961V: Supernova vs. Luminous Blue Variable
PI: You-Hua Chu
PI Institution: University of Illinois

The most massive stars evolve into luminous blue variables (LBVs) and end their lives in supernovae (SNe). Studies of the late evolutionary stages of the most massive stars will aid our understanding of the chemical enrichment and stellar energy feedback in a galaxy. The final days of the most massive stars can be confusing, as LBV outbursts often mimic SN explosions. The nature of three SNe have been called into question: SN 1954J and SN 1997bs are most likely LBVs, but the nature of SN 1961V is still debatable. SN 1961V is a peculiar SN in a complex environment. Its decaying nonthermal radio emission is consistent with a radio supernova, while its optical light curve and initial expansion velocity suggest an LBV outburst similar to Eta Car. HST WFC1 images could not conclusively identify the LBV. SN 1961V is either a bona fide SN related to exotic hypernovae or failed supernovae, or a superluminous LBV that is the most massive star known. We request STIS observations,

necessary for their high spatial resolution, to use emission lines to identify LBV candidates and to discriminate among LBV ejecta nebula, decades-old SN/SNR, and mature SNR that are present within 1" from SN 1961V. We further request WFPC2 images in V, R, and I bands to search for red stars similar to Eta Car and to study the stellar populations in the vicinity of SN 1961V.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9373
Title: Reaching the Horizontal Branch in NGC 5128: Deepest Probe of a Giant Elliptical
PI: Marina Rejkuba
PI Institution: ESO

NGC 5128 is the nearest easily observable giant E galaxy, and is a unique testing ground for stellar population models. Previous WFPC2 photometry of its halo red-giant stars has shown that they are predominantly metal-rich (<~nglem/H rangle ~eq -0.45), but little is yet known about their spread in ages. With the ACS/WFC camera, we propose to obtain deep (V,I) photometry down to the level of its horizontal-branch population, with the goal of refining the metallicity distribution function and gaining quantitative information on its age distribution. This will be unique data for any giant elliptical galaxy and will provide major new input to population synthesis techniques for such galaxies.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9374
Title: The FUV Flux Irradiating the Surfaces of Protostellar Disks
PI: Edwin Bergin
PI Institution: Smithsonian Astrophysical Observatory

We propose to use STIS to determine the Far-Ultraviolet (FUV) radiation field in 3 proto-planetary disk systems. These systems: LkCa 15, GM Aur, and DM Tau, are among a handful of sources that can be subjected to detailed chemical studies with the current generation of millimeter-wave instruments. Such studies have found that the disks have a rich molecular chemistry, which

appears to be controlled by the FUV radiation field (Qi 2001; Dutrey et al 1997; Kastner et al 1997). These observations will allow, for the first time, a firm characterization of the FUV radiation field impinging on the surfaces of circumstellar disks. Knowledge of the FUV field for each object will allow for theoretical chemical models to be created specific to each object and compared to observations. Since these objects will remain, for some time, the main templates for chemical studies of extra-solar disks this project will provide the real UV data required to push theory forward. Given that molecules are excellent probes of their environment, the new information will place better constraints on the virtually unknown vertical structure of proto-planetary disks. This project is unique in scope and will increase our limited understanding of disk chemical evolution, but also improve our knowledge of uncertain physical processes, such as the possible dissipation of outer disks by photo-evaporation and on the timescales of dust grain growth.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9375
Title: The Host Galaxies of Time Delay Lenses: , An Independent Route to the Hubble Constant
PI: Christopher Kochanek
PI Institution: Smithsonian Astrophysical Observatory

Because of its importance in setting the distance scale, the time scale and in estimating cosmological parameters from the CMB, astronomy needs an estimate of the Hubble constant independent of the local distance scale and its systematic problems. This can be achieved using gravitational lenses with time delay measurements given enough constraints on the gravitational potential of the lens. We will use deep NICMOS observations of the lensed quasar host galaxies in 7 gravitational lenses with time delay measurements to obtain the necessary constraints, determine the dark matter distribution and estimate H_0. Analysis of the existing images and the well-developed theory for analyzing Einstein ring images of host galaxies suggest the new data will break the familiar degeneracies between lens mass distributions and the Hubble constant. We also request 30 ksec Chandra ACIS images for each of the 2 systems lacking them (B1608+656 and B1600+434) to measure the mass in nearby or surrounding groups and clusters.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9376
Title: A Powerful Double Radio Source from a Spiral Galaxy
PI: William C Keel
PI Institution: University of Alabama

We have identified a powerful double radio source whose host galaxy is clearly a disk system, and probably a spiral. This violates a very general pattern among radio-loud AGN, and understanding this object may thus shed light on the differences among expressions of nuclear activity between spiral and elliptical hosts. We propose a set of images to verify the spiral morphology, seek evidence of a nuclear ionization cone and jet/ISM interactions via narrow-band imaging, and search for optical synchrotron emission from the radio jet. These data would show whether indeed this (already strong) case indeed represents a spiral galaxy producing a powerful double source, what kind of spiral, and how both the nuclear and extended activity compare to those in typical elliptical host systems.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9377
Title: NICMOS Imaging Polarimetry of Compact Proto-Planetary Nebula Dust Shells
PI: Toshiya Ueta
PI Institution: University of Illinois at Urbana-Champaign

We propose to resolve the structure of 4 proto-planetary nebula (PPN) dust shells by means of imaging polarimetry using NICMOS. In our previous WFPC2 imaging surveys, these PPNs show a compact elliptical nebulosity (of radius 0arcs5 to 2") with a prominently visible central star. These PPNs appear to be members of a distinct class of PPNs, compared with bipolar nebulae in which an optically thick dust lane obscures the central star. Based on our previous mid-IR PPN survey, these PPNs are expected to host an optically thin, edge-on toroidal dust shell as evidence for the intrinsic axisymmetry of the PPN shells caused by an equatorially-enhanced mass loss during the asymptotic giant branch phase. These PPNs, however, are too compact to be fully resolved at mid-IR even with large ground-based telescopes because mid-IR images are

diffraction-limited. The unique ability of imaging polarimetry at unprecedented high resolution makes HST the only instrument capable of isolating dust-scattered, polarized light from the shell and directly resolving the structure of compact PPNs without being hindered by the dominantly bright central star. These observations and following analysis with our radiative transfer code will provide crucial clues to the physical mechanism that drives the axisymmetric mass loss from originally spherically symmetric stars, which still remains to be one of the fundamental problems in astrophysics.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9378
Title: Galaxy Dynamics at Very Large Radius using LyAlpha Absorption Lines
PI: Stephanie Cote
PI Institution: Herzberg Institute of Astrophysics, NRC

We propose to investigate the outer dynamics of the nearby spiral galaxy NGC1398 at very large galactocentric radii by using the kinematical information from Ly-alpha absorption lines in the spectra of 3 background UV-bright objects (two Seyferts 1 and one QSO). It is a unique opportunity to have 3 UV-bright objects surrounding one single isolated spiral galaxy, and this will enable us to measure its disk rotation up to radii several times greater than what is possible in HI at 21cm, since the UV-bright objects lie at projected distances of ~ 80 to 270 kpc. At these large radii we expect to observe the turn down from flat rotation, and be able to determine the size of the dark matter halo and hence measure the total mass and mass-to-light ratio of a spiral galaxy.

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Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9379
Title: Near Ultraviolet Imaging of Seyfert Galaxies: Understanding the Starburst-AGN Connection
PI: Henrique Schmitt
PI Institution: National Radio Astronomy Observatory

We propose a near-UV snapshot survey of 101 Seyfert galaxies using ACS/HRC and the filter F330W, a configuration which is optimal to detect faint star forming regions around their nuclei. These images will complement optical and near-IR images available in the HST archive, thus providing a panchromatic atlas of the inner regions of active galaxies, which we will use to study the starburst-AGN connection. The main goals of this proposal are: (1) Determine the frequency of circumnuclear starbursts in Seyferts, down to levels which cannot be observed from the ground; (2) characterize the observational (fluxes, colors, structure, sizes) and intrinsic (luminosities, masses, ages, global star-formation rate) properties of these clusters; (3) derive the luminosity functions of young star clusters around the nucleus of Seyferts and compare these results with those from normal and starburst galaxies to determine their survival rate close to the AGN; (4) address questions about the relation between AGNs and starbursts, like the possible connection between the masses and luminosities of black holes and starbursts, and the implications for the evolution of the black holes and their host galaxy bulges. By adding UV images to the existing optical and near-IR ones, this project will create an extremely valuable database for astronomers with a broad range of scientific interests, from the properties of the AGN to the properties of their host galaxies.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9380
Title: Determination of Extragalactic Extinction Laws at UV wavelengths with gravitationally-lensed QSOs
PI: Evencio Mediavilla
PI Institution: Instituto de Astrofisica de Canarias

The study of extragalactic extinction laws is of paramount importance as it plays a key role in galaxy evolution, as well as for the determination of the cosmological parameters, for example using SNe. We propose to utilize a new technique based on flux measurements of gravitationally lensed, multiply-imaged QSOs to estimate the extinction law of the lensing galaxy. Here we propose a pilot project of STIS observations of the doubly-imaged QSO SBS 0909+532 with a separation between images of 1.1 arcsec. Our goal would be to determine the extinction law at UV wavelengths in the lens galaxy (z=0.83). In a study that is the first of this type, we have obtained ground-based

Integral Field Spectroscopy (IFS) data in the region of the 2175Angstrom PAH bump for SBS 0909+532. Our proposed observations will allow us to complete and extend the extinction law farther in the UV. Such observations would be impossible from the ground because they extend too far into the UV, and HST is the only instrument available with the necessary spatial resolution and sensitivity.

Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9381
Title: The Birth of a Dwarf Galaxy: The Star Formation History of the Tidal Arm near NGC 3077.
PI: Fabian Walter
PI Institution: California Institute of Technology

The extended tidal arm of neutral gas near NGC 3077 (member of the M 81 triplet, D~3.8 Mpc) is one of the most dramatic features of its kind seen in the local universe; it was created by an interaction with M 81 some 3*10^8 yr ago. It is one of the few tidal systems where atomic (HI) and molecular (CO) gas as well as low--level star formation (HAlpha) is detected over an area of several kpc^2. This tidal complex is believed to be in the process of forming a tidal dwarf galaxy. Using the unique resolving capability of the Hubble Space Telescope (HST) and the wide--field imaging capabilities of the ACS, we propose to perform a stellar population study of this tidally created system. By combining various methods to recover the star formation history (e.g., using the luminosity function of the core Helium burning stars) we will 1) measure the SF history since closest encounter with M 81, 2) determine whether older stars are present in the tidal feature or not and 3) investigate propagation of star formation across the tidal feature. This can be done with F435W, F555W, and F814W imaging using HST's ACS with only 8 orbits. We will, for the first time, recover the star formation history and the distribution of stars within a tidally created system. This study will also shed light on the creation and evolution of other tidal dwarf galaxies which are typically much further away.

Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9382

Title: A Large Targeted Survey for z < 1.6 Damped Lyman Alpha Lines in SDSS QSO MgII-FeII Systems
PI: Sandhya Rao
PI Institution: University of Pittsburgh

We have searched the first public release of SDSS QSO spectra for low-z (z < 1.65) metal absorption lines and found over 200 large rest equivalent width MgII-FeII systems. Previously, we empirically showed that such systems are good tracers of large neutral gas columns, with ~50% being classical damped Lyman alpha (DLA) systems (N2 * 10^20 cm^-2). Here we propose to follow up a well-defined subset of 79 of them to search for DLAs with 0.47 < z < 1.60. Only QSOs brighter than 19 were selected. The QSO emission and DLA absorption redshifts were constrained to virtually eliminate data loss due to intervening Lyman limit absorption. Consequently, we expect to discover ~40 new DLAs, which is a three-fold increase in this redshift interval. This will significantly improve our earlier low-z DLA statistical results on their incidence, cosmological mass density, and N2 distribution. The results will also allow us to better quantify the empirical DLA -- metal-line correlation. With this improved understanding, the need for follow-up UV spectroscopy will lessen and, with the release of the final database of SDSS QSO spectra (an ~25-fold increase), the number of low-z DLAs could be increased arbitrarily. Thus, the power of the large and statistically-sound SDSS database in combination with a proven technique for finding low-z DLAs will, over the next few years, essentially solve the problem of making an accurate determination of the cosmic evolution of the neutral gas component down to z ~0.4.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9383
Title: Probing the Grains Responsible for Extinction Using Small Magellanic Cloud Sightlines
PI: Karl Gordon
PI Institution: University of Arizona

Small Magellanic Cloud sightlines have the greatest potential to relate specific interstellar extinction features to distinct grain properties. The

reasons for this are 1) prominent extinction features such as the 2175 Angstrom bump and the far-ultraviolet rise vary among SMC targets and 2) grain types may be very different from those in the Galaxy. Specifically, Welty et al. (2001) recently identified an SMC sightline that contains dust, but no silicate grains. Silicates are a dominant source of extinction in all dust models; the SMC may be the only location where the importance of silicates can be verified or disproven. We propose to explore the relationship between grain types and extinction toward 2 SMC stars with very different extinction curves; AzV 18 lacks a 2175 Angstrom bump and has a strong far-UV rise while the extinction curve towards the SMC star AzV 456 has a prominent 2175 Angstrom bump and a much weaker far-UV rise. We will compare the interstellar abundances of atoms that are prevalent in silicates (Si, Mg, Fe) toward these 2 stars and use the results to constrain dust extinction models. These SMC observations, which can only be obtained with STIS, are the only direct way to probe the connection between grain types/environments and extinction. The results from this study will be useful for modeling and understanding all regions that contain dust (AGN, circumstellar disks, star formation regions, etc.).

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Proposal Category: GO
Scientific Category: Solar System
ID: 9384
Title: Ozone, Condensates, and Dust in the Martian Atmosphere
PI: Philip James
PI Institution: University of Toledo

We propose to utilize the unique UV capabilities of STIS and ACS/HRC in order to study the spatial and seasonal variations in ozone, condensates, and dust in the Martian atmosphere. The data obtained will be critical in addressing recent breakthroughs in understanding the basic radiative, transport, and microphysical processes that provide for both long-term and short-term balance within the global Mars climate system. The proposal includes both Cycle 11 & 12 observations in order to span the classic dust storm season on Mars and provide the first good opportunity for HST to synoptically observe a dusty atmosphere on the planet. The UV observations will complement broad-band visible and IR observations that will be made during the Mars Global Surveyor Extended Mission and will provide support for the future UV observations of MARCI on the 2005 Mars Reconnaissance Orbiter.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9385
Title: Spatially-resolved polarimetry of Titan
PI: Mark Lemmon
PI Institution: Texas A&M University

Titan's stratospheric haze not only hides the surface in visible light, it also traces the progress of Titan's seasons and controls the solar flux into the troposphere. Since 1994, we have monitored the seasonal context on Titan. We propose to continue this program and, with ACS and NICMOS, we can add important new measurements. Spacecraft polarimetry has suggested small particles, while high phase angle images suggest larger particles. Two types of models have been used to successfully explain the discrepancy: larger particles held above smaller particles by Titan's atmospheric dynamics; or a more uniform distribution of fluffy aggregate aerosols. The distinction is not just a question of large particles vs. small, it is about the process that governs the evolution of Titan's haze. New constraints have been slow in coming. Titan's disk integrated polarization near zero-phase angle does not distinguish the models. Intensity alone does not distinguish the models. We have the opportunity to make a set of observations that can test the models. We propose to obtain disk-resolved polarization measurements from 0.2 to 2 micron. We will use this information to develop a set of constraints on the type of particles in Titan's stratosphere. We will also continue our program of monitoring seasonal change on Titan, and use the data sets to provide context to the Cassini mission.
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Proposal Category: SNAP
Scientific Category: Solar System
ID: 9386
Title: Infrared Photometry of a Statistically Significant Sample of KBOs
PI: Keith Noll
PI Institution: Space Telescope Science Institute

While the discovery rate of Kuiper Belt objects is accelerating, the physical study of this new region of the solar system has been slowed by a lack of

basic astrophysical data. Photometric observations of the majority of the more than 400 known KBOs and Centaurs are rudimentary and incomplete, particularly in the infrared. The multicolor optical-infrared photometry that exists for a small subset of KBOs often shows significant discrepancies between observations by different observers. Their intrinsic faintness puts them at the practical limits of ground-based systems. In July 2001 we began what will be the largest uniform sample of optical photometry of KBOs with a WFPC2 SNAPSHOT program that will perform accurate photometry at V, R, and I on a sample of up to 150 targets. We seek to greatly enhance the value of this survey by obtaining J and H photometry on the same sample using NICMOS. Combined optical and infrared broad band photometry is a far more powerful tool for physical studies than is either alone. Our sample includes objects that will be observed at thermal infrared wavelengths by SIRTF and will be used with those data to derive the first accurate diameters, albedos, and surface properties for a large sample of KBOs.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9387
Title: The Natural Occulting Disk and Host Galaxy of the Red BAL Quasar FIRST J1556+3517
PI: Michael Brotherton
PI Institution: NOAO

We propose an innovative imaging observation of the host galaxy of the red, broad absorption line (BAL) quasar FIRST J1556+3517. This object is already noteworthy as being the first radio-loud BAL quasar, and moreover a member of the very rare class of "Fe-LoBAL" quasars. FIRST J1556+3517 also has the unique property (out of some 60+ BALQSOs) of having unpolarized BAL troughs wider than the bandpass of the linear ramp filter of ACS. This unpolarized trough light most likely arises from stars comprising the host galaxy of FIRST J1556+3517. In this special quasar exists a natural occulting disk -- the BAL outflow -- and the opportunity to image a quasar host galaxy at high redshift without the complications of separating out the quasar. Red low-ionization BAL quasars like FIRST J1556+3517 have been hypothesized to be young merger products with high accretion rates and active star formation, perhaps representing a key evolutionary state in the lifetime of massive galaxies.

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Proposal Category: SNAP
Scientific Category: Solar System
ID: 9391
Title: High-Resolution Imaging of Pluto's Surface
PI: Marc W. Buie
PI Institution: Lowell Observatory

We propose a series of SNAPSHOT observations with the ACS/HRC from which we will derive a two-color global map of Pluto's surface. We will image Pluto at F435W and F555W, wavelengths that have been extensively studied from the ground over the past 50 years. The maps will provide albedoes with accurate error determinations down to 52degrees South latitude. These observations will provide a second epoch of HST mapping of the active surface of Pluto as it continues to receed from the Sun and will provide an important context for other detailed studies of Pluto. These observations take advantage of the observational and scheduling constraints imposed on SNAPSHOT observations to collect an extremely high-quality dataset from which to construct surface maps. This proposal has an associated INNOVATIVE proposal component that will map Pluto at longer wavelengths using super-resolution techniques to provide constraints on the methane frost distribution. The combination of albedo maps (from this program) and methane maps (from the INNOVATIVE program) will provide the strongest observational constraints yet on the complex problem of volatile frost transport on Pluto.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9392
Title: The Ancient Stars of M32
PI: Mario Mateo
PI Institution: University of Michigan

The question of whether the dwarf elliptical galaxy M32 contains a population of truly ancient stars has remained unsettled for decades. We recently used HST/WFPC2 to identify for the first time a population of RR Lyr stars in this galaxy. Since these stars are known only to be present in stellar populations older than 8-10 Gyr, we contend that M32 does possess an old stellar component and certainly cannot be comprised of only intermediate-age (~ 5 Gyr) stars as has been frequently suggested in the literature. Our earlier

observations were insufficient to determine even the most basic photometric properties of these stars. Nor could we use the data to identify independent evidence of the old population that could help constrain just what fraction of the galaxy's stars are ancient. We propose new HST/ACS observations to (a) get periods and luminosities of the previously observed RR Lyr stars, (b) search for additional RR Lyr stars in a significantly larger volume of M32, and (c) obtain ultra-deep 2-color photometry to study the ancient main-sequence turnoff region of that galaxy directly, (d) look for radial population gradients in M32, both among the RR Lyr/Horizontal Branch and main-sequence populations, (e) compare the M31/M32 old populations in terms of metallicity spread, and (f) use the RR Lyr stars to precisely determine the relative and possibly the absolute distances of M32 and M31's halo.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9393
Title: Dynamics and Cloud Structure of Neptune
PI: Lawrence Sromovsky
PI Institution: University of Wisconsin-Madison

A 4-year gap in detailed observation of one of the most active planets in our solar system can be ended by our proposed multispectral WFPC2 imaging of Neptune over a period of 4.5 Neptune rotations. Our objectives are (1) mapping the two-dimensional distribution of Neptune's discrete cloud features and zonal bands with sufficiently dense longitudinal sampling to insure detection of any Great Dark Spot, or other major storm system, up to 35degrees N, (2) characterizing Neptune's circulation by tracking cloud motions during two densely sampled half-rotations that ensure reliable target identification, (3) measuring cloud evolution and more accurate tracking of non-evolving features by sparse imaging at earlier and later rotations relative to the two densely sampled primary sequences, and (4) characterizing the vertical structure of clouds by imaging with filters that select varying amounts of Rayleigh scattering and methane absorption and by capturing their center-to-limb variations during intensely sampled feature transits. To enhance the characterization of cloud structure we will also propose coordinated groundbased IRTF and Keck observations, both using adaptive optics at near IR wavelengths that provide access to additional strong methane and hydrogen absorption bands. The proposed HST observations use the same filters as in

1996 and 1998, as well as additional filters, permitting detailed comparisons with previous observations.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9394
Title: Halo Microlensing: Direct Detection of a Microlens
PI: Kem Cook
PI Institution: Lawrence Livermore National Lab

The MACHO project has recently released 5.7 years of LMC microlensing data, presenting 17 candidate microlensing events. These events suggest an 8-50 MACHO halo and a most likely MACHO mass of 0.2-0.9 M. However, nearly a decade after the first reported event (Alcock et al. 1993) there still remains much debate about the nature and location of the lensing matter. MACHO has also obtained WFPC2 follow-up data of the microlensing source stars, to date we have observed 16 candidates with HST. The WFPC2 follow-up data of MACHO event LMC-5 provided unexpected insight into the nature of the lens. This image revealed a very red, faint object displaced by 0.134^ from the source star which may well be the first direct detection of the dark matter component (lens) of a microlensing event. A second epoch of WFPC2 photometry will verify the proper motion of the lens and allow for a parallax measurement of its distance.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9395
Title: Is Bulge Formation Still Going-On? , An ACS Survey of Pseudo-Bulges
PI: C. Marcella Carollo
PI Institution: Columbia University

vspace*-0.2truecm Pseudo-bulges, i.e., bulges with an exponential light profile, have been unveiled in the centers of many intermediate-type disks. Their structural similarity with the disks provides support to theoretical scenarios in which bulges may form due to secular evolution processes within the host disks. If at play, these processes would likely be active throughout a large fraction of cosmic history down to our days: `young' bulges should

exist

Proposal Category: GO
Scientific Category: Galaxies
ID: 9396
Title: Young Cluster Systems in Two Super-Gas-Rich , Mergers: Arp 220 and Arp 299
PI: Christine Wilson
PI Institution: McMaster University

Massive young star clusters are found in large numbers within the mergers of massive, gas-rich disk galaxies. The most outstanding and well studied case is in the nearby merging Antennae pair (Whitmore and colleagues). These systems may give us our best hope to see directly the way in which globular clusters formed in the uniquely gas-rich protogalactic era of the universe. But, even in the Antennae, the many hundreds of young clusters have a median mass which is still 5 to 10 times smaller than the characteristic mass ~ 3 * 10^5 M that characterizes normal, old-halo globular clusters. To find objects closer to the mass range of "true" protoglobular clusters, we need mergers which are still more gas-rich than the Antennae and in which the gas has been collected into more massive GMCs. Two excellent candidates are Arp 220 and Arp 299, both of which are undergoing extremely high star formation rates and have > 10^10 M of molecular hydrogen compressed into their central few kpc. With the ACS High Resolution Camera we will obtain deep UBVI imaging of the active central regions of these galaxies, allowing us to trace the luminosities, colors, masses, and ages of the young star clusters within them.

Proposal Category: GO
Scientific Category: Galaxies
ID: 9397
Title: Unmasking the optical counterpart to the ultraluminous X-ray source, NGC 5204 X-1
PI: Timothy Roberts
PI Institution: University of Leicester

We propose HST/STIS near- and far-UV spectroscopy of the recently identified optical counterpart to the ultraluminous X-ray source (ULX) NGC 5204 X-1

(Roberts et al. 2001). This source has since been resolved with HST/WFPC2 (data just public) into two sources with V magnitudes of 20.5 and 22.0 respectively, separated by 0.4 arcsecs (10 pc at the distance of NGC 5204). Existing low resolution ground-based data are dominated by the brighter source, the spectrum of which appears blue and apparently featureless, consistent with either (i) at least one unusually bright supergiant O star (M_v<=-7.8), or (ii) an O star association, although the data cannot presently rule out the presence of a background BL-Lac object. Ground-based data cannot unambiguously type both the new sources, due to their small separation (there are no bright nearby stars necessary for adaptive optics), and the absence of strong features in the optical spectra of O stars. By observing with the HST/STIS far- and near-UV MAMA we will obtain spectra in a waveband rich in O star absorption features, with sufficient S/N (10--15) and resolution (0.6-1.5Angstrom) to identify the sources, and reveal the nature of the first optical counterpart to an ULX. This result will be an important step in determining whether most ULX systems contain a new, 10^2 - 10^3 M `intermediate-mass' class of black hole.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9398
Title: Understanding Irradiation and Dipping Behaviour in Low Mass X-ray Binaries
PI: Robert Hynes
PI Institution: University of Southampton

It is now clear that X-ray irradiation is the driving force behind many of the observed properties of accretion discs on a huge range of scales from Galactic interacting binaries to AGN. However to study the detailed physics of this process requires the accessible timescales and geometrical constraints afforded by Galactic low mass X-ray binaries (LMXBs). The ideal object for this study is EXO 0748--676 (UY Vol) because of its high inclination and full spectrum of LMXB phenomenology: type I bursts, dips and total eclipses. It is also remarkable as it was designated a transient on its discovery in 1985, but remains X-ray active to this day, thereby providing a potential unifying link between persistent and transient systems. Its present high state is likely maintained by X-ray heating; hence we can learn about a disk strongly influenced by irradiation. STIS TIMETAG observations in the far-UV will

eclipse map continuum and emission lines; examine obscuration by the likely thick disk rim; and search for the UV signatures of dips and bursts. This provides an unprecedented range of techniques with which to probe the structure of an irradiated accretion disk and further our understanding of the irradiation of accretion flows in general.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9399
Title: Insights into Elliptical Galaxy Formation from HST Imaging of Shell Galaxies
PI: David Carter
PI Institution: Liverpool John Moores University

We propose to use ACS to carry out an imaging survey of the cores of shell galaxies. Key to understanding several aspects of shell formation is to determine how far in do shells exist. Photometric detection from the ground is limited by seeing and sampling to radii of at best R ~ 10 - 15 arcsec. In velocity maps derived from high spatial resolution long-slit and integral-field ground-based spectra we have found shell-like features with distinct kinematics in several shell galaxy cores (R ~ 3 - 5 arcsec ~ 1 kpc). Hence we believe that shells may extend further in than previously known. HST provides the spatial resolution and sampling needed to map out shells in the pronounced surface brightness gradients of elliptical galaxy cores. The data will allow us to detect and map inner shells, to measure their colors, to establish their dynamics with the help of ground-based kinematics, to compare the inner surface brightness profiles of shell and non-shell ellipticals, and to measure the mass and distribution of the dust. Where shells are found, combined spatial and velocity information will establish the orbital structure of shell-producing merger debris on the basis of data, and will allow useful checks of the models for formation of shell systems in early-type galaxies.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9400
Title: Are there young galaxies in the local universe: the age of the blue compact dwarf galaxy I Zw 18
PI: Trinh Xuan Thuan

PI Institution: Astronomy Department, University of Virginia

The question of whether there exists young galaxies in the local universe is important for cosmology. Cold Dark matter models predict that low-mass galaxies could still be forming at the present epoch. In the hierarchical model of galaxy formation, large galaxies result from the merging of smaller structures. These primordial building-block galaxies are too faint and small to be studied at high redshifts, while we stand a much better chance of understanding them if we can find some local examples. One of the best candidates for being a young nearby galaxy forming stars for the first time at the present epoch, is the blue compact dwarf (BCD) galaxy I Zw 18 because of its extremely low heavy element content (2 We propose to obtain deep V and I ACS images of I Zw 18. Our goal is to detect or put limits on the red giant branch (RGB) stellar population in this galaxy. If RGB stars are not detected, then we can set an upper limit for the age of I Zw 18 to be less than ~ 1 Gyr. If they are detected, I Zw 18 is not young, and the RGB tip can be used to derive its distance and set limits on the metallicity of the pregalactic gas.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9401
Title: The ACS Virgo Cluster Survey
PI: Patrick Cote
PI Institution: Rutgers, The State University of New Jersey

We propose the most comprehensive imaging survey to date of low-redshift, early-type galaxies. Our goal is to exploit the exceptional imaging capabilities of the ACS by acquiring deep images --- in the SDSS g^ and z^ bandpasses --- for 163 E, S0, dE, dE,N and dS0 galaxies in Virgo, the nearest rich cluster. This extraordinary dataset would likely constitute one of the principal legacies of HST, and would have widespread applications for many diverse areas of astrophysics. Our immediate scientific objectives are threefold: (1) measure metallicities, ages and radii for the many thousands of globular clusters (GCs) in these galaxies, and use this information to derive the protogalactic mass spectrum of each galaxy; (2) measure the central luminosity and color profile of each galaxy, and use this information to carry out a completely independent test of the merging hierarchy inferred from the GCs, with the aid of N-body codes that simulate the merger of galaxies

containing massive black holes; and (3) calibrate the z^ -band SBF method, measure Virgo's 3-D structure, and carry out the definitive study of the GC luminosity function's precision as a standard candle. Our proposed Virgo Cluster Survey will yield a database of unprecedented depth, precision and uniformity, and will enable us to study the record of galaxy and cluster formation in a level of detail which will never be possible with more distant systems.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9402
Title: A NICMOS Study of Merging Nuclei in the Toomre Sequence: Finding Order Amid Chaos
PI: Seppo Laine
PI Institution: Space Telescope Science Institute

The final death throes of merging spiral galaxy nuclei are hidden behind dusty maelstroms of colliding gas clouds and glaring star formation activity. The dynamically important centers of mass can only be uncovered by imaging at NIR wavelengths and with the high spatial resolution of HST. We propose a near-infrared imaging program to inspect the physical processes of merging at spatial scales of ~100 pc. The Toomre Sequence provides the best sample of merging galaxies for such a study, because it has been studied extensively from the ground, and the global properties are well understood. Our previous Cycle 9 WFPC2 images of the nuclei have revealed a wealth of information on star forming activity and dust, but based on those data alone it is impossible to determine the locations of the current centers of mass. Determining the mass centers and stellar density profiles is important for understanding both the kinematics and the dynamical evolution of the nuclei, and the formation of nuclear density cusps in galaxies. We propose J, H and K band imaging of the nuclei in early and intermediate stage mergers in the Toomre Sequence. Because of the much reduced effect of dust extinction, the near-infrared images are also optimally suited to searches for nuclear rings and bars around the nuclei. Combined with our ongoing Cycle 9 program, these data will provide a detailed view of the structure and evolution of a sequence of merger nuclei.

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Proposal Category: GO
Scientific Category: Galaxies

ID: 9403
Title: Galaxy Formation in Nearby Voids: Reflections of the High-Redshift Universe?
PI: Norman Grogin
PI Institution: Space Telescope Science Institute

vspace-.075inGalaxy voids, at the opposite environmental extreme from galaxy clusters, present an ideal yet under-utilized laboratory for probing the relationship between environment and the mechanisms of galaxy formation and evolution. Mounting evidence from ground-based surveys of galaxies in voids suggests that they have formed comparatively recently (and many are still forming) from gas-rich, low velocity-dispersion surroundings: a picture in accordance with models of hierarchical structure formation. The superior resolution of HST allows us to verify this hypothesis with the first directed HST imaging survey of void galaxies (VGs). With HST/ACS deep imaging of a subset of E+S0 VGs from our earlier ground-based imaging and spectroscopic survey, we will investigate their globular cluster (GC) systems to unravel their formation history and to constrain the age of their oldest GCs. The HST resolution of their inner light profiles will reveal whether they have significantly under-massive central black holes, as might be expected if these are young systems. HST will also detect the presence of morphological fine structure indicative of recent merger activity. If the present-day VGs truly reflect the early stages of galaxy formation which occurred at higher redshift outside the voids, their proximity enables the investigation of galaxy formation processes in much greater detail than possible from observations of the high-redshift field, even with NGST.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9404
Title: Spatially Resolved Stellar Populations in Two z~2.5 Gravitational Arcs
PI: David Thompson
PI Institution: California Institute of Technology

We propose to use ACS and NICMOS to observe two gravitationally lensed galaxies at z~2.5. We will combine these data with existing archival and scheduled GTO observation to make spatially resolved maps of color, dust, and

age for these objects. We will then use these maps to study the properties of individual star-forming regions within these galaxies, to search for an underlying old stellar population between the knots of active star formation, and to test previous HST and ground-based studies which have hitherto relied on spatially unresolved colors alone to study stellar population in high redshift star-forming galaxies. Ours will be the first study of stellar populations of Lyman Break Galaxies on sub-galactic scales, and will give important new insights into the way that these high-z galaxies are assembled.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9405
Title: The Origin of Gamma-Ray Bursts
PI: Andrew Fruchter
PI Institution: Space Telescope Science Institute

The rapid and accurate localization of gamma-ray bursts (GRBs) promised by a working HETE-2 during the coming year may well revolutionize our ability to study these enigmatic, highly luminous transients. We propose a program of HST and Chandra observations to capitalize on this extraordinary opportunity. We will perform some of the most stringent tests yet of the standard model, in which GRBs represent collimated relativistic outflows from collapsing massive stars. NICMOS imaging and STIS CCD spectroscopy will detect broad atomic features of supernovae underlying GRB optical transients, at luminosities more than three times fainter than SN 1998bw. UV, optical, and X-ray spectroscopy will be used to study the local ISM around the GRB. Chandra spectroscopy will investigate whether the GRB X-ray lines are from metals freshly ripped from the stellar core by the GRB. HST and CTIO infra-red imaging of the GRBs and their hosts will be used to determine whether `dark' bursts are the product of unusually strong local extinction; imaging studies may for the first time locate the hosts of `short' GRBs. Our early polarimetry and late-time broadband imaging will further test physical models of the relativistic blast wave that produces the bright GRB afterglow, and will provide unique insight into the influence of the GRB environment on the afterglow.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9406

Title: GD 552: The Oldest Cataclysmic Variable
PI: Joseph Patterson
PI Institution: Department of Astronomy, Columbia University

A terrible puzzle has long afflicted our understanding of the evolution of cataclysmic variables (CVs). Angular momentum loss should grind the binaries down to orbital periods near 1.3 hr in 2 -- 4 Gyr, and then slowly drive them apart again. Most CVs should therefore have undergone ``period bounce" long ago, and be evolving towards longer period, with secondaries << 0.1 M. However, not a single post-bounce CV has been conclusively identified. Where are the old CVs hiding? They should be hard to find since they're probably faint intrinsically, and because their accretion rates may be too low to trigger dwarf-nova eruptions. One, and only one, good candidate appears in the Lowell proper-motion lists. This is GD 552: noneruptive, possessing a light secondary, and probably the least luminous CV yet found (M_V >~ +12.5). An accurate FGS parallax will establish whether this object (clearly very nearby) signifies a large population of very old CVs. A 1200 -- 10000 Angstrom spectrum would likely represent a pure steady-state low-M disk (the only one known), and the FUV region would provide a measurement of T_ eff in a white dwarf long after eruptive heating episodes have stopped. The UV observation obviously requires HST, and efforts to measure the parallax from the ground are thwarted by a background star 0^ .7 distant.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9407
Title: FGS Astrometry of a Star Hosting an Extrasolar Planet: The Mass of Upsilon Andromedae d
PI: G. Fritz Benedict
PI Institution: University of Texas

We propose observations with HST/FGS to determine the astrometric elements (perturbation orbit semimajor axis and inclination) produced by the outermost extra-solar planet orbiting the F8V star Upsilon Andromedae. These observations will permit us to determine the actual mass of the planet by providing the presently unknown sin i factor intrinsic to the radial velocity method which discovered this object. An inclination, i = 30degrees, within the range of one very low precision determination using reanalyzed HIPPARCOS

intermediate data products, would produce the observed radial velocity amplitude, K = 66 ms with a companion mass of ~8 M_Jupiter. Such a mass would induce in Upsilon Andromedae a perturbation semi-major axis, Alpha = 0arcs0012, easily within the reach of HST/FGS fringe tracking astrometry. The proposed observations will yield a planetary mass, rather than, as previous investigations have done, only suggest a planetary mass companion.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9408
Title: Calibrating the Mass-Luminosity Relation at the End of the Main Sequence
PI: Todd Henry
PI Institution: Georgia State University

We propose to use HST-FGS1R to calibrate the mass-luminosity relation (MLR) for stars less massive than 0.2 Msun, with special emphasis on objects near the stellar/brown dwarf border. Our goals are to determine M_V values to 0.05 magnitude, masses to 5 than double the number of objects with masses determined to be less than 0.20 Msun. This program uses the combination of HST-FGS3/FGS1R at optical wavelengths and ground-based infrared interferometry to examine nearby, subarcsecond binary systems. The high precision measurements with HST-FGS3/FGS1R (to 1 mas in the separations) for these faint targets (V = 10--15) simply cannot be equaled by any ground based technique. As a result of these measurements, we are deriving high quality luminosities and masses for the components in the observed systems, and characterizing their spectral energy distributions from 0.5 to 2.2 Mum. Several of the objects included have M < 0.1 Msun, placing them at the very end of the stellar main sequence. Three of the targets are brown dwarf candidates, including the current low mass record holder, GJ 1245C, with a mass of 0.062 +/- 0.004 Msun. The payoff of this proposal is high because all 10 of the systems selected have already been resolved with HST-FGS3/FGS1R during Cycles 5--10 and contain most of the reddest objects for which masses can be determined.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9409

Title: The Evolution of Globular Cluster Systems in Merger Remnants
PI: Paul Goudfrooij
PI Institution: Space Telescope Science Insititute

Mergers seem to have played a major role in determining the shapes and dynamics of elliptical galaxies. A few galactic mergers still occur and offer valuable clues to past evolutionary processes. Globular clusters formed during mergers are crucial probes for age-dating such events, and help shed light on the process of cluster formation and evolution. With young globulars in ongoing mergers now well studied, we propose to make deep ACS observations of intermediate-age globular clusters in three bona fide ellipticals: NGC 1316, 1700, and 3610. These ellipticals all have line-strength indices, UBV colors, and fine structure indicative of their being 2 -- 4 Gyr old merger remnants. Past HST+WFPC2 observations have shown that they also possess significant numbers of intermediate-age globulars as part of their bimodal cluster populations. We plan to use the new HST+ACS observations to (1) measure high-accuracy BVI colors for clusters up to ~ 2 -- 3 mag fainter than ever before, (2) use these colors to separate first- and second-generation clusters, and (3) determine the luminosity functions of the two kinds of clusters to 3 -- 4 mag past the peak for old globulars. Deep dithered BVI images form a crucial part of our observing strategy. This program should permit---for the first time---to directly detect the predicted evolution of the cluster luminosity function from a power law for young clusters to the Gaussian distribution typical of old globulars.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9410
Title: The Galactic Warm Ionized Medium: the First Direct Measures of its Ionization and Abundances
PI: J. Christopher Howk
PI Institution: The Johns Hopkins University

The warm ionized medium (WIM) is the dominant gaseous component of the Galactic halo and represents an important sink of the radiative and kinetic energy output of stars and supernovae, though the source of its ionization remains unknown. We will use STIS spectroscopy of the post-AGB stars ROB

162 and ZNG 1 in the globular clusters NGC 6397 and Messier 5 to measure directly the abundances and ionization states of several key metals in the Galactic WIM. These sight lines are unique: because the two clusters also contain pulsars with published radio dispersion measurements, these are the only sight lines for which we can derive the column densities of both HI,em and ionH2, as well as the columns of multiple ionization stages of the important metals S, P, and Fe. We will use the proposed STIS observations with existing FUSE data to derive the total gas-phase abundances of S, P, and Fe for the material along these sight lines with no ionization uncertainties. We will directly measure the ionization fractions of S and P in the WIM. We will also infer the dust content of the WIM. Our study of the ionization state and dust content of the WIM will provide the best yet constraints for models of this gas. Our work will also provide the best constraint for the fundamental "cosmic" reference abundance (averaged over these sight lines) of the undepleted elements S and P.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9411
Title: Morphologies and faint neighbors of z=4.5 Lyman Alpha Emitting Galaxies
PI: Sangeeta Malhotra
PI Institution: The Johns Hopkins University

We propose to image one ACS field containing four spectroscopically confirmed Ly-alpha emitters at z=4.5 in restframe UV and a narrowband filter containing the Ly-alpha line. These observations will (A) Reveal the morphology of the four spectroscopically confirmed sources. The high equivalent widths of the Ly-alpha line in these four galaxies in particular and this population in general cannot be explained without invoking one or more of: extreme youth of the stellar population, zero metallicity, energetic winds or type II quasars. Comparison of morphologies in the line and continuum would help favor or rule out some of these possibilties. This would also tell us whether the star-formation is uniformly distributed or centrally concentrated or concentrated but in many clumps? Proximity of these galaxies (average projected physical separation of 200 kpc, with one pair 30 kpc apart) also makes interactions likely. (B) Extend the luminosity function of Ly-alpha sources by 2.5 magnitudes due to better spatial resolution of HST and sensitivity of ACS. We

will be able to detect sources with line flux of ~eq 2 * 10^-18 ergcm2s over 11.5 sq-arcmins (~ 100 sources). This complements the LALA (Large Area Lyman Alpha) survey which covers 1/3 square-degree to a line sensitivity of ~eq 2 * 10^-17. Thus we get a picture of this patch of young universe in two ways: statistics of faint galaxies and morphologies of relatively bright ones.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9412
Title: The Physical Parameters of the Hottest, Most Luminous Stars as a Function of Metallicity
PI: Philip Massey
PI Institution: Lowell Observatory

We have obtained excellent, new ground-based blue optical and HAlpha spectra of a sample of very early-type stars in the Magellanic Clouds in order to measure their physical properties, for comparison with the extensive data that exists for higher-metallicity Galactic stars. Our aim is to understand how effective temperatures depend upon metallicity (necessary in determining IMFs), and to explore the astrophysically interesting regime of stars of extreme temperatures, masses, and luminosities. In order to do this, we need to measure the stellar wind terminal velocities for our stars, necessary to constrain the stellar models. These can only be measured with STIS/FUV on HST. In addition, we will obtain higher spatial resolution data on the HAlpha line for several stars for which nebular contamination is significant in our ground-based data. We also include several R136 stars with excellent STIS/CCD data but which lack UV line measures. These new HST data will provide important information about the strengths of stellar winds at extreme luminosities and the calibration of the Wind Momentum-Luminosity Relationship at lower metallicities. This proposal was highly rated in Cycle 9, but only 4 snapshots were obtained. We have completed the analysis of these plus additional data from the archives, but need spectra of the remaining objects if we are to answer the questions we pose.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9413
Title: Infrared Spectroscopy of z > 5 QSOs

PI: Michael Corbin
PI Institution: Space Telescope Science Institute

The elemental abundances of high-redshift QSOs provide an important probe of the early universe. The ratio of iron to alpha-process elements observed in all QSOs to z ~ 4.5 in particular suggests that the gas has been enriched by Type Ia supernovae. Evidence of such enrichment in turn helps constrain the ages and masses of QSO host galaxies, which can be compared with the predictions of galaxy formation models under currently popular LambdaCDM cosmologies. With these motivations we propose to obtain NICMOS grism spectra of five bright (z^* ~ 19) QSOs from z = 5.03 to z = 6.28 recently discovered in the Sloan Digital Sky Survey. Our main goal will be to measure the strength of the broad Fe II emission complex at 2500 Angstrom (rest) in these very young (~ 1 Gyr) objects, if it is present at all. With the exception of two objects at z = 5.99 and z = 6.28 it will also be possible to measure the Mg II Lambda2800 line. These measurements are impossible from the ground because of the atmospheric absorption bands in the near infrared. The Fe II / Mg II emission ratio will in turn be used to estimate the relative abundance of these elements in the objects, and to compare these abundances to those of QSOs at lower redshifts. The infrared brightness of the objects and reduced sky background will allow high signal-to-noise ratio spectra to be obtained in relatively short integration times (1 orbit per object).

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9414
Title: Resolved halo stellar populations in the Milky Way analogue edge-on galaxy NGC 891
PI: Richard de Grijs
PI Institution: University of Cambridge

The stellar halo is one of the fundamental building blocks of galaxies. Although ground-based surface photometry has shown that stellar halos exist in some spiral galaxies, with colours similar to those of the main disk, little else is known about their stellar populations. We propose to carry out a systematic study of the halo regions of the edge-on galaxy NGC 891. The resulting deep colour-magnitude diagrams will be used to infer the mean metallicity of the bright halo giants at the tip of the RGB and below, and its

metallicity spread. Recently, Zepf et al. (2000) inferred that the halo metallicity of NGC 5907 has to be low (Fe/H <=sssim -1.7), with a large stellar M/L ratio. We will be able to test this hypothesis with much better and deeper data. If we can confirm a similar halo composition in NGC 891, this would imply that the Milky Way halo might be very different from external halos. Since galactic halos trace the history of galaxy formation, this will have important implications for our understanding of galactic evolution on cosmological time scales. Using these survey data, we will be able to conclusively distinguish between genuine halo objects and merger remnants, without having to assume a scenario in which the halo field population is fully mixed. Surprisingly, such studies have not yet been undertaken for NGC 891, although the galaxy is a prime Milky Way analogue.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9415
Title: Is the Compact HVC Toward Ton S210 Remnant Debris from the Formation of the Local Group?
PI: Kenneth Sembach
PI Institution: Space Telescope Science Institute

There is a fortuitous coincidence in the positions of the quasar Ton S210 and a compact ionH1 high velocity cloud on the sky that makes it possible to test the hypothesis that such clouds are extragalactic entities located in the Local Group. The HVC toward Ton S210 has ionH1 21 cm emission properties similar to those of isolated compact HVCs suspected of being Local Group clouds. It has recently been detected in ionO6 absorption by FUSE, which suggests that either there is hot gas associated with the collapse of the cloud or that the HVC is interacting with a hot, tenuous Galactic halo or Local Group medium. We propose to observe the HVC in absorption against the smooth ultraviolet continuum of Ton S210 with HST/STIS. To answer the question posed in the proposal title, we will combine the STIS observation with extant FUSE and ionH1 21 cm data to determine the metallicity, elemental abundances, and ionization properties of the HVC. To date, such information has been difficult to obtain for all but a few HVCs, and this is the first time such an opportunity has been available for a compact HVC. The results of this study will bear directly upon the issues of the locations of compact HVCs, the ionization conditions of HVCs detected in ionO6 absorption, and the

possible influence HVCs might have on the chemical evolution of galaxies.

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9417
Title: New Clues to the Origin of the Extreme Helium Stars
PI: David L. Lambert
PI Institution: University of Texas at Austin

The extreme helium stars (EHes) are H-poor supergiants whose origins are not yet understood despite thorough analyses of optical spectra. This proposal seeks STIS echelle spectra for 7 stars from which novel data on their chemical compositions will be obtained to pin down key abundances. First, even the EHe's initial metallicity is uncertain; certain abundance ratios - e.g., Ca/S, Ti/S, and Fe/S - imply alterations of surface abundances among elements from Na to Ni resulting from fractionation or diffusive separation, possibly the result of winnowing of dust grains from gas. The zinc abundance measurable only from UV spectra will be a powerful clue to the true metallicity because it is known not to be removed by such winnowing. Second, elements affected by the s-process, the last of the major nucleosynthetic processes for which surface abundances are unknown for EHes, will be studied. The new abundances will be used to probe the evolutionary origins of these peculiar stars by comparisons with theoretical scenarios involving a merger of white dwarfs or a final He-shell flash in a low mass white dwarf, and with observed abundances for R Coronae Borealis stars that would seem to be close relatives of the EHes. Spectrophotometric observations of EHes obtained with GO 8603 will give accurate estimates of effective temperature and surface gravity that will be used in our abundance determinations.

Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9418
Title: The Sight-line toward PHL 1811: A Rare Chance to Probe a Lyman Limit System at Very Low Redshift
PI: Edward Jenkins
PI Institution: Princeton University Observatory

The sight-line to an extraordinarily bright quasar, PHL 1811, penetrates four

gas systems at z(abs) < z(em)=0.192. One of them is a Lyman limit system (LLS: N(H I)>10^17.5, cm^-2) at z(abs)=0.08088 which is especially well suited for a study of atomic abundances, local density, and ionization state. We propose to obtain a STIS E140M spectrum with moderately good S/N so that we can measure absorption features that will permit the determinations of overall metallicity of the system, its nucleosynthetic ratios Alpha/Fe and Alpha/N, the fractions and kinematics of ionized gas, and the amount of gas-phase element depletions caused by dust. The LLS should be close enough for us to identify an associated galaxy, but to be sure we do not miss one very close to the quasar in projection, we plan to supplement our spectrum with a short-exposure ACS HRC image of the quasar's immediate surroundings.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9419
Title: The Complete IMF of a Massive Young Cluster
PI: Jesus Maiz-Apellaniz
PI Institution: Space Telescope Science Institute

We propose to use the large improvement in sensitivity and wide-field resolution provided by ACS to obtain for the first time the complete ~ 0.1 M to ~ 100 M IMF of a single massive young cluster. We will obtain BVI + nebular deep (V ~ 27) WFC photometry of six cluster and one background pointings and we will use the auto-parallel capacity of ACS to simultaneously acquire deep NUV+U+V photometry of selected regions in the cluster. Special care has been taken to treat all the complications which arise in the reduction of data for the purpose of calculating the IMF of a young cluster. We have chosen as our object of study N11 in the LMC because it arguably provides the best combination of stellar mass range (> 40 O stars, with several O3 stars), spatial resolution (1 WFC pixel = 0.0125 pc), low extinction (E(B-V) ~ 0.1), crowding, background confusion, and nebular contamination in comparison to other Galactic and Local Group clusters. It also has the advantage of having two separate regions, one which has already stopped forming stars and another one which is still forming them, thus allowing us to search for differences in the IMF between those two cases. The ACS data will be complemented with IR ground-based observations obtained using Gemini South, for which we already have been awarded time.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9420
Title: Intensive Coverage of the Eta Carinae Event in 2003
PI: Kris Davidson
PI Institution: University of Minnesota

For a variety of reasons, HST can provide a very special and unique data set when Eta Car experiences its next spectroscopic event in mid-2003. Explaining the phenomenon is only part of the motivation. This star and its ejecta have unique characteristics that make them important for several branches of astrophysics; and when a spectroscopic event occurs, it's like varying the parameters in an experiment (or rather, set of experiments). The 2003 event will be the last chance in the forseeable future to obtain such a data set. Eta Carinae has extreme parameters; it is mysterious in surprisingly basic ways; and HST/STIS can gather useful data on it at a terrific rate. As we explain below, the proposed data set will be valuable in several independent ways: It will help solve a specific set of current problems, it will constitute a large and unique archival data base for both stellar and nebular astrophysics, and it will be well-suited for educational uses.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9421
Title: UV Observations of Hubble Flow Type Ia Supernovae
PI: Peter Nugent
PI Institution: Lawrence Berkeley National Laboratory

Two independent research groups have presented compelling evidence for an accelerating universe from the observation of high-redshift Type Ia supernovae (SNe Ia). These findings have such important ramifications for cosmology that every effort must be made to thoroughly test the calibrated standard candles on which they are based, improve upon our understanding of the underlying physics of the SN Ia explosion mechanism and attempt to constrain or determine their progenitors. Here we propose to obtain STIS UV spectra of five Hubble Flow SNe Ia. The spectra will be taken at weekly intervals over a range in time starting slightly before maximum light and extending to +30 days. These observations will accomplish the following three goals: (1) Calibration of the

rest frame UV light curves of SNe Ia and an assessment of their potential use as distance indicators through UV light curve shape analyses. (2) Improvement in our understanding of the physics of SNe Ia, metallicity/evolutionary effects and correlations between peak brightness and UV spectral features. (3) Calibration of the SNe Ia previously observed by HST at high-redshift. For z > 0.8 SNe Ia discovered by the Supernova Cosmology Project, the High-Z Supernovae Search Team and future HST discovered SNe Ia (like SN 1997ff found in the HDF) this data is crucial for proper cross-filter K-corrections and calibration of the supernova photometry.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9422
Title: Masses of AGB stars
PI: Kenneth Hinkle
PI Institution: NOAO

There are few AGB stars with known masses. We have undertaken a program to measure spectroscopic orbits for about 50 binary systems containing M giants and typically white dwarfs. These are all single lined systems so the spectroscopic orbit of the M giant results in a mass function, m_2^3sin^3i / (m_1 + m_2)^2, for the secondary. Under special conditions, it is possible to undertake a simple observation that allows a solution for the masses. By measuring the angular separation at the epoch of greatest elongation of a zero eccentricity, eclipsing system (i.e. a system with a known inclination) m_1+m_2 can be determined, hence allowing the masses to be solved. Parallaxes indicate that there are two systems that can be resolved using HST/ACS. We propose to carry out this observation.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9423
Title: NICMOS Observations of Transient Infrared Jets in the Galactic Microquasar GRS1915+105
PI: Stephen Eikenberry
PI Institution: Cornell University

We propose to use HST/NICMOS to make Target of Opportunity observations of the

galactic microquasar GRS1915+105. This source possesses transient radio jets which exhibit apparent superluminal motions, and resolved infrared emission from these jets has been observed in GRS1915+105 (Sams, Eckart, and Sunyaev, 1996; Eikenberry and Fazio, 1996). Because the jet ejection events are correlated with X-ray outbursts, we will use observations of X-ray flares with the Rossi X-Ray Timing Explorer to trigger the HST observations. We will then monitor GRS1915+105 periodically with NICMOS, obtaining relative astrometry, photometry, polarimetry, and grism spectroscopy of the jets and the parent object. These observations will allow us to greatly increase our understanding of the jets' radiative mechanisms and physical conditions, and their evolution with time. We require the capabilities of HST and NICMOS due to the small angular separations between the jets and the parent object (increasing from ~ 0.1 to ~ 0.8 arcsec over the span of the TOO observations) and the high reddening towards GRS1915+105 (A_V ~ 30 mag).

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9424
Title: Externally Illuminated Circumstellar Material in the , Young Nebulous Cluster NGC 2024
PI: Karl Stapelfeldt
PI Institution: Jet Propulsion Laboratory

HST imaging of the Orion M42 H II region has revealed circumstellar emission and absorption regions ("proplyds") with sizes comparable to those expected for protoplanetary disks. Disk morphology is directly observed in a dozen cases; disk photoevaporation is now the working model to explain the ionized rims seen at more than 100 Trapezium cluster stars. Are the Trapezium circumstances unique? Different cluster ages, densities, and UV radiation fields may strongly affect proplyd characteristics. To address these questions, we have searched for proplyds in several other young nebulous clusters, and found that the embedded infrared cluster associated with the NGC 2024 H II region has a large group of strong proplyd candidates. Our WFPC2 images of the optically visible edge of the cluster have identified an HAlpha proplyd aligned toward a B0 star. Our VLA 3.6 cm maps show compact ionization regions coincident with 20 members of the infrared cluster - a result similar to the original VLA proplyd discovery in M42 by Churchwell (1987). These results strongly indicate that infrared emission line imaging of selected

cluster members should reveal many objects similar to the those in M42. We propose NIC2 Paschen Alpha and continuum imaging of fourteen of the NGC 2024 compact VLA sources. Our goal is to resolve and characterize their circumstellar structures, and compare them with those seen in M42.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9425
Title: The Great Observatories Origins Deep Survey: Imaging with ACS
PI: Mauro Giavalisco
PI Institution: Space Telescope Science Institute

We propose a Treasury program of ACS imaging as part of the Great Observatories Origins Deep Survey (GOODS), covering 320(square)', or 32* the area of the two original WFPC2 HDFs, to within 0.5--0.8 mag of their depth in four ACS bands, BViz. The two GOODS fields, the Hubble Deep Field North and Chandra Deep Field South, are the premier deep survey areas from X--ray to radio wavelengths. ACS data will provide unique angular resolution, sensitivity, and wavelength coverage to close the gap between the deepest Chandra and SIRTF observations. Supported by extensive imaging and spectroscopy from the VLT, Keck, Subaru, NOAO, Gemini, VLA, JCMT, and other facilities, the combined GOODS data set will make it possible to map the evolution of the Hubble sequence with redshift, reconstruct the history of galaxy mass assembly, star formation and nuclear activity from the epoch of reionization to the present, trace the growth of density perturbations via cosmic shear, and, with properly phased z--band observations, detect ~ 12 Type Ia supernovae at 1.2<z<1.8 to test the cosmic acceleration and the presence of dark energy. All HST, SIRTF, Chandra, and supporting GOODS data are non--proprietary, with science--quality images and catalogs released on a timescale of months. This will constitute the deepest, largest, and most uniform panchromatic data set ever assembled to study the distant universe.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9426
Title: Jupiter's Ring Plane Crossing of 2002--2003
PI: Mark Showalter

PI Institution: NASA Ames Research Center

Jupiter's ring system consists of three components: the main band, the vertically-extended inner halo and the exterior gossamer rings. Each component illustrates aspects of dust dynamics within Jupiter's inclined magnetic field and its strong plasma environment. We will image all three components with ACS during an unusual, extended period of edge-on viewing, December 2002 through February 2003. For faint planetary rings, this geometry improves the signal-to-noise ratio considerably and permits an unambiguous decoupling of radial and vertical structure. We will also revisit the main ring briefly in Cycle 12, when it is open by 2^degrees, in order to examine its poorly understood longitudinal asymmetry. Although the Jovian rings have been examined by four spacecraft and from the ground, we are still lacking in a systematic set of data that can distinguish between the ring's prominent dust population and its embedded macroscopic source bodies. We also do not know the size distribution of dust with sufficient accuracy to test rival theories of ring origin. Observations of the system at a range of wavelengths and phase angles with ACS will finally make this determination possible. Coordinated observations at the W. M. Keck Telescope will extend our wavelength coverage well into the IRNull.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9427
Title: Globular Cluster Systems in Supergiant E Galaxies
PI: William Harris
PI Institution: McMaster University

The most populous globular cluster systems are found in the giant ellipticals at the centers of galaxy clusters (Brightest Cluster Galaxies). It is among this BCG class that the characteristics of globular cluster systems display their widest range in metallicity distribution and specific frequency and thus confront galaxy formation models with their most varied challenges. Were these systems built primarily by early in situ conversion of gas clouds, by later mergers, or by ongoing accretions of dwarfs? Their extensive halo cluster systems contain many clues to these relic events. BCGs are the biggest and rarest type of galaxy, and to date the globular clusters in only two BCGs (M87, NGC 1399) are well studied. The ACS camera now brings many more such

systems within reach. We propose to image the globular cluster systems in 13 BCGs in the distance regime cz ~eq 2000 - 5000 km s^-1. With deep (B,I) exposures we will measure the globular cluster metallicity distribution functions, specific frequency, radial distributions, and luminosity distributions, as well as correlations among these quantities. This work will be the first comprehensive, homogeneous deep survey of globular clusters in BCGs. The superior area and sensitivity of ACS will yield a gain of a factor of eight over previous WFPC2 studies for sample size and metallicity discrimination.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9428
Title: SINS: The Supernova INtensive Study--Cycle 11
PI: Robert Kirshner
PI Institution: Harvard College Observatory

Supernovae create the chemical history of the Universe, energize the interstellar gas, form the spine of the extragalactic distance scale, and provide the only direct evidence for an accelerating universe. SINS is a program to study supernovae, near and far. HST is the perfect match in field and scale for spatially-resolved observations of SN 1987A. There, a violent encounter between the fast-moving debris and the stationary inner ring is well underway. Monitoring this interaction will help solve the riddles of stellar evolution posed by the enigmatic three-ring system of SN 1987A. Our UV observations of Ly-Alpha emission reveal a remarkable reverse shock that provides a unique laboratory for studying fast shocks and a powerful tool for dissecting the structure of the vanished star. For more distant events, we propose Target-of-Opportunity observations. In addition to one bright new supernova in Cycle 11 discovered by any search at any time, we propose to discover two supernovae for study in the ultraviolet at times specificed in advance, using the Lick Observatory Supernova Search. SINS will study the historic SN 1987A, explore UV emission from supernovae, and press late-time observations of supernovae into uncharted territory of infrared catastrophes, light echos, and stellar remnants.

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Proposal Category: GO
Scientific Category: Hot Stars

ID: 9429
Title: Observing the Next Nearby Supernova
PI: John Bahcall
PI Institution: Institute for Advanced Study

If a neutrino-producing supernova (SN) explodes in the Galaxy, the Large or Small Magellanic Clouds, or a close member of the Local Group, it will be detected first by operating neutrino experiments: Super-Kamiokande, SNO, MACRO, and AMANDA. The supernova neutrino early warning system will notify photon observers throughout the world within an hour of the neutrino detection. Although the per-year probability of observing a neutrino SN (within 100 kpc) is small, the detection would be importantly scientifically and of widespread interest. The optical counterpart could be much brighter than normal extragalactic SNe. A bright nearby supernova detected by other means would also be of great interest and should activate this proposal. We propose unique STIS ultraviolet spectroscopic observations to measure the principal metallic lines, and hence the composition, velocity, and physical state, of the outermost atmosphere of the exploded star. In addition, we propose narrow- and broad-band imaging to provide information about the stellar environment and early morphology unobtainable from the ground. The data, especially images, will be valuable for public outreach and will be released immediately by NASA.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9430
Title: The Role of Jets in Shaping Planetary Nebulae
PI: Susan Trammell
PI Institution: University of North Carolina at Charlotte

Recent CO observations of several planetary nebulae (PN) suggest that collimated outflows may play a crucial role in the early shaping of these objects. The idea that jets may be the primary driver of the early development of some PN represents a major shift in thinking about the evolution of these objects. In the past, the role of jets has been considered secondary to the interacting winds scenario, the standard model of PN formation. We propose to use the unique capabilities of HST to access the importance of collimated outflows in the development of the young PN PK166-06degrees1 (AFGL 618). We

have chosen PK166-06degrees1 for this study because it is in the early stages of PN formation - the time during which jets would have the greatest impact on PN development. We propose to use STIS, ACS, and NICMOS to characterize the collimated outflows present in PK166-06degrees1. The goals of this study are: 1) to characterize the interaction of the jets with the surrounding AGB shell by determining the physical conditions in the outflows and the interaction regions, 2) to determine the structure of the surrounding AGB shell using deep optical imaging, 3) to investigate the origin of the collimated outflows by examining the central regions of the nebula. We require both the stability and high spatial resolution capabilities of HST for this project because we will be investigating the detailed structure of compact regions (<~ 1").

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9431
Title: Composition and history of Beta Pictoris-like circumstellar gaseous disks
PI: Alain Lecavelier des Etangs
PI Institution: Institut d'Astrophysique de Paris

The gaseous parts of dust disks surrounding main sequence stars have been the subject of intense investigations since 1985. The origin of the gas content was a puzzle around such evolved stars. But the spectral signatures of Beta Pictoris led to the explanation that the gas is probably produced by the evaporation of many small bodies (see Lecavelier et al., 2001, Nature 412, 706). It is thus believed that Beta Pictoris like disks are young planetary systems in the clearing-out phase. Our previous HST observations confirmed the presence of gas disks similar to the Beta Pictoris one. Here we propose new STIS observations of four stars with known circumstellar gas. Four main objectives can be achieved with STIS observations: the determination of the composition of the gas, the investigation of the puzzling high ionization species, the determination of the CO and CI history and monitoring of spectral variability. The analysis of these issues will provide valuable clues to the origin of these gas disks and the subsequent evolution of young planetary systems. In particular, from abundance studies it will be possible to show if the gas is produced by evaporation of bodies like extra-solar comets.

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Proposal Category: GO

Scientific Category: AGN/Quasars
ID: 9432
Title: The Radio-Loud BAL QSO PKS 1004+13: A Key to Understanding QSO Outflows?
PI: Beverley Wills
PI Institution: University of Texas at Austin

Accretion and outflows drive astrophysical engines on many scales. In powerful QSOs, broad absorption lines (BALs) reveal partially-ionized outflows to ~0.1c. What is the geometry of the flow, its origin, the driving mechanism? Why are the most extreme outflows always seen in radio-weak QSOs? Such basic questions remain unanswered. Plausibly, radiation pressure can drive an equatorial wind off the dusty torus or outer accretion disk. Are BAL QSOs seen nearly edge-on, as this scenario requires? We don't know because there is no good inclination indicator for these generally radio-weak QSOs. The bright, low-redshift QSO PKS 1004+13 may be a valuable exception. Its dominant radio lobes imply a near edge-on view, while low SNR IUE spectra suggest it is a BAL QSO. Indirect indications that it's a BAL QSO are: very weak soft X-ray flux, high scattering polarization, and unusually weak ionO3. It also shows clear high-ionization non-BAL absorption with partial continuum coverage. We propose high quality UV spectroscopy to confirm its BAL QSO identity. PKS 1004+13 would be only the second known BAL QSO with powerful radio jets, hence known inclination, providing a clear test of the outflow geometry, and the only such object at low redshift, allowing high SNR, high spatial resolution follow-up.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9433
Title: The Size Distribution of Kuiper Belt Bodies
PI: Gary Bernstein
PI Institution: University of Michigan

The Kuiper Belt is a population of remnant planetesimals from the formation of the Solar System. Since the planetesimals in extrasolar systems are too faint to see with present or planned telescopes, the Kuiper Belt is our best chance to test models of accretional/collisional evolution against observations. Current ground-based observations of Kuiper Belt Objects (KBOs) are consistent

with a pure power law size distribution N(D) prop to D^-q, q~4.3. Current accretion models predict a break to a shallower slope q=3.5 for objects of diameter D<=sssim100 km. We will conduct a survey of 6 ACS/WFC fields to detect KBOs with R<28.5, and diameters as small as D~10 km. The number of KBOs at these small sizes, unmeasurable from the ground, will test the existence of the predicted break with 95 between 12 and 50 detections. A census of small KBOs is also important in confirming the idea that short-period comets are errant KBOs. With HST and ground-based followup, we can determine orbital parameters for the detected KBOs, and search for dynamical populations which may be deficient in D>100 km KBOs and hence not yet detected. In particular, we will determine whether the current absence of objects with perihelia beyond 50 AU is due to a truncation of the protoplanetary disk at some point in Solar System history, or just a failure to accrete D>150 km objects.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9434
Title: A SNAPSHOT Survey of the Hot Interstellar Medium
PI: James Lauroesch
PI Institution: Northwestern University

We propose to obtain SNAPSHOT STIS echelle observations of key tracers of hot interstellar gas (ionC4, ionN5, and ionSi4) for selected FUSE Team ionO6 survey targets with known UV fluxes. By taking advantage of the SNAPSHOT observing mode we will efficiently obtain a large number of spectra suitable for the study of the highly ionized hot component of the interstellar medium (ISM). Our goals are to explore the physical conditions in and distribution of such gas, as well as to explore the nature of the interfaces between the hot ISM and the other interstellar gas phases. Using inter--comparisons of the various ionic ratios for ionC4, ionN5, ionO6, and ionSi4, we will be able to discriminate between the various models for the production of the highly ionized gas in the Galactic ISM. The survey will also enable detailed studies of regions already known to contain hot gas through X-ray emission measurements (e.g., SNRs and radio loops). The proposed SNAPSHOT observations will extend our previous Cycle 9 survey (which was compromised by the STIS side 1 failure), and should roughly double the number of stars for which high quality STIS observations of the important hot gas tracers are available,

enabling us to derive a truly global view of the hot ISM.

Proposal Category: GO
Scientific Category: Star Formation
ID: 9435
Title: Systematic Search for Rotation at the Base of Outflows from T Tauri Stars
PI: Francesca Bacciotti
PI Institution: Osservatorio Astrofisico di Arcetri

We wish to search for rotation signatures in the initial portion (first 100 AU) of a sample of outflows emanating from T Tauri stars (TTSs). This project originates from our detection of systematic transverse radial velocity shifts in STIS spectra of the DG Tau jet (Bacciotti et al., 2001a). The shifts, observed in a region where the flow is already collimated, but has not yet manifestly interacted with its environment, are consistent with the predictions of magneto-centrifugal launching models, and may constitute the first observed indication for rotation in the initial portion of a jet flow. Rotation is a fundamental ingredient in star formation theories, thus we propose to confirm the above result by carrying out a systematic survey in similar flows. We plan to take for each jet a STIS spectrum in the 6300 -- 6800 Angstrom range, with the slit perpendicular to the flow direction and at a distance of about 0.3" from the source (i.e., in our targets, 40 -- 70 AU along the jet depending on inclination angle). Since the flows are resolved transversely with HST, the proposed slit orientation allows for the direct detection of systematic velocity shifts. Where found, we will check for consistency between the sense of rotation observed and that of the underlying disk through CO interferometric measurements. As a by-product, estimates of the excitation conditions across the flow (including ionization fraction) and of the mass outflow rates will be derived.

Proposal Category: GO
Scientific Category: Galaxies
ID: 9436
Title: Proper Motions of Bulge Stars at b=-6: The Shape of the Potential in the Central kpc of the Galaxy
PI: Konrad Kuijken
PI Institution: Kapteyn Institute

We propose to measure proper motions in a bulge field at l,b=0,-6, near the globular cluster NGC 6558. Suitable first-epoch data exist (from 1997). These data will allow us to calculate the vertical potential gradient in the bulge region, and hence the flattening of the potential in the central regions of the potential - a crucial piece of information for deciding measuring the central density of the dark halo of the Galaxy. Central halo densities currently constitute one of the most discrepant predictions of structure formation theories. In addition, the proper motions will allow us to make a kinematic separation between bulge, disk and globular cluster stars. The resulting cleaned colour-magnitude diagrams allow the bulge main sequence turnoff to be viewed cleanly, and compared with lower-latitude regions. Thus age and metallicity gradients in the bulge can be measured.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9437
Title: Quantitative Constraints for Massive Star Evolution Models with Rotation
PI: Kim Venn
PI Institution: U.Minnesota, Macalester College

Rotation is now recognized as an important physical component in understanding massive stars. Theory suggests that rotation affects the lifetimes, chemical yields, stellar evolution tracks, and the supernova and compact remnant properties (Heger & Langer 2000, Maeder & Meynet 2000). In a Cycle 7 program, we proved that rotational mixing occurs in massive main sequence stars (Venn et al. 2001). In this proposal, we want to quantitatively test model predictions and constrain the theory for a better understanding of massive star evolution. We are requesting HST STIS observations of the ionB3 2066 Angstrom resonance line of seven massive stars in three young clusters carefully selected from IUE analyses. These stars show traces of boron depletion, but without nitrogen enrichment; rotation is the only theory able to explain this abundance pattern. These new abundances will allow us to test rotating model predictions: that mixing strength increases with stellar age, mass, and rotation rate. They will also help to quantitatively constrain the rotational mixing efficiencies in massive stars. One very high S/N spectrum of a moderately boron-depleted star is also requested. We wish to measure

its ^11B/^10B ratio, which is predicted to change as boron is depleted in the rotating models. This ratio will further confirm rotational effects and observationally constrain the ^10B(p,Alpha) thermonuclear reaction rate, which is presently highly uncertain.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9438
Title: The Origin of the Intergalactic Globular Cluster Population in Abell 1185
PI: Michael West
PI Institution: University of Hawaii

We request deep V and I observations with ACS to examine the properties of a newly discovered population of intergalactic globular clusters in the core of the rich galaxy cluster Abell 1185. Our previous WFPC2 observations of this field (GO-8164) revealed an excess of five times the number of objects at the expected magnitudes of globular clusters compared to the Hubble Deep Fields. The colors and luminosity function of these intergalactic globular clusters will place strong constraints on their origin, which in turn will yield new insights to the evolution of galaxy populations in dense environments.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9439
Title: The Size Scales of Line-Emitting Regions in the Cloverleaf QSO
PI: David A. Turnshek
PI Institution: University of Pittsburgh

The Cloverleaf QSO is a four-component gravitationally-lensed broad absorption line (BAL) QSO. Models of the Cloverleaf lens indicate that, if a sufficiently extended emitting region surrounds the central source, an Einstein ring or partial ring will be seen in emission. However, the compact continuum should appear as four unresolved components, as is verified in existing broad-band images. These predictions are very robust. We propose here to determine or place limits on the size-scale of several of the emitting regions in the Cloverleaf using this effect. This will be done using the ACS-WFC RAMP filters

to take images in LyAlpha, NV, and the nearby continuum. Narrow-band observations with NICMOS will image OIII and the nearby continuum. An observation of each of these emitting regions will allow us to explore a different aspect of the QSO's physical environment. Regardless of the findings, these results will improve our understanding of the size-scales of the line-emitting regions in BAL QSOs and in QSOs in general.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9440
Title: The Composition of Io's Pele Plume
PI: John Spencer
PI Institution: Lowell Observatory

We propose to determine the composition of Io's largest volcanic plume, Pele, with unprecedented accuracy. This will give us new constraints on the temperatures, pressures, and magma composition of this volcano, and thus an improved window into Io's interior. We will use the proven Jupiter transit spectroscopy technique, which resulted in the discovery of S_2 gas in the Pele plume, but will use exposures that are 4 times longer than in the discovery observations. This will allow us to accurately measure plume SO_2 abundances, seen only with low S/N in the discovery observations, and possibly SO, in addition to S_2, and gives the chance to discover other, currently unknown, plume components. We will also use ACS to obtain UV and visible images of the Pele plume in reflected light prior to Jupiter transit, to constrain the dust abundance and particle size in the plume. This will allow refined estimates of plume dust/gas ratios and resurfacing rates. We will repeat the observations four times to build up S/N to even higher levels, and to look for time variability in both dust and gas abundance and chemistry.

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Proposal Category: GO
Scientific Category: Quasar Absorption Lines and IGM
ID: 9441
Title: Zinc Abundances in Damped Ly-Alpha Systems at z < 0.5: A Missing Link in the Chemical History of Galaxies
PI: Varsha Kulkarni
PI Institution: University of South Carolina

The evolution of metallicity in damped Lyman alpha (DLA) quasar absorption systems is an important constraint on the global star formation history of the universe, but remains a big puzzle at present. The H I column density weighted mean metallicity in DLAs is expected to rise to solar values at low redshifts, based on cosmic chemical evolution models, because the mass-weighted mean metallicity of local galaxies is near-solar. However, current DLA abundance studies are highly uncertain and cannot distinguish between evolution and no evolution in the mean metallicity at redshifts 0.4 < z < 3.5. The existing data are particularly incomplete because no Zn measurements exist for z < 0.4, and only 2 exist for $z < 0.5, which spans the past 35-45 age of the universe. To pin down the cosmic age-metallicity relation all the way to the present epoch, we propose to measure Zn abundances in six DLAs at 0.1 < z < 0.5. We propose to use HST STIS because it is the only existing instrument that can measure the necessary UV lines. Our observations will clearly distinguish between no metallicity evolution vs. the predicted evolution. Our data will also provide Cr measurements, which will help to estimate the dust abundance. The proposed observations are crucial for tying together the absorption and emission histories of gas and stars in galaxies and for clarifying the relation of DLAs to present-day galaxies.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9442
Title: Optical Counterparts for Low-Luminosity X-ray Sources in Omega Centauri
PI: Adrienne Cool
PI Institution: San Francisco State University

We propose to use narrow-band HAlpha imaging with ACS to search for the optical counterparts of low-luminosity X-ray sources (lx about 2 x 10^30 - 5 x 10^32 ergs) in the globular cluster Omega Centauri. With 9 WFC fields, we will cover the inner two core radii of the cluster, and encompass about 90 of the faint sources we have identified with Chandra. Approximately 30-50 of these sources should be cluster members, the remainder being mostly background galaxies plus a smaller number of foreground stars. This large population of low-lx cluster X-ray sources is second only to the more than 100 faint sources recently discovered in 47 Tuc with Chandra (Grindlay et 2001a), which have been identified as a mixture of cataclysmic variables, quiescent

low-mass X-ray binaries, millisecond pulsars, and coronally active main-sequence binaries. Our Cycle 6 WFPC2 program successfully identified 2 of the 3 then-known faint X-ray sources in the core of wcen using H-alpha imaging. We now propose to expand the areal coverage by a factor of about 18 to encompass the much larger number of sources that have since been discovered with Chandra. The extreme crowding in the central regions of wcen requires the resolution of HST to obtain optical IDs. These identifications are key to making meaningful comparisons between the populations of faint X-ray sources in different clusters, in an effort to understand their origins and role in cluster dynamics.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9443
Title: Calibration of the Geometric Distortion of ACS
PI: Ivan King
PI Institution: University of California, Berkeley

We propose to calibrate the geometric distortion of the WFC and HRC of ACS, using the state-of-the-art techniques that we have developed for WFPC2. We are confident that we can measure the distortion to at least an order or magnitude higher accuracy than is called for in the ACS Manual. We will use the images that are to be taken in GO-9028 and will re-image the field used there at different orientation and through different filters, so as to improve knowledge of the skewness of the field and the dependence of distortion on wavelength. Our results will not only enhance the accuracy of our own proposed proper-motion work in star clusters; they will greatly increase the accuracy of sparse-field astrometry by others, such as solar-sytem and extragalactic work.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9444
Title: The Region of the Hydrogen-Burning Limit in Omega Centauri and 47 Tucanae
PI: Ivan King
PI Institution: University of California, Berkeley

We propose a photometric study of the lower main sequences of Omega Cen and 47 Tuc, down to the region of the H-burning limit, which the deeper faintness limit of ACS will allow us to reach. For the faintest stars, proper-motion separation of cluster from field is essential; hence we include Cycle 13 observations. The resulting color--magnitude diagrams (CMDs) and luminosity functions (LFs) will allow study of stars in a mass regime and metallicity that have never been accessible before, and will serve as an important check on theories of the structure of low-mass stars. Our CMDs will check the luminosity--radius relation, while the faint end of the LF can be used to check the mass--luminosity relation. With 47 Tuc we extend these checks to a higher metallicity than before, while in Omega Cen we investigate the effect of a range of metallicity within a single cluster. In both clusters we will produce the faintest existing MS and WD sequences, and the faintest LF. With this proposal we initiate high-precision astrometry with ACS using the state-of-the-art techniques that we have developed for WFPC2. A separate proposal addresses the geometric distortion of ACS, but we can do well in the present work even with approximate distortion corrections, as we can if necessary confine our measurements to relative positions of closely neighboring stars.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9445
Title: Gravitational Microlensing in the NGC 3314A-B Galaxy Pair
PI: David Bennett
PI Institution: University of Notre Dame

Determining the composition of the dark matter that dominates the masses of galaxies is an important unsolved problem, and the results of the MACHO Collaboration suggest that some of Milky Way's dark matter may be in the form of very old white dwarfs. However, some have argued that the excess of microlensing events seen by MACHO are due to a larger than expected microlensing rate for lens stars in the LMC itself or its tidal debris. We propose to address this question by detecting microlensing events in the line-of-sight galaxy pair NGC 3314 A & B. The large line-of-sight distance between these galaxies gives an optical depth that is 3-4 orders of magnitude larger than if the source stars and lenses were in the same galaxy, and the fact that the background galaxy is a spiral ensures that there will be a sufficient number of bright, non-variable source stars. Our proposed observations should

have the sensitivity to detect microlensing by both ordinary stars and dark matter in NGC 3314A (the foreground galaxy). If there are dark matter microlensing events to be found, they can be clearly distinguished from stellar microlensing events because they will occur outside the visible disk of NGC 3314A. If baryonic dark matter is detected in NGC 3314A, we will be able to map its radial density variation.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9447
Title: Characterizing the Atmosphere of an Extrasolar Planet
PI: David Charbonneau
PI Institution: California Institute of Technology

HD 209458 b is the first extrasolar planet known to transit the disk of its parent star. Precise measurement of both the photometric transit curve and the radial velocity orbit has allowed for an accurate estimation of the mass, radius, average density, and surface gravity. Numerous theoretical investigations of the planetary atmospheres have been presented in the literature, but no data capable of addressing these has yet been published. We propose to use the method of transmission spectroscopy to constrain greatly models of the planetary atmosphere. We will use STIS to disperse the stellar flux over a large number of detector pixels. The photometric signal is produced by summing the counts over a desired band. For each of twelve bands spanning the UV to the near-IR, we will obtain sufficient precision to detect variations in the transit depth greater than mbox5 * 10^-5. We have already made a detection of the sodium absorption signature in the planetary atmosphere. With these new data, we will be able to detect, if present, absorption due to Rayleigh scattering, water bands, and/or strong alkali metal lines. These observations will allow us to determine the broad characteristics of the planetary atmosphere. For example, we will be able to distinguish between models with a high cloud deck, and those with no clouds but reduced chemical abundances.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9448
Title: Nuclear Dynamics of NGC 205: Probing the Low-Mass End of

the ms Relation
PI: Laura Ferrarese
PI Institution: Rutgers University

-.1in In 1994, HST produced the first detection of a supermassive black hole, of a few billion M(sun), in a galactic nucleus. That discovery marked the beginning of a new era for black hole studies. Today, the firm, dynamical detection of an intermediate mass black hole, one with 10^2 < mh< 10^6 M(sun), would have an equally profound impact. No such detection exists. NGC 205 is the only galaxy in which one can be attempted. We propose to obtain for NGC 205 the most complete dataset available for any galaxy targeted by HST for similar studies. Eleven orbits with STIS will provide the kinematical information. One orbit with NIC1/F160W (~ H) will produce a surface brightness profile at ~ 0Sec resolution. Variations of mass-to-light-ratio with age are minimized in the near IR, reducing the potential of biasing the deprojected mass density. Two orbits with ACS/HRC/F555W and F814W (~ V and I), at twice the NIC1 resolution, will allow us to quantify the broadening introduced by the NICMOS PSF in the H-band brightness profile. Furthermore, they will resolve the nucleus into individual stars: with the aid of a color magnitude diagram, stellar populations differing in age and/or metallicity can be identified, and an independent estimate of the mass density can be derived directly for each. To give all competing groups a fair chance of analyzing the data in a timely fashion, we ask for a reduced, three month proprietary period.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9449
Title: UV Spectrum of the Massive X-ray Binary LS 5039
PI: Douglas Gies
PI Institution: Georgia State University

LS 5039 is a massive X-ray binary with non-thermal radio emission, relativistic jets, and probably high energy Gamma-ray emission. It appears to be one of the closest of the Galactic microquasars, stellar-sized engines that produce relativistic jets like extragalactic quasars. We recently discovered that the system is a 4.1 day binary with a very eccentric orbit (indicating large mass loss in the supernova event that gave birth to the

system). The companion is probably a neutron star, but a black hole companion is viable if the system inclination is small. Here we propose to obtain the first UV observations of the binary to determine fundamental properties about the O7 V((f)) optical star and the mass transfer process. The UV spectrophotometry will allow us to measure accurately the interstellar extinction and system distance, and the unreddened spectrum will provide information on the optical star's effective temperature, spectral classification, and surface abundances. The stellar wind lines in the FUV provide the means to measure the O-star's wind terminal velocity and mass loss rate, and these parameters will allow us to determine if the X-ray luminosity can be generated by wind accretion alone. We plan to observe these wind lines at both orbital conjunction phases to search for evidence of changes in the wind structure caused by proximity to the X-ray source's radiation field, accretion disk wind, and jets.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9450
Title: The lensing galaxy of JVAS B0218+357: determination of H_0
PI: Neal Jackson
PI Institution: University of Manchester, Jodrell Bank Observatory

Much effort has been devoted to estimating Hubble's constant H_0 using observations of very nearby objects. Gravitational lensing time delays offer potentially the most accurate method for determining H_0 using observations on cosmological scales; it is a very clean method in that little complicated astrophysics is involved, and it is a single--step method compared to the traditional multi--step distance ladder. The major problem with most such determinations in the past has been systematic errors due to uncertainties in the lens mass model, leading to 20 Einstein-ring lens system, is the one system for which these systematic uncertainties can be reduced very substantially, and in particular is unique in that the modelling systematics can be reduced to the level of the uncertainties in the measurement of the time delay. The only requirement left is to be able accurately to locate the centre of the lensing galaxy. We propose an extremely deep ACS image in I-band of this system for this purpose; the prize is a robust 5 lens mass model). We have conducted simulations to estimate the necessary S:N ratio in an ACS

observation in order to be able to achieve a successful deconvolution of the lens galaxy and lensed images with the required accuracy.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9451
Title: ACS Imaging and STIS Spectroscopy of Binary Brown Dwarfs
PI: Wolfgang Brandner
PI Institution: European Southern Observatory

We have compiled a sample of 9 spatially resolved binary brown dwarfs (18 objects), and now propose ACS imaging and STIS spectroscopic follow-up observations. While theoretical models on the interplay of chemical and physical processes governing brown dwarf atmospheres have reached a high level of sophistication, interpretation of observational data remains difficult. As brown dwarfs never stabilize themselves on the hydrogen main sequence, there is always an ambiguity between the temperature or luminosity of any brown dwarf and its mass or age. The individual components of brown dwarf binaries, however, are expected to be coeval and have the same underlying chemical composition. This provides crucial constraints on any model, thus greatly reducing the number of the free parameters. The aim is to obtain photometric and spectroscopic data to probe the physical and chemical properties of the brown dwarf atmospheres, as well as second epoch astrometric data to characterize the orbital motion. The study will provide important feedback on theoretical model atmospheres and evolutionary tracks for brown dwarfs. As such, it will be an important step towards a better understanding of objects with spectral properties intermediate between those of giant planets and late-type stars.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9452
Title: Characterizing the Star Formation History of a Highly Magnified z=5.6 mboxLyman Alpha Source
PI: Richard Ellis
PI Institution: California Institute of Technology

We have located a remarkably faint pair of compact images arising from a z=5.6

mboxLyman Alpha emitting source, magnified 33-fold by the lensing foreground cluster mboxAbell 2218. Keck spectra verify the lensing hypothesis but fail to locate any UV stellar continuum to interesting limits, suggesting the object is a 10^6 M source viewed close to its epoch of formation. We argue the source could be representative of an abundant population of low mass systems forming their first stars at z>5, this example becoming visible only by virtue of the strong gravitational magnification. We seek HST imaging to provide much tighter constraints on the nature and distribution of starlight in this intriguing source. ACS will be used to investigate the spatial extent of UV continuum light on <100 pc scales also providing the equivalent width of the mboxLyman Alpha emission. NIC will be used to measure the slope of the rest-frame continuum in order to break age and mass degeneracies caused by the unknown amount of dust extinction. HST uniquely provides the resolution and sensitivity to gather detailed information on a remarkable source which may be representative of a population seen in future surveys with NGST.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9453
Title: The Age of the Andromeda Halo
PI: Thomas M. Brown
PI Institution: Space Telescope Science Institute

With the advent of the ACS, we can cross a critical threshold in the study of galaxy formation: For the first time, we can resolve the old main sequence stars in the Andromeda halo, and thus directly determine the ages of the halo stars in a giant galaxy other than our own. As the nearest giant galaxy, Andromeda offers the best testing ground for understanding galaxy formation and evolution. Resolution of its halo will tell us about its spread in age and metallicity, thus providing a formation history. Via extensive simulations, we demonstrate that we can unambiguously characterize the halo population via a deep F606W/F814W color-magnitude diagram reaching below the main sequence turnoff. The data will distinguish whether the halo formed quickly or through protracted infall and merging episodes, and would detect even a few percent trace of intermediate age stars. Our field was carefully chosen to meet two criteria: an optimal stellar density ensuring adequate statistics while avoiding overcrowding, and the inclusion of an Andromeda

globular cluster matched to the peak halo metallicity. We also propose very brief observations in the same two bands of five Galactic globular clusters spanning a wide metallicity range, thus establishing population templates in the ACS photometric system that will be used to calibrate and interpret the Andromeda data.

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Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9454
Title: The Nature of the UV Continuum in LINERs: , A Variability Test
PI: Dan Maoz
PI Institution: Tel-Aviv University

LINERs may be the most common AGNs, and the signposts of accretion onto the massive black holes present in most galaxies. However, the LINER spectrum is the result of UV excitation, and, in at least some LINERs, a nuclear cluster of hot stars, rather than an AGN, dominates the energetics in the UV. Thus, it is still unknown if the UV continuum, or the optical emission lines it excites, have anything to do with an AGN. The demographics and accretion physics of low-luminosity AGNs hinge on this question. We propose to search for variability in a sample of 17 LINERs with compact UV nuclei. Variability can reveal an AGN component in the UV continuum, even when its light is not dominant. We will test systematically the handful of non-definitive reports of UV variability, and potentially quantify the AGN contribution to the UV emission. Variability in all or most objects will be strong evidence that LINERs mark dormant AGNs in most galaxies. Alternatively, a general null detection of variability will suggest that, even in LINERs with additional AGN signatures, the UV continuum is stellar in origin. Contemporaneous monitoring with the VLA/VLBA of 11 objects which have radio cores (five of which we already know are radio-variable) will reveal the relations between UV and radio variations. The UV-variable objects will be targeted for future, better-sampled, monitoring.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9455
Title: Mid-Ultraviolet Spectral Templates for Old Stellar

Systems
PI: Ruth C. Peterson
PI Institution: Astrophysical Advances

We propose a three-year program to provide both observational and theoretical mid-ultraviolet (2300 -- 3100Angstrom) spectral templates for interpreting the age and metallicity of globular clusters and elliptical galaxies from spectra of their integrated light. The mid-UV is the region most directly influenced by stellar age, and is observed directly in optical and infrared studies of high-redshift quiescent systems. The reliability of age and metallicity determinations remains questionable until non-solar metallicities and abundance ratios are considered, and stars spanning the color-magnitude diagram are included, as we propose here. With archival HST STIS spectra we have improved the list of mid-UV atomic line parameters, then calculated spectra from first principles which match observed spectra of standard stars up to one-fourth solar metallicity. We will extend both observations and calculations to stars of solar metallicity and beyond, and to those in short-lived stages hotter than the main-sequence turnoff, stars not currently well-represented in empirical libraries. The necessary line-list improvements will come from new high-resolution mid-UV spectra of nine field stars. A key application of the results of this program will be to the old systems now being discovered as "Extremely Red Objects" at high redshifts. Reliable age-dating of these places constraints on the epoch when large structures first formed in the universe.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9456
Title: Sakurai's Novalike Object: Real-Time Monitoring of a Stellar Thermal Pulse
PI: Howard E. Bond
PI Institution: Space Telescope Science Institute

This is a continuation of a program carried out in Cycles 7--10.
Sakurai's Object (V4334 Sgr) presents a "once-in-a-lifetime" opportunity for real-time observations of a star undergoing a final helium thermal pulse. The star rose from obscurity to become an 11th-magnitude "born-again" hydrogen-deficient red giant in 1995-96, and currently it is undergoing episodes of

atmospheric dust formation. If it follows the pattern that the similar object V605 Aql took early in the 20th century, it will soon begin evolving back to high temperature. During the subsequent few years, it will begin to (re)-ionize its large, faint, old planetary nebula as well as the new ejecta, and we should be able to witness the re-establishment and evolution of a fast stellar wind as the effective temperature increases. When the star does begin to heat up, we will initiate Target-of-Opportunity STIS observations to monitor the star's spectroscopic development in the UV at regular intervals, continuing over the next 3 Cycles. We will also use ACS/HRC twice over the next 3 years to continue our monitoring of the expansion of the ejecta and to determine the star's proper motion. In combination with ground-based monitoring (optical, IR, and mm), we will thus produce the first detailed case study of a thermal pulse, as the star re-traces its evolution across the HR diagram from the AGB back to the hot planetary-nebula-nucleus phase.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9457
Title: NICMOS Observations of the Galactic Center: Environment of a Black Hole
PI: Marcia Rieke
PI Institution: University of Arizona

Intensive observation of the Galactic Center in recent years has shown conclusively that the Milky Way is home to a 2.5*10^6Msun black hole. Infrared observations of the stellar population have revealed a bright, young stellar cluster nearly coincident with the Center. We still do not know how the black hole influences its surroundings beyond the stellar dynamics very close to the hole. We do not even know whether the Milky Way has a core similar that seen in massive bulges or has a mass distribution that follows a power-law right into the center. We propose to use NICMOS to measure the central surface brightness profile of the galaxy, and to measure proper motions over the critical volume where the transition from black hole-dominated gravitational field to stellar mass-dominated gravitational field occurs. The data collected to investigate these issues will also shed light on the main sequence associated with the young stellar cluster and whether it formed in situ or elsewhere in the galaxy.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9458
Title: Probing the Formation & Evolution of M31's Outer Disk and Halo
PI: Annette Ferguson
PI Institution: Kapteyn Institute

The fossil record of galaxy formation and evolution is imprinted on the spatial distribution, ages and metallicities of galactic stellar populations. The observations proposed here build significantly upon our extensive ground-based and archival WFPC2 programs and aim to constrain the formation and evolution of our nearest large neighbour, M31. We propose deep imaging of 8 fields in the outer disk and halo, several of which have been identified from our panoramic ground-based CCD survey (covering ~ 20 degrees**2rees) to possess significant stellar density and/or potential metallicity variations. Deep colour-magnitude diagrams reaching ~2-3 magnitudes below the horizontal branch will be constructed, allowing detailed characterization of the luminous evolved stellar populations via the red giant metallicity distribution, the luminous asymptotic giant branch, the horizontal branch morphology and the red clump, as well as the detection of a main-sequence that may be present from any younger component. Our primary goals are to: (i) quantify the stellar population variations associated with M31 halo substructure, including the newly-discovered giant stellar stream, and (ii) derive stringent constraints on the age and metallicity of stars in the far outer disk. These observations will directly address two key predictions of cold dark matter hierarchical galaxy formation models.
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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9459
Title: The Response of the White Dwarf in WZ Sge to the Unexpected July 2001 Superoutburst
PI: Edward Sion
PI Institution: Villanova University

WZ Sge, the most extreme dwarf nova and one of the closest known cataclysmic

variables, underwent a superoutburst in July 2001 after 22 years in quiescence. Because of the uniqueness of this event, two DD proposals were approved, one to observe the outburst itself, and another for us to observe the early decline phase. Here we propose to complete our fundamental study of the response of a dwarf nova system to an outburst by continuing our UV coverage of this most extreme outbursting system during its decline to quiescence. This decline is expected to take more than 3 yrs, with the most dramatic changes occurring in the first 2 years. The brightness of WZ Sge has made it possible for unprecedented multi-wavelength coverage with HST, Chandra, FUSE and ground-based optical. This once-in-a-lifetime chance to obtain high quality, high time (and spectral) resolution FUV data as the decline progresses into the critical transition from the disk-dominated phase to the bare white dwarf, provides an unique opportunity to study the response of the emerging white dwarf, whose chemical abundances, rotation and temperature variation with time bear the imprint of this extraordinary gigantic accretion event.

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Proposal Category: GO
Scientific Category: Star Formation
ID: 9460
Title: Irradiated Jets and Proto-Planetary Disks in the Outer Orion Nebula
PI: John Bally
PI Institution: University of Colorado

We propose to acquire high resolution ACS H-alpha , N Ii , and O Iii images in four outlying portions of the Orion Nebula that will sample the type of environment in which most members of the Trapezium cluster stars are located. We seek to understand the properties of outflows and protoplanetary disks 'proplyds' located more than 4' (0.5 pc) from the core of the Orion Nebula as a function of the radiation field intensity. Two of our target fields contain recently identified externally irradiated jets that suffer large C-shaped bends. The Orion jets are ionized by external UV radiation. Thus, the structures of the target flows can be directly determined from images without recourse to non-linear shock models. High resolution images of their shocks will be used to distinguish between several possible models of jet deflection and to directly compare with 3D numerical models of jets in side-winds. Two other fields contain large proplyd candidates and large numbers of young stars

formed from the Orion molecular ridge. These young stars are in less irradiated environments than the well studied proplyds in the nebular core. We will search for new proplyds surrounding these stars to see if the lower radiation field implies a better chance of disk survival. These observations will serve to constrain the properties of protoplanetary disks in lower radiation environments than those in the nebular core.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9461
Title: HST / Chandra Monitoring of the M87 Jet
PI: John Biretta
PI Institution: Space Telescope Science Institute

We propose to correlate the X-ray variability of the M87 jet against morphological changes and variability seen in high resolution HST optical/UV observations. We have already been granted Chandra bi-monthly monitoring between Nov. 2001 and Aug. 2002, as well as HST observations in Nov. 2001. Here we propose for a second HST epoch in Aug. 2002 which will allow measurement of optical/UV variability and morphological changes during the Chandra run. These observations will elucidate the X-ray emission mechanism for the jet.

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Proposal Category: SNAP
Scientific Category: Stellar Populations
ID: 9462
Title: Systemic and Internal Proper Motions of the Magellanic Clouds from Astrometry with ACS
PI: Charles Alcock
PI Institution: University of Pennsylvania

We request first epoch observations with ACS of Magellanic Cloud fields centered on background quasars. Second epoch observations will be requested ~ 5 years later to allow the measurement of the systemic and internal proper motions of the Clouds with error <~0.05 mas/year. These motions are of fundamental importance. The systemic motions of the LMC and SMC probe the gravitational potential of the dark halo. The internal proper motion due to rotation can be exploited to yield a rotational parallax distance to the LMC;

the first time that this will be done for any galaxy. This is particularly important for the LMC because of its crucial role in the extragalctic distance ladder. Previous measurements of the proper motion of the LMC yield a systemic component ranging from 1.4 mas/year to 3.4 mas/year (differing by several times the quoted errors), with no useful determination of the internal motions. The main problem with measurements of the proper motion of the LMC has been the lack of a sample of background quasars to use as reference frame. We have recently been able to identify a sample of 54 quasars behind the Magellanic Clouds from their variability characteristics in the MACHO database. With this sample and the advent of ACS an accurate proper motion measurement has become possible for the very first time.

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Proposal Category: SNAP
Scientific Category: ISM and Circumstellar Matter
ID: 9463
Title: Are OH/IR stars the youngest post-AGB stars? An ACS SNAPshot imaging survey
PI: Raghvendra Sahai
PI Institution: Jet Propulsion Laboratory, California Institute of Technology

Essentially all well-characterized preplanetary nebulae (PPNs) -- objects in transition between the AGB and planetary nebula evolutionary phases - are bipolar, whereas the mass-loss envelopes of AGB stars are strikingly spherical. In order to understand the processes leading to bipolar mass-ejection, we need to know at what stage of stellar evolution does bipolarity in the mass-loss first manifest itself? We have recently hypothesized that most OH/IR stars (evolved mass-losing stars with OH maser emission) are very young PPNe. We propose an ACS/SNAPshot imaging survey of a large, morphologically unbiased sample of these objects, selected using their IRAS 12-to-25micron colors. Our ground-based imaging study of OH/IR stars has revealed a few compact bipolar objects, supporting our hypothesis. However since most objects remain unresolved, HST observations are needed to determine how and when the bipolar geometry asserts itself. Our complementary program of interferometric mapping of the OH maser emission in our sources is yielding kinematic information with spatial resolution comparable to that in the HST images. The HST/radio data will provide crucial input for theories of post-AGB stellar evolution. In addition, these data will also indicate whether the

multiple concentric rings, "searchlight beams", and truncated equatorial disks recently discovered with HST in a few PPNs, are common or rare phenomena.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9464
Title: Exploring the Role of Acoustic Heating in Cool Dwarfs and Subgiants
PI: Steven Saar
PI Institution: Smithsonian Astrophysical Observatory

Recent observations cast doubt on the importance of acoustic waves for chromospheric heating in stars. These include low upper limits to their contribution to upper layers of the solar chromosphere, and evidence for significant magnetic heating contribution even in "basal" activity stars. These findings contradict the widely accepted picture that acoustic heating accounts for a significant fraction, the "basal component", of chromospheric heating in inactive stars. To help resolve this issue, we propose to observe two very inactive stars with significantly different properties to search for specific signatures of upward propagating acoustic waves: blue-shifts and enhanced blue wings in chromospheric lines. Solar data show that the degree of blue-shift can be used to estimate the acoustic contribution to chromospheric heating. We will compare the data to HST spectra of similar stars, and solar spectra from the SUMER instrument on SOHO. Lack of a significant acoustic signature in our targets would indicate that magnetic heating generated by a local (turbulent, non-cycling) dynamo is responsible for the basal component of chromospheric heating in inactive stars. Our targets may be in a phase analogous to the solar Maunder minimum, and the HST spectra might serve as a proxy for the solar spectrum in this state. The spectra will also be used for emission measure analysis differentially between the Sun and solar-like stars.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9465
Title: The Cosmic Carbon Budget
PI: Ulysses Sofia
PI Institution: Whitman College

Gaseous carbon drives the chemistry of, and is an important coolant in interstellar clouds. In solid form, carbon is the second most abundant element in interstellar dust, the key element contributing to interstellar extinction, and the dominant heat source in some interstellar clouds. Given the fundamental importance of this element to interstellar cloud physics, it is surprising that only 8 measurements of gas-phase carbon abundances exist for neutral clouds; 7 are in diffuse clouds where the least amount of chemistry and dust incorporation are expected. The single measurement in a translucent cloud suggests a C abundance that differs from the diffuse clouds, but the measurement uncertainties make this difference statistically insignificant. We, therefore, have no information about carbon's behavior in translucent clouds, regions dense enough for chemistry and dust growth to be important but low enough extinction so that UV spectroscopy is possible (unlike for molecular clouds). We propose to measure total gas-phase C abundances in 6 translucent clouds with our principal scientific goals being to 1) accurately determine the fraction of carbon in the gas and dust phases in environments bridging the gap between diffuse and molecular clouds 2) determine the relative depletions of C and O in neutral clouds with known O-depletion enhancements and 3) explore how the interstellar gas-phase C/H is related to extinction variations.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9466
Title: SBS 1150+599: A Population III Planetary Nebula?
PI: Peter Garnavich
PI Institution: University of Notre Dame

SBS 1150+599 is a puzzling emission-line object. Optical spectra reveal only strong Balmer, He II and Ne V lines, along with a hot, featureless continuum. We have recently partially resolved the HAlpha emission in a ground-based image, and believe the object to be a new halo planetary nebula, one of only handful known in the Milky Way. If correct, its lack of significant O III and other forbidden emission means that SBS 1150+599 has the lowest metallicity of any known planetary nebula. Our estimate of the oxygen abundance places it 40 times lower than that of K 648 in the globular cluster M15, the previous record holder, and would make it one of the most metal-poor objects in the

Galaxy. We propose obtaining ACS images of SBS 1150+599 to confirm that it is a planetary nebula and to determine its morphology. Planetary nebulae in old populations may occur due to binary-star merging, and the morphology may test this hypothesis. We will also study the UV spectrum of SBS 1150+599 using STIS to confirm the O/H value and estimate carbon and nitrogen abundances unobtainable in the optical.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9467
Title: The Enigmatic Central Object of the RCW 103 Supernova Remnant
PI: Divas Sanwal
PI Institution: Pennsylvania State University

X-ray observations of the young (2,000 yrs) supernova remnant RCW 103 have revealed an enigmatic central object, originally claimed to be an isolated neutron star. However, long-term variability and 6-hr periodicity hint that this may be an accreting neutron star or a black hole, perhaps in a low-mass X-ray binary. Previous optical observations with 4-m class telescopes failed to find an optical counterpart (R >~ 24, V >~ 25.5). Recent near-IR observations with the CTIO/OSIRIS and VLT-UT1/ISAAC revealed four objects within about 2" radius circle around the X-ray position. One of these objects -- which is 0arcs6 from the X-ray source position -- is a plausible candidate for the IR counterpart of the X-ray source. To verify this hypothesis and understand the nature of the X-ray source, we propose deep imaging with NICMOS. An IR counterpart, variable at the X-ray period, and with brightness and broad-band spectrum consistent with a stellar object, would identify the source as an accreting binary with a subluminous companion. This would be the first discovery of a binary system inside a young SNR. Alternatively, a faint counterpart with a peculiar spectrum would indicate the presence of a long-hypothesized residual disk leftover after the supernova explosion.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9468
Title: ACS Grism Parallel Survey of Emission-line Galaxies at

Redshift z 7
PI: Lin Yan
PI Institution: California Institute of Technology

We propose an ACS grism parallel survey to search for emission-line galaxies toward 50 random lines of sight over the redshift interval 0 < z 7. We request ACS parallel observations of duration more than one orbit at high galactic latitude to identify ~ 300 HAlpha emission-line galaxies at 0.2 z 0.5, ~ 720 O IILambda3727 emission-line galaxies at 0.3 z 1.68, and 1000 Ly-alpha emission-line galaxies at 3 z 7 with total emission line flux f 2* 10^-17 ergs s^-1 cm^-2 over 578 arcmin^2. We will obtain direct images with the F814W and F606W filters and dispersed images with the WFC/G800L grism at each position. The direct images will serve to provide a zeroth order model both for wavelength calibration of the extracted 1D spectra and for determining extraction apertures of the corresponding dispersed images. The primary scientific objectives are as follows: (1) We will establish a uniform sample of HAlpha and O II emission-line galaxies at z<1.7 in order to obtain accurate measurements of co-moving star formation rate density versus redshift over this redshift range. (2) We will study the spatial and statistical distribution of star formation rate intensity in individual galaxies using the spatially resolved emission-line morphology in the grism images. And (3) we will study high-redshift universe using Ly-alpha emitting galaxies identified at z 7 in the survey. The data will be available to the community immediately as they are obtained.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9469
Title: NGC 4303: A Seyfert 2 nucleus powered by stars?
PI: Luis Colina
PI Institution: Instituto de Estructura de la Materia (CSIC)

NGC 4303 is to date the best example of the claimed starburst-AGN connection. HST images have unveiled the existence of an unresolved (size <= 4 pc) UV-optical-NIR bright core connected with a star-forming spiral (radius ~ 250 pc). The STIS UV spectrum of the core shows prominently the characteristic broad absorption lines produced by the winds of massive young stars, and it is best fitted with the synthesised spectrum of a massive, young (<= 5 Myr)

stellar cluster. Ground-based optical spectra of the nucleus containing the bright core, place it at the borderline of low-excitation Seyfert 2 and LINER nuclei. STIS 0.1^" slit spectroscopy of the unresolved core is requested to obtain an unambiguous AGN classification of it, and to measure its enclosed mass, i.e. determine the presence and mass of the black-hole. In addition, the spectra will be combined with evolutionary spectral synthesis and photoionization models to quantify the relative AGN and stellar energy contributions. If the Seyfert classification is confirmed, NGC 4303 will be the first ever detected galaxy with a Seyfert nucleus where the ionizing and bolometric energy output of its core (size <= 4 pc) could be dominated by a massive stellar cluster of young stars, as implied by the STIS UV spectrum. NGC 4303 will also be one of the few Seyferts for which the mass enclosed within the inner few pc would have been determined independently from stellar and gas kinematics.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9470
Title: Deep Lyman alpha images of starburst galaxies
PI: Daniel Kunth
PI Institution: Institut d'Astrophysique de Paris

We propose a pilot study to obtain deep ACS Ly-alpha images of a carefully selected sample of local starburst galaxies. Ly-alpha imaging of such objects has become feasible with ACS. These observations will bring unprecedented insight into the processes regulating the luminosity of the cosmologically important Ly-alpha line. Our targets cover the full range of observed Ly-alpha properties. They have been chosen to investigate the effects of dust, the starburst luminosity, and outflows within the ISM. The sample is optimized for a most favorable trade-off between the relevant parameter space and the minimum number of orbits. We can build on this pilot study for a much larger follow-up survey in a later cycle. Deep H Alpha and H Beta high-resolution images from the ground will allow us to quantify the Ly-alpha emission (or its lack) and its attenuation as a function of the local dust content. The H Alpha emission at a given location will constrain the intrinsic intensity of the expected Ly-alpha emission. A non-detection will allow us to quantify the fraction of Ly-alpha photons destroyed within the neutral gas, and to correlate this fraction with the properties of the neutral gas and dust. Since

Ly-alpha emitters are used to identify and study galaxies at redshift 3-6, our study will document the circumstances when a star--forming galaxy shows Ly-alpha emission. This will be an important first step towards an empirical calibration of the relation between Ly-alpha and the star--formation rate.

Proposal Category: GO
Scientific Category: Hot Stars
ID: 9471
Title: The Hunt for the Optical Counterpart of the Fastest Pulsar.
PI: Roberto Mignani
PI Institution: European Southern Observatory

PSR J0537-6910 is a fast, young (~ 5,000 yrs) X-ray pulsar --still undetected in radio-- at the center of the SNR N157B in the LMC. PSR J0537-6910 is a champion pulsar -- with a period of 16 ms it is the fastest rotator among "ordinary" pulsars, with the sharpest X-ray pulse among young pulsars. It is the most energetic one (together with the Crab), with a rotational energy loss E ~ 5 10^38 erg s^-1, and its space velocity (>1,000 km/s), inferred from the shape of its X-ray bow-shock nebula, is probably the highest in the pulsar family. Soon after its discovery, we performed multicolor observations with the ESO NTT to search for the optical counterpart. However, none of the several potential candidates detected within, or close to, the original ROSAT/HRI error circle (~eq 3 ") could be associated with the pulsar, which remained undetected down to V ~ 23.4. The results could not be improved by using the more accurate Chandra position (~eq 1 "). Since the crowding of the area, with a relatively bright star close to the pulsar position, makes the search for the PSR J0537-6910 optical counterpart virtually hopeless from the ground, we propose to obtain deep high-resolution multicolor imaging with ACS/WFC. The same data will allow us to study, for the first time, in the optical the compact nebula detected around the pulsar by Chandra. Since the target is in a CVZ, the whole program can be completed in two orbits.

Proposal Category: SNAP
Scientific Category: AGN/Quasars
ID: 9472

Title: A Snapshot Survey for Gravitational Lenses among z >= 4.0 Quasars
PI: Michael Strauss
PI Institution: Princeton University

Over the last few years, the Sloan Digital Sky Survey has revolutionized the study of high-redshift quasars by discovering over 200 objects with redshift greater than 4.0, more than doubling the number known in this redshift interval. The sample includes eight of the ten highest redshift quasars known. We propose a snapshot imaging survey of a well-defined sample of 325 z > 4.0 quasars (including luminous non-SDSS quasars from the literature), in order to find objects which are gravitationally lensed. Lensing models including magnification bias predict that at least 4 multiply lensed. Therefore this survey should find of order 10 lensed quasars at high redshift; only one gravitationally lensed quasar is currently known at z > 4. This survey will provide by far the best sample to date of high-redshift gravitational lenses. The observed fraction of lenses can put strong constraints on cosmological models, in particular on the cosmological constant Lambda. In addition, magnification bias can significantly bias estimates of the luminosity function of quasars and the evolution thereof; this work will constrain how important an effect this is, and thereby give us a better understanding of the evolution of quasars and black holes at early epochs, as well as constrain models for black hole formation.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9473
Title: Masses and IMF Variations in Super Star Clusters
PI: William Vacca
PI Institution: Max-Planck-Institut fuer extraterrestrische Physik

We are proposing to obtain high spatial resolution images of a set of super star clusters for which we have been granted observing time to measure velocity dispersions via high-resolution ground-based optical echelle and K-band spectroscopy. The images will allow us to fit the light profiles and measure the radii of the clusters, and when combined with the velocity dispersions, will enable us to estimate the cluster masses. By comparing the mass-to-light ratios with those predicted from spectral synthesis models, we

will investigate possible variations in the slope and lower mass cut-offs of the initial mass functions in these clusters. Correlations of the variations of these parameters with cluster environment may provide insight into the formation mechanisms for super star clusters. By comparing the light profiles obtained in a blue and red filter, we will also search for evidence of mass segregation in the clusters. Since these clusters are too young to have experienced dynamical mass segregation, differences in the light profiles of the clusters in the two filters could be due to processes that differentiate between high and low mass stars during the birth of the clusters and would provide further constraints on theoretical models of cluster formation. Since these clusters are far too compact to be resolved by any ground-based observations, the ACS/HRC on board HST is the only instrument capable of carrying out these observations.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9474
Title: Intriguing Transient Sources in M87
PI: William Sparks
PI Institution: Space Telescope Science Institute

We have found a remarkable number of transient point sources in M87. Within the jet itself we have observed dramatic changes in less than a year. The point sources are seen well in the bluest regions of the spectrum, where we obtain high spatial resolution, are free from cosmic ray artifacts and obtain excellent discrimination against the underlying old, red galaxy. They display a variety of unusual properties: one is brighter than any in the catalogue of novae in M31; several are very close to the jet; another hints at rapid variability. We propose to investigate the population of transient sources in M87 and to probe the intrinsic jet variability on short timescales by taking images in the near UV. Do the sources show nova-type light curves? Is there a decline-rate/luminosity relation? If yes, may we use it for distance estimation, as in Galactic novae, and hence constrain the still very important Virgo distance. Are there very rapidly varying sources, flare stars or gravitational lenses? Is the variable stellar population related to the excess globular cluster frequency in M87? Is there a population of flickering objects in and around the jet, which may be responsive emission arising from their close proximity to a BL Lac nucleus (viewed down the jet axis)? Can we find

variability in the jet itself indicative of light week length scales?

Proposal Category: GO
Scientific Category: Star Formation
ID: 9475
Title: ACS coronagraphic survey for debris disks around nearby stars
PI: Paul Kalas
PI Institution: Universty of California, Berkeley

We propose a comprehensive imaging survey of nearby stars that will realize the full potential of the ACS coronagraph to map debris disks, the extrasolar analogs of our Kuiper Belt. Most debris disks are detected only by excess thermal emission at far-infrared wavelengths. Because they have a factor of 100 less dust cross section than the young debris disks around HR 4796A and b Pic, they are undectable by present techniques. In simulations of disk detectability, Kalas and Jewitt (1996) determined that detecting the scattered light from the disk requires at least two orders of magnitude of supression of the central PSF than is attainable from the ground. The ACS coronagraph finally provides this increase in sensitivity, surpassing the WFPC2 sensitivity to faint nebulosity near bright stars by at least three orders of magnitude. Mapping the debris around stars is particularly important for the indirect detection of planet-mass objects. Dynamical models have shown that unseen perturbers dynamically modify the radial, azimuthal and vertical structure of debris disks. These data will provide the critical high-resolution mapping of debris disks.

Proposal Category: GO
Scientific Category: Cosmology
ID: 9476
Title: Galaxy Evolution in the Richest Clusters at z=0.8: the EDisCS Cluster Sample
PI: Julianne Dalcanton
PI Institution: University of Washington

The study of distant cluster galaxies requires two key ingredients: (1) deep high-resolution imaging, to constrain galaxy structure; and (2) 8m-class spectroscopy, to measure stellar content, star-formation rates, dynamics, and

cluster membership. We will reach both conditions with the addition of HST/ACS imaging to our suite of VLT (36 nights) and NTT (20 nights) observations of 10 confirmed clusters at z 0.8, drawn from the ESO Distant Cluster Survey (EDisCS). The proposed HST/ACS data will complement our existing optical/IR imaging and spectroscopy with quantitative measures of cluster galaxy morphologies (i.e. sizes and shapes, bulge-disk decompositions, asymmetry parameters), and with measurements of cluster masses via weak lensing. Major advantages unique to the EDisCS project include: (i) uniform selection of clusters; (ii) large enough sample sizes to characterize the substantial cluster-to-cluster variation in galaxy populations; (iii) large quantities of high quality data from 8m telescopes; (iv) uniform measurements of morphologies, spectroscopic and photometric redshifts, SEDs, star-formation/AGN activities, and internal kinematics; (v) optical selection of clusters to complement the X-ray selection of almost all high-z clusters in the ACS GTO programs; (vi) forefront numerical simulations designed specifically to allow physical interpretation of observed differences between the high-z and local clusters.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9477
Title: TRGB Distance to the Maser Galaxy NGC 4258
PI: Barry Madore
PI Institution: Carnegie Institition of Washington

Masers surrounding the nucleus of the galaxy NGC 4258 have been used to derive a geometric distance to this galaxy from proper motions and accelerations of individual sources assumed to be in Keplerian orbits. This provides us with a unique opportunity to test the zero point of the Cepheid Period-Luminosity relation in specific, and the extragalactic distance scale in general. A Cepheid distance has also been determined to NGC 4258 by us following the exact methodology adopted by the HST Key Project on the Extragalactic Distance Scale. The two answers differ, with the maser distance being smaller by 12. We are proposing to use a third and totally independent means to assess the sense and significance of the difference that may need to be applied to the extragalactic distance scale. By using the tip of the red giant branch (TRGB) method we will obtain a

Population II distance measurement to the maser galaxy NGC 4258 good to a precision of better than 10. Resolving this issue is important because if the maser distance is adopted and used to recalibrate the HST Cepheid Key Project distances, then the Hubble constant increases from H_o = 70 to 80 km/sec/Mpc. Both distance scales must be scrutinized and tested very closely before any recalibration takes place.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9478
Title: The Duty Cycle of Star Formation : Far-UV imaging of the Hubble Deep Field
PI: Harry I. Teplitz
PI Institution: NOAO/Goddard Space Flight Center

We propose deep far-UV imaging of the Hubble Deep Field (HDF) with the ACS-SBC . Previously, we surveyed 1/5 of the HDF in the UV and now propose to complete the area. Near- and far-UV number counts suggest that there is a large population of UV-bright starbursts at moderate redshifts (z<0.6), and our proposed observations will investigate their nature. We will measure the star formation properties of these galaxies and their morphologies in the UV, optical, and near-IR. This catalog of starbursts will also be important to the astronomical community after Cycle 11 in interpreting planned SIRTF observations of the field. We will also set strict limits on the flux escaping in intermediate redshift (1<z<2) galaxies at wavelengths below the rest-frame 912 Angstrom Lyman limit, and thus infer the contribution of star forming galaxies at z~ 5 to the metagalactic ionizing radiation. Finally, we will measure the diffuse far-UV background at 1600 Angstrom. The HDF is the best field in the sky for the background measurements, given the legacy of ultra-deep observations at other wavelengths. In the spirit of the Hubble Deep Fields, we waive proprietary rights to these data.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9479
Title: The Field Stellar Populations of M33's Outer Halo
PI: Ata Sarajedini
PI Institution: University of Florida

In cycle 5, we observed 10 globular clusters in the halo of M33 with HST/WFPC2. For each cluster, we have constructed VI color-magnitude diagrams (CMDs) that reach some 2 magnitudes below the horizontal branch (HB). Although their mean metallicity is <~ngleFe/H rangle= -1.27 +/- 0.11, 80 possess completely red HB morphologies, much redder than comparable globular clusters in the halo of the Milky Way. Furthermore, these M33 halo globulars therefore suffer from the `second parameter effect' where another parameter in addition to metallicity is influencing the HB morphology. If interpreted in terms of age, this leads us to the surprising conclusion that the epoch of halo formation in M33 was significantly more extended as compared with the Milky Way. Of course, this conclusion is based only on the properties of the halo clusters in M33. As a result, we propose to investigate the properties of the halo field stars in M33. Our approach involves the construction of VI color-magnitude diagrams for 3 fields located at projected distances of 7 kpc, 8 kpc, and 9 kpc from the center of M33. From the color-magnitude diagrams, we will measure the mean metallicity, metallicity dispersion, and horizontal branch morphology of the field halo stars in M33. These properties will be compared with those of the M33 halo globular clusters as well as the halo populations of the Milky Way and M31.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9480
Title: Cosmic Shear With ACS Pure Parallels
PI: Jason Rhodes
PI Institution: Goddard Space Flight Center

Small distortions in the shapes of background galaxies by foreground mass provide a powerful method of directly measuring the amount and distribution of dark matter. Several groups have recently detected this weak lensing by large-scale structure, also called cosmic shear. The high resolution and sensitivity of HST/ACS provide a unique opportunity to measure cosmic shear accurately on small scales. Using 260 parallel orbits in Sloan textiti (F775W) we will measure for the first time: the cosmic shear variance on scales <0.7 arcmin, the skewness of the shear distribution and, the magnification effect. endlist Our measurements will determine the amplitude of the mass power spectrum sigma_8Omega_m^0.5, with signal-to-noise (s/n) ~ 20, and the mass

density Omega_m with s/n=4. They will be done at small angular scales where non-linear effects dominate the power spectrum, providing a test of the gravitational instability paradigm for structure formation. Measurements on these scales are not possible from the ground, because of the systematic effects induced by PSF smearing from seeing. Having many independent lines of sight reduces the uncertainty due to cosmic variance, making parallel observations ideal.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9481
Title: Pure Parallel Near-UV Observations with WFPC2 within High-Latitude ACS Survey Fields
PI: Jonathan P. Gardner
PI Institution: NASA's Goddard Space Flight Center

In anticipation of the allocation of ACS high-latitude imaging survey(s), we request a modification of the default pure parallel program for those WFPC2 parallels that fall within the ACS survey field. Rather than duplicate the red bands which will be done much better with ACS, we propose to observe in the near-ultraviolet F300W filter. These data will enable study of the rest-frame ultraviolet morphology of galaxies at 0<z<1. We will determine the morphological k-correction, and the location of star formation within galaxies, using a sample that is likely to be nearly complete with multi-wavelength photometry and spectroscopic redshifts. The results can be used to interpret observations of higher redshift galaxies by ACS.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9482
Title: ACS Pure Parallel Lyman-Alpha Emission Survey (APPLES)
PI: James Rhoads
PI Institution: Space Telescope Science Institute

Ly-alpha line emission is an efficient tool for identifying young galaxies at high redshift, because it is strong in galaxies with young stars and little or no dust --- properties expected in galaxies undergoing their first burst of star-formation. Slitless spectroscopy with the ACS Wide-Field Camera and

G800L grism allows an unmatched search efficiency for such objects over the uninterrupted range 4 <~ z <~ 7. We propose the ACS Pure Parallel Ly-alpha Emission Survey ("APPLES"), to exploit this unique HST capability and so obtain the largest and most uniform sample of high redshift Ly-alpha emitters yet. Parallel observations will allow this survey to be conducted with minimal impact on HST resources, and we will place reduced images and extracted spectra in the public domain within three months of observation. We aim to find ~ 1000 Ly-alpha emitters, 5 times the biggest current sample of Ly-alpha emitters. This unprecedented sample will provide robust statistics on the populations and evolution of Ly-alpha emitters between redshifts 4--7; a robust measurement of the reionization redshift completely independent of the Gunn-Peterson trough; spatial clustering information for Ly-alpha emitters which would let us probe their bias function and hence halo mass as a function of redshift; many galaxies at redshift exceeding 6; and lower redshift serendipitous discoveries.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9483
Title: Origin and Evolution of IR Luminous Galaxies: Are z>=1 Dusty Starbursts and z=0 ULIRGs the Same?
PI: Min S. Yun
PI Institution: University of Massachusetts

Interactions and mergers involving gas-rich galaxies are the main driving mechanism behind the luminous IR galaxy phenomenon. However it is dangerous to extrapolate this model directly to high redshifts because massive spiral progenitors may have been relatively uncommon at earlier epochs. Mergers and interactions involving less massive but more gas-rich progenitors may have occurred instead. We propose to test this hypothesis directly by imaging 12 FIR-selected, dusty starbursts at z~ 1 at sub-kpc resolution afforded by HST in the rest frame B and I (observed I and H) bands using ACS and NICMOS. While studying higher redshift systems is clearly desirable, band-shifting and surface brightness dimming makes the investigations of tidal features and the nature of progenitors possible only out to z~ 1 (Hibbard & Vacca 1997). From the morphologies, surface brightnesses, and color distribution, we will determine the physical status of the starburst hosts, the history of tidal interactions/mergers, and the nature of the progenitors. We will also test

for the presence of hidden AGNs and for enhanced galaxy number density. Our 12 target galaxies form a complete sample of known ultraluminous and hyperluminous galaxies at 0.7<z<1.4 and represent the most distant and the best statistical set for investigating the nature and roles played by tidal interactions and mergers in the dusty starburst phenomenon at high redshift.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9484
Title: The NICMOS Parallel Observing Program
PI: Patrick McCarthy
PI Institution: Carnegie Observatories

We propose to manage the default set of pure parallels with NICMOS. Our experience with both our GO NICMOS parallel program and the public parallel NICMOS programs in cycle 7 prepared us to make optimal use of the parallel opportunities. The NICMOS G141 grism remains the most powerful survey tool for HAlpha emission-line galaxies at cosmologically interesting redshifts. It is particularly well suited to addressing two key uncertainties regarding the global history of star formation: the peak rate of star formation in the relatively unexplored but critical 1<= z <= 2 epoch, and the amount of star formation missing from UV continuum-based estimates due to high extinction. Our proposed deep G141 exposures will increase the sample of known HAlpha emission-line objects at z ~ 1.3 by roughly an order of magnitude. We will also obtain a mix of F110W and F160W images along random sight-lines to examine the space density and morphologies of the reddest galaxies. The nature of the extremely red galaxies remains unclear and our program of imaging and grism spectroscopy provides unique information regarding both the incidence of obscured star bursts and the build up of stellar mass at intermediate redshifts. In addition to carrying out the parallel program we will populate a public database with calibrated spectra and images, and provide limited ground-based optical and near-IR data for the deepest parallel fields.

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Proposal Category: SNAP
Scientific Category: Cool Stars
ID: 9485
Title: Completing A Near-Infrared Search for Very Low Mass Companions to Stars within 10 pc of the Sun

PI: David Golimowski
PI Institution: The Johns Hopkins University

Most stars are fainter and less massive than the Sun. Nevertheless, our knowledge of very low mass (VLM) red dwarfs and their brown dwarf cousins is quite limited. Unknown are the true luminosity function (LF), multiplicity fraction, mass function, and mass--luminosity relation for red and brown dwarfs, though they dominate the Galaxy in both numbers and total mass. The best way to constrain these relations is a search for faint companions to nearby stars. Such a search has several advantages over field surveys, including greater sensitivity to VLM objects and the availability of precise parallaxes from which luminosities and masses can be derived. We propose to complete our four-filter NICMOS snapshot search for companions to stars within 10 pc. With a 10 Sigma detection limit of M_J ~ 20 at 10 pc, we can detect companions between 10 AU--100 AU that are at least 9 mag fainter than the empirical end of the main sequence and at least 6.5 mag fainter than the brown dwarf Gl 229B. When completed, our search will be the largest, most sensitive, volume-limited search for VLM companions ever undertaken. Our four-filter search will permit unambiguous identification of VLM-companion candidates for follow-up observation. Together with IR speckle and deep imaging surveys, our program will firmly establish the LF for VLM companions at separations of 1--1000 AU and the multiplicity fraction of all stars within 10 pc.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9486
Title: What Excites LINERs: The Brilliant Case of NGC 3998
PI: Linda Dressel
PI Institution: Space Telescope Science Institute

LINER emission is now known to occur in many galaxies at a variety of levels, with causes as diverse as old nuclear starbursts, cooling flows, accretion disks, and jets. The early prototypes, including NGC 3998, belong to a distinct class of AGN-like LINERs with the most luminous line emission and powerful nuclear radio emission. These LINERs have ionized gaseous disks on the scale of tens of parsecs, which have now been found to be in rotation about supermassive black holes. The disks are apparently the outer parts of

energy-releasing accretion disks. Powerful new UV+optical emission line diagnostics have been developed to settle the long-standing debate over whether the gas is being photoionized or shock excited. With STIS, we will be able to test ionization models, to determine whether the UV continuum is produced by a nonthermal source or by hot stars, and to determine whether that continuum is sufficient to ionize the gas. We will also make a spatially resolved study of the nucleus to test ideas about the energy transport in the disk. NGC 3998 is an exceptionally good AGN-like LINER to apply the new modelling and the sensitivity and resolution of STIS to. It is very nearby, active, bright in emission lines, UV-bright, and free of obscuration. We propose to observe its nuclear spectrum from 1150 Angstrom to 10000 Angstrom to get what may be our best look yet at a LINER AGN.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9487
Title: UV Sounding of the M-Giant Atmosphere in the Symbiotic Binary EG-AND
PI: Brian Espey
PI Institution: Space Telescope Science Institute

noindent EG-AND is an eclipsing system which provides us with the capability to study the structure of a fairly normal non-variable red giant point-by-point through its atmosphere. The white dwarf secondary provides a bright far-UV continuum source against which absorption from a broad range of ionization levels can be seen, ranging from molecular hydrogen close to the giant star to ionized material further away. The systemic velocity is such that these features are well resolved from the intervening ISM component. In addition, the system has low extinction (A_V = 0.15), has never been observed to undergo an eruption, and has a circular orbit, so there is no periodic disturbance of the giant atmosphere. Both calculation and direct observation show that the effect of the dwarf star's ionizing continuum on the red giant is minimal. We have an on-going FUSE program that has covered part of the orbital cycle. We have proposed for FUSE Cycle 3, and we request observing time with STIS to complete the picture. The resolution of the FUSE and STIS spectra are well-matched and suitable for detailed comparison of the intrinsic atmospheric features. Existing archival IUE data is insufficient for our purposes due to low resolution and/or low S/N. HRS data is of low S/N, partial

wavelength coverage, and may suffer from instrumental scattered light. Even when both datasets are combined, some phases have never been observed in the UV.

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9488
Title: Cosmic Shear - with ACS Pure Parallel Observations
PI: Kavan Ratnatunga
PI Institution: Carnegie Mellon University

The ACS, with greater sensitivity and sky coverage, will extend our ability to measure the weak gravitational lensing of galaxy images caused by the large scale distribution of dark matter. We propose to use the ACS in pure parallel (non-proprietary) mode, following the guidelines of the ACS Default Pure Parallel Program. Using the HST Medium Deep Survey WFPC2 database we have measured cosmic shear at arc-min angular scales. The MDS image parameters, in particular the galaxy orientations and axis ratios, are such that any residual corrections due to errors in the PSF or jitter are much smaller than the measured signal. This situation is in stark contrast with ground-based observations. We have also developed a statistical analysis procedure to derive unbiased estimates of cosmic shear from a large number of fields, each of which has a very small number of galaxies. We have therefore set the stage for measurements with the ACS at fainter apparent magnitudes and smaller, 10 arc-second scales corresponding to larger cosmological distances. We will adapt existing MDS WFPC2 maximum likelihood galaxy image analysis algorithms to work with the ACS. The analysis would also yield an online database similar to that in archive.stsci.edu/mds/

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9489
Title: Determining the Physical Processes, Origin, and Fate of Cometary Knots in the Helix Nebula
PI: C. Robert O'Dell
PI Institution: Vanderbilt University

We propose to acquire STIS slitless spectra of a well defined cometary knot in

the inner part of the the Helix Nebula while at the same time making WFPC2 and NICMOS H_2 images in the outer parts. This program exploits a unique opportunity to pursue one scientific goal simultaneously with three HST instruments. The primary goal is to determine accurately the structure of the cometary knots in their neutral cores and their ionized zones, thus allowing development of models that can predict their future in terms of dissipation (or not) as they enter the ISM. The STIS spectra will detail the ionized structure of an inner knot, the NICMOS H_2 will supplement WFPC2 dust extinction information in detailing the structure of the neutral cores, and the WFPC2 observations will determine the general characteristics in the outer regions, thus allowing us to establish how they originate. Only the HST has sufficient spatial resolution to undertake this project. Understanding these cometary knots is essential for understanding the process of recycling material into the ISM for they contain about half of all the material being inserted by planetary nebulae.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9490
Title: Stellar populations in M101: X-ray binaries, globular clusters, and more
PI: K.D. Kuntz
PI Institution: University of Maryland Baltimore County

Given our location in the disk of the Milky Way, it is often difficult to catalogue a complete population of objects in the Galaxy due to obscuration. M101 is the closest face-on Milky Way analogue and thus is the best system for studying stellar populations similar to those of the Milky Way. We propose a multi-purpose mosaic of ACS observations of M101 that will allow us to complete two major goals. 1) We will identify optical counterparts of M101's population of X-ray sources, resolving the mystery of M101's curious X-ray population and increasing the number of known High Mass X-ray Binaries (HMXB) to the point that statistical studies of those objects will be useful. 2) We will identify globular clusters in M101 and measure the luminosity and metallicity distribution of the M101 globular cluster system, which has not been previously studied. These measurements will improve our understanding of the variation in globular cluster populations as a function of galaxy type, and provide an important study of a spiral galaxy's globular cluster system

for use in constraining galaxy formation/merger models. Given M101's closeness, an optical map of a substantial portion of the disk, when combined with high resolution data at other energies, will allow M101 to play a key role in further studies of galactic structure.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9491
Title: The Oxygen Abundance in the Metal-Poor Halo Star HD 140283 from UV-OH lines
PI: Suchitra Balachandran
PI Institution: University of Maryland

Oxygen is critical in numerous astrophysical contexts, including the derivation of globular cluster ages and the early history of the Galaxy's chemistry. However, its abundance, particularly in metal-poor stars, remains controversial, with optical, IR and UV abundance indicators in dwarfs and giants yielding different abundance patterns; a flat O/Fe ratio with Fe/H is suggested by OI and IR-OH lines, while a monotonically increasing O/Fe trend with decreasing Fe/H is measured from OI and UV-OH lines with a factor of 10 difference at Fe/H=-3. We propose an in-depth study of the UV-OH lines in the halo subgiant HD 140283 with R=110,000 and S/N=200 spectra and state-of-the-art 3-D model atmospheres. Understanding UV-OH lines is particularly important because these provide the sole means of measuring the oxygen abundance in the most metal-poor stars and therefore in the early Galaxy. STIS will for the first time provide several dozen unblended UV-OH lines. Predictions about the variation of line strength with excitation potential and the asymmetries of the OH line profiles will be tested and used to refine the cool outer layers of the 3-D models where the OH lines are formed. The end result will be an accurate oxygen abundance, a thorough understanding of OH line formation, and a good characterization of the atmosphere of a metal-poor star.

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Proposal Category: GO
Scientific Category: Stellar Populations
ID: 9492
Title: Extragalactic Distances: the Need for Accurate Photometry of Blue Supergiants and Cepheids
PI: Fabio Bresolin

PI Institution: Institute for Astronomy, University of Hawaii

The investigation of the Wind Momentum-Luminosity Relationship (wlr) of blue supergiant stars as an independent extragalactic distance indicator has reached a critical phase. Following our recent discovery and spectroscopic follow-up of several tens of stars outside of the Local Group in NGC 300 and NGC 3621, we can now calibrate the wlr in terms of spectral subtype and metallicity with a higher accuracy than hithertho possible with the statistically limited samples available in the nearby galaxies studied so far. This, however, requires high-resolution imaging to obtain accurate BVI photometry of a significant fraction of those stars for which we have spectroscopic information. This can be effectively accomplished with eight ACS/WFC fields in these two galaxies. As a further step, we can use the calibrated wlr to measure the first independent extragalactic distance. We then propose additional imaging of six ACS/WFC fields in M101 to select blue supergiant candidates for spectroscopic follow-up. Having recently discovered more than a hundred new Cepheids in NGC 300, the high-resolution imaging proposed for the photometry of blue supergiants can also be used, with no additional observing effort, to verify the effects of blending on the Cepheid distance to this galaxy, an important calibrator of secondary distance indicators.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9493
Title: Revealing the nature of low luminosity radio-galaxies with imaging polarimetry
PI: Alessandro Capetti
PI Institution: Osservatorio Astronomico di Torino

HST imaging of low luminosity FR I radio-galaxies allowed us to isolate for the first time their optical nuclear emission from that of the host galaxy. Fluxes of these unresolved nuclear sources strongly correlate with those of the radio-cores, suggesting a common non-thermal origin. The picture which emerges is that these radio-galaxies differ in many fundamental aspects from the other classes of AGN as they might be lacking the substantial BLR, thermal disk emission and torii, usually associated to active nuclei, probably reflecting a fundamentally different accretion mode. On the other hand, these

results support the identification of FR I as the misoriented population of BL Lac objects. It is crucial at this stage to firmly establish the synchrotron origin of these nuclear sources. A simple and direct test can be performed by measuring their polarization. In case of synchrotron emission we expect to detect significant nuclear polarization, as routinely measured in BL Lac objects, at level of 3 - 20. We thus propose to obtain imaging polarimetry of a sample formed by the 9 nearest FR I radio-galaxies.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9494
Title: ACS Observations of the Optical Jet of MH 2136-428
PI: Paolo Padovani
PI Institution: Space Telescope Science Institute

The total number of well-established extragalactic jets is less than twenty, and of these only a handful are blazars. We propose here to use ACS (one orbit) to image in four bands the newly discovered optical jet in the BL Lac object MH 2136-428. This is the first time that an optical jet has been discovered in a completely featureless blazar, that is in an object whose nucleus is particularly highly beamed and/or whose accretion disk power is extremely low. Moreover, our source has a radio flux more than an order of magnitude fainter than those typical of the other blazars with optical jets, allowing us to study an intrinsically weaker jet. Our goals include the study of the jet morphology, its spectral energy distribution, and the relationship between the jet properties in blazar and non-blazar sources, extremely relevant for unified schemes. Only HST can provide the resolution required to study such a faint, narrow feature, close to the bright nucleus. We are also asking for 10ks of Chandra observing time to further constrain the jet spectral energy distribution and its underlying emission processes.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9495
Title: Do the Most Powerful Radio Galaxies Host the Most Massive Black Holes ?
PI: Andre Martel
PI Institution: The Johns Hopkins University

The 3CR Snapshot Imaging Survey that we have undertaken has revealed the existence of spectacular sub-arcsecond emission-line disks in three FR II radio galaxies : 3C 109, 3C 184.1, and 3C 382. They span a redshift range of 0.06<z<0.31, have diameters of 3-15 kpc, and have nearly orthogonal disk and radio jet axes. We propose to measure the black hole (BH) masses in these three galaxies with STIS/G750M and test whether the masses correlate more tightly with the optical bulge luminosity, the radio luminosity, or the nuclear velocity dispersion. These will represent the first mass determinations of BHs in FR II galaxies. For 3C 184.1 and 3C 382, the radio M_bullet- L_5, GHz correlation predicts BH masses ((11,8)times10^9 Msun) that are factors of ~10-55 greater than predicted by the optical M_bullet- L_B relation ((0.2,1)times10^9 Msun), while for 3C 109, both relations yield a stunning BH mass of sim20*10^9 Msun

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Proposal Category: GO
Scientific Category: Solar System
ID: 9496
Title: UV Spectroscopic Investigation of any Bright, Newly Discovered Comet
PI: Harold Weaver
PI Institution: The Johns Hopkins University

We propose a Target of Opportunity program to investigate any bright comet (mboxV<=sssim7) that is newly discovered during Cycle 11, including comets of any dynamical class. Our main scientific objective is to obtain accurate abundance measurements for several key cometary species: CO from the CO 4PG bands, C02 from the CO Cameron bands, S2 from the S2 B-X bands, CS2 from CS emissions, and H20 from OH emissions. The UV Cameron band emission is currently the only way to probe CS2 in comets. The high sensitivity and long-slit capability of STIS will allow us to characterize the spatial distribution of the coma species, so that we can identify those derived from an extended source (e.g. CO), study the decay of short-lived molecules (e.g. S2 and CS2), compare the dust and gas spatial distributions, and investigate the importance of e-impact on CO for the excitation of the Cameron bands (the latter for any comet having mboxV<=sssim5). If an exceptionally bright (V<=sssim2) comet is discovered, we would then request Director's Discretionary time to measure the D/H ratio.

This program is a continuation of our successful efforts in previous cycles to observe as many comets as possible with HST, so that we can eventually make abundance intercomparisons on a statistically meaningful sample. Our ambitious scientific objectives are only possible on bright comets, and given the paucity of data on several of the species listed above, these opportunities should not be missed.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9497
Title: Microarcsecond Imaging of a Gravitationally Lensed QSO: 2237+0305
PI: Rachel Webster
PI Institution: University of Melbourne

The microarcsecond scale structure of the central region of the gravitationally lensed quasar, 2237+0305, can be determined from its wavelength dependent lightcurve if viewed during a microlensing event. We are monitoring the QSO from the ground at regular intervals to ascertain the onset of a microlensing event. STIS spectra will then be taken and compared with the spectra taken after the event. As the microlensing event occurs, we will measure wavelength-dependent changes in the continuum, and also the variations in lines with different ionizations. Thus we will use microlensing to directly probe the structure of the source QSO on microarcsecond scales -- a factor of ten smaller than those measured by indirect techniques such as reverberation mapping. An already approved CHANDRA Cycle 3 GO program will provide complementary X-ray data, thus greatly increasing the wavelength range over which we hope to probe the quasar's inner structure.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9498
Title: The Nature of the Close Binary Quasar LBQS 0103-2753
PI: Vesa Junkkarinen
PI Institution: University of California, San Diego

We propose STIS spectroscopic and ACS imaging observations of the small-- separation quasar pair LBQS 0103-2753 A/B (= CT 344). This quasar pair with z

= 0.85, has a projected separation of only 0 arcs3 or 2.3 kpc. The brighter member of the pair (V = 18.2) is a BAL quasar while the fainter (V = 19.4) is a quasar at a similar redshift without BALs. It is very likely that the two quasars are a binary quasar, and not a chance superposition along the line of sight or a gravitational lens (Junkkarinen et al. 2001). The goals of the STIS spectroscopic observations are to accurately measure the systemic redshifts and redshift difference, to search for variability, and to quantify the emission line differences between the two quasars. ACS HRC imaging, in the F330W and F435W filters, will be used to detect any faint, blue point sources. Deeper ACS WFC images, in the F606W and F814W filters, will be used to provide information on the host galaxy morphologies, to look for the signatures of a merger/interaction -- in particular disturbed isophotes and tidal tails, and to study any cluster of galaxies around this quasar pair. These observations will test the lensing versus binary hypothesis and help differentiate between merging and a high relative velocity galaxy--galaxy interaction. Studies of binary quasars with such close separations will put constraints on merger timescales and duty cycles for AGN fueling at these separations.

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Proposal Category: GO
Scientific Category: Cool Stars
ID: 9499
Title: Brown Dwarf Binaries as Tests of Substellar Evolution
PI: Eduardo Martin
PI Institution: University of Hawaii

We propose to obtain STIS spectroscopy of two brown dwarf binaries for which dynamical masses are being obtained by monitoring the orbital motion using ground-based telescopes with adaptive optics. The HST/STIS spectra will allow to study the LiI resonance line at 670.8 nm. The lithium depletion of the members of these binaries will be estimated with the aid of synthetic spectra. These observations will be compared to model predictions of lithium depletion as a function of age and mass, and hence will provide an observational test to the theory of substellar objects. Spin-offs will be the measurement of the strength of Halpha emission, an indicator of chromospheric activity in cool atmospheres, and comparing the shape of the optical continuum with model spectra with different dust opacities.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9500
Title: The Evolution of Galaxy Structure from 10,000 Galaxies with 0.1<z<1.2
PI: Hans-Walter Rix
PI Institution: Max-Planck Institute for Astronomy (MPIA)

We propose to determine the evolution of galaxy structure over the last half of cosmic history from galaxy images in the redshift range 0.1<z<1.2. Our sample of 10^4 galaxies is contained within a 30'* 30' field centered on the Chandra Deep Field South and is complete to m_r~ 24. The redshift of each galaxy is known to Delta z ~ 0.02 from low-resolution spectra using 17 medium band filters, which also provide SED's complete from 3500Angstrom to 9250Angstrom for the whole sample. A mosaic of 9* 9 ACS pointings in F555W and F850LP will provide < 0.1" (<500 pc) rest-frame 4500Angstrom images for the entire sample of distant galaxies with known redshifts, a 30-fold improvement by number over published surveys. This unique data set will let us to resolve some of the most important issues in galaxy evolution. We will see why star formation activity has declined dramatically since z ~ 1: it could be changes in the interaction and merger rate, waning fuel supply, or simply a shift of star-formation to progressively less massive systems. By resolving the galaxies in rest-frame B, we can separate the bulges, bars, and disks to determine if the bulges simply dim, while disks grow radially with time. The growing disk surface mass density might increase the incidence of large-scale bars. Using the >100 AGNs identified in the field, we will investigate whether the population of host galaxies evolved in the last 10^10 years.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9501
Title: Life Cycles of Radio Galaxies
PI: Christopher O'Dea
PI Institution: Space Telescope Science Institute

Now, for the first time, we can probe the duration of nuclear activity and its duty cycle and the relationship between the growth of the bulge (via a starburst) and the growth of the BH (via fueling the AGN). We have identified

a class of powerful radio galaxy which displays both an outer 'older' radio source as well as an inner 'younger' radio source. These 'double-doubles' are sources in which the current radio source is propagating outwards through the relic of the previous epoch of activity. In 3C 236 we found that repeated episodes of star formation and radio ejection were indeed temporally linked. We propose to obtain images of the host galaxies of 4 additional double-double radio galaxies in the NUV with STIS and the R band with ACS/HRC. The proposed HST observations will allow us to determine the existence of young star forming regions in these double-double sources. Follow up imaging and spectroscopy combined with our detailed radio imaging, will allow us to use the double-doubles to address critical questions concerning probe the relationship between star formation and AGN fueling, e.g., - Over what time scales do these processes occur ? -- are they short and intense or long and gradual ?

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Proposal Category: GO
Scientific Category: Cosmology
ID: 9502
Title: Evolution of the Tully--Fisher Relation of Field Spiral Galaxies
PI: Bodo Ziegler
PI Institution: University Observatory Goettingen

We seek imaging of the FORS deep field (FDF) with the ACS to determine morphological and structural parameters of a complete sample of 80 late-type galaxies brighter than R_ lim=23^m (corresponding to ~ M_B^*+2 at z=0.5) selected there. We already obtained spectra and derived velocity curves of these galaxies using the ESO VLT. Only combined with the ACS HST observations this will allow us to establish the Tully--Fisher relation between luminosity and rotation of spirals at a mean redshift of 0.5 and therefore measure the luminosity and mass evolution of spiral and irregular galaxies within about half of the age of the Universe, strongly constraining current theories of galaxy formation and evolution. Several other important scientific projects based on the FDF, such as a study of the Fundamental Plane of field elliptical galaxies at <~ngle z angle = 0.3, a study of the size and type evolution of high--z galaxies (up to z~5) and a study of galaxy--galaxy lensing will also benefit from these observations.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9503
Title: Milli-arcsec Registration of Nuclear Optical and Radio Structures in the Seyferts NGC 1068 and NGC 4151
PI: Neil Nagar
PI Institution: Osservatorio Astrofisico di Arcetri

We propose to obtain accurate (as good as ~15 milli-arcsec) textitabsolute positions for the complex optical continuum and emission-line structures in the nuclei of NGC 1068 and NGC 4151, by bootstrapping positions from Hipparcos catalog stars in the same ACS/WFC field-of-view. This will also allow us to obtain accurate absolute positions for the central engine - as traced by HST imaging polarimetry in NGC 1068, and by kinematics of emission-line clouds in NGC 4151. The absolute positions of the optical features will be compared with those of the complex milli-arcsec-scale nuclear radio structures in order to: (a) identify the radio component corresponding to the central engine or determine if it is absorbed; (b) use the central engine position, in conjunction with already determined nuclear radio structure and free-free- and H I-absorption to the nuclear radio sources, to construct a more accurate model for the central engine and obscuring torus in AGN; (c) look for detailed correlations (or lack thereof) between the radio jets and the emission-line gas at the milli-arcsec level. An absolute position determination makes all prior and future HST observations of these galaxies more useful. Prompt observations are required as the position uncertainties of the Hipparcos stars are increasing with time. In case of technical problems with ACS, the goals of the project can be achieved with WFPC2 imaging.

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Proposal Category: GO
Scientific Category: Galaxies
ID: 9504
Title: Probing the Halo and ISM of Low-Redshift Galaxies with Young Supernovae
PI: George Sonneborn
PI Institution: NASA's Goddard Space Flight Center

We propose a Target of Opportunity program to study the halo and ISM of a low-redshift galaxy hosting a bright new supernova (V<= 14). The primary

objectives are to characterize the ionization state, gas-phase abundances, metallicity, and gas kinematics in the ISM and halo of the host galaxy, and, if the properties of the sightline are favorable, in the intervening intergalactic medium. Core-collapse supernovae occuring in galaxies out to the Virgo cluster are the potential targets for this program. The principal spectral region for this study is the short-wavelength ultraviolet <1700 Angstrom using STIS echelle spectra, which provide a comprehensive set of lines to study the hot, warm, and cool phases of the ISM. The HST spectra will be augmented by FUSE TOO observations (900<Lambda<1185Angstrom) of the same object for which we already have allocated time. New core-collapse supernovae, with their strong, nearly featureless UV continua, provide outstanding opportunities to obtain high-quality absorption line spectra of the gas on the line of sight to the SN, but only if the observations are executed within ~1 week of outburst. Our team has the experience and extensive ground-based support to promptly assess the suitability of each newly-discovered supernova for this program and to quickly provide all the necessary data to rapidly execute the observations.

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Proposal Category: GO
Scientific Category: ISM and Circumstellar Matter
ID: 9505
Title: The Evolution of Molecular Clouds
PI: Peter Wannier
PI Institution: Jet Propulsion Laboratory, Caltech

How is the evolution of dense clouds affected by their surrounding, more diffuse gas? Without an answer, it is not possible to understand the evolution of the ISM. Dense clouds can end their lives through the combined actions of star formation, violent disruption, and ablation. If ablation is an important process, then it is not a foregone conclusion that the dense clouds we see today will ever form stars. We will learn about the ablation process using STIS observations toward 18 stars for which we have existing FUSE observations, sightlines selected to lie behind the extended halos of four widely separated, molecular clouds. Our primary goal is to measure the gas pressure, the key to driving gas flows; secondary goals are to estimate the prevailing radiation and the CO column density. We have completed a pilot study of three stars in B5/Perseus, which enabled us to infer the presence near that cloud, of an isobaric, evaporative outflow, probably driven by UV

irradiation. The 18 proposed sightlines lie near four dense clouds which have been well studied at radio, mm and far-IR wavelengths, providing needed auxiliary information about morphology and kinematics. The clouds (1) are nearby, (2) are unperturbed by massive star formation, and (3) sample a range of external environments. The combined STIS, FUSE and ground-based results will yield information needed to understand the role of ablation in the evolution of the central clouds.

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Proposal Category: SNAP
Scientific Category: Quasar Absorption Lines and IGM
ID: 9506
Title: A SNAPSHOT SURVEY OF HIGH COLUMN DENSITY, LOW-Z LyAlpha ABSORBERS
PI: John T. Stocke
PI Institution: University of Colorado, Boulder

We propose a STIS G140L spectroscopic Snapshot program of bright (V<=16.5) AGN not previously observed in the UV to discover new high-column density (N_HIgeq10^15 cm^-2) LyAlpha absorbers in the local Universe (z <=0.45). Many more of these high column density systems are needed because: (1) They contribute most of the baryons to the local IGM; (2) They include systems for which valuable metallicity and D/H measurements can be made with the Cosmic Origins Spectrograph (COS); (3) They include many of the "warm-hot" absorbers, thought to be a large baryon reservoir in the local Universe; and (4) They are most likely to be ``associated'' with galaxy halos. Because of their low-z, many of these absorbers can be located relative to galaxies of known redshifts, allowing an immediate scientific return from these snapshots. Perhaps the most important, lasting results of this survey require higher resolution reobservations with COS by our GTO team. Using these snapshots to select the best targets, we will obtain COS R~22,000 spectra to determine the D/H and metallicity of absorbers in galaxy halos, groups, and voids. We will use pairs and "constellations" of AGN to determine absorber sizes, shapes, and covering factors. Candidate "warm-hot" absorbers will be reobserved with COS to determine their numbers accurately and to assess their metallicity, sizes, and relationships to galaxies and galaxy groups.

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Proposal Category: SNAP
Scientific Category: AGN/Quasars

ID: 9507
Title: STIS/UV snapshot survey of bright AGN
PI: Nahum Arav
PI Institution: UC Davis

We propose a UV spectroscopic snapshot survey of bright AGN, quadrupling the number of Seyferts UV spectra and adding dozens of new quasars, aimed at the following goals: beginenumerate em Finding the relationship between the intrinsic luminosity of the AGN and the maximum velocity (and width) of the outflow emanating from it, and determining the frequency of outflows in low-z AGN as a function of luminosity. em Surveying IGM absorption line systems in numerous new sight-lines. em Identifying promising targets for observations with the future highly sensitive Cosmic Origin Spectrograph. endenumerate A 35-minute snapshot with exposures in either the G140L or G230L will yield spectra with a minimum S/N > 15 per resolution element at all wavelengths for all our potential targets. This will allow us to be sensitive to absorption lines to a limiting equivalent width of 0.3 Angstrom at the 3 Sigma level. In order to facilitate rapid observational followup, we waive the data proprietary period entirely.

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Proposal Category: GO
Scientific Category: Solar System
ID: 9508
Title: A binary system in the Kuiper Belt: 1998 WW31
PI: Christian Veillet
PI Institution: Canada France Hawaii Telescope

1998 WW31 is the first Kuiper Belt Object, outside the pair Pluto/Charon, to be discovered as a binary object. Though only preliminary results are available from two orbits of HST DDT observation when this proposal is submitted, the pair exhibits a very high eccentricity (larger than 0.5) and a period of 570 days. The purpose of this proposal is to complete the monitoring of the pair on a full orbit, up to February 2003. Monitoring will then have to cease (Sun too close). The binarity of an asteroid allows the determination of the total mass of the system and provides important information on the past Kuiper Belt environment (formation/collisions/capture processes). If size can be obtained from albedo determination, the mass will give the density, a key parameter for any study of the origin and evolution of the Kuiper Belt.

Hubble's unparalleled resolution provides the unique way to acquire observations of the pair good enough to access the physical characteristics of this system with a high degree of confidence, as the high eccentricity of the orbit keeps the two components less than 1 arc-second apart for most of the orbit. The observations would be made public immediately to allow the continuation of the education program offering to follow the pair on a regular basis to illustrate the prediction/verification iterative process of science and the direct use of simple laws for the determination of key parameters.

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Proposal Category: GO
Scientific Category: Hot Stars
ID: 9509
Title: Probing the Distance and Structure of the LMC Using Eclipsing Binaries: STIS Spectrophotometry
PI: Edward Guinan
PI Institution: Villanova University

The distance to the LMC is crucial to calibrating the Cosmic Distance Scale but remains controversial and uncertain despite the efforts of many investigators. We have shown that the analysis of eclipsing binary (EB) systems has the potential to resolve this controversy. We have determined accurate distances to three eclipsing binaries in the LMC. Two EBs in the LMC bar, HV 2274 and EROS 1044, yield a consistent distance of 46.0+/-1.2 kpc for the bar itself. A third system, HV 982, is located at a greater distance (50.2+/-1.2 kpc), which is similar to that of the nearby SN 1987A (51.4+/-1.2 kpc). These results may suggest a significant depth to the LMC populations but a larger stellar sample is needed to verify this. The distances of the program stars were derived from ground-based light curves, HST or CTIO radial velocity data, and HST UV/optical spectrophotometry. We propose HST/STIS low-resolution spectra of seven LMC EBs for which we already have radial velocity and light curves. This will permit us to complete the analysis and derive accurate (to ~3 is a key dataset because it provides T_ eff, Fe/H, and A_Lambda. The ensemble of targets, in addition to nailing down the distance to the LMC, will provide fundamental stellar properties and a detailed probe of the structure and spatial extent of this important galaxy, in particular its line-of-sight depth.

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Proposal Category: GO

Scientific Category: ISM and Circumstellar Matter
ID: 9510
Title: AG Dra -- a high density plasma laboratory
PI: Peter Young
PI Institution: Smithsonian Astrophysical Observatory

A STIS observation of the symbiotic star AG Draconis yielding spectra in the range 1150--10 000 Angstrom is requested. AG Dra is a non-eclipsing binary that shows strong, narrow nebular emission lines that originate in the wind of a K giant, photoionized by a hot white dwarf. The density of the nebula is around 10^10 electrons/cm^3 and is the perfect laboratory for testing the plasma modeling codes cloudy and xstar at high densities. These codes are used for a wide range of astrophysical objects including stellar winds, accretion disks, active galactic nuclei and Seyfert galaxies, and calibrating them against high signal-to-noise spectra from comparatively simple systems is essential. AG Dra is the perfect high density laboratory for this work. In addition, many previously undetected emission lines will be found through the high sensitivity of STIS, which will allow new plasma diagnostics to be tested. These twin objectives are particularly pertinent as the high sensitivity of emphHST/COS will will permit similar high resolution spectroscopy to be applied to a whole new regime of extragalactic objects. By combining far-UV data from FUSE with complementary data from STIS, we will determine ratios of emission lines from the same ion, or ions of similar ionization level. These will permit a more complete set of diagnostics than are obtainable from one instrument alone.

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Proposal Category: GO
Scientific Category: AGN/Quasars
ID: 9511
Title: Connecting the UV and X-ray Warm Absorbers in NGC 5548
PI: Jelle Kaastra
PI Institution: Space Research Organization Netherlands

In the last Chandra cycle, we were awarded a joint Chandra/HST proposal to study the warm absorber in NGC 5548 and to obtain a definitive answer about the connection between the warm absorber and the UV absorber in this object. We are confident that the deep Chandra observation (500 ksec) will allow for an unprecedented determination of the kinematic components in the warm

absorber as well as accurate column density measurements from several line series. However, two new lines of investigation that appeared after the submission of the Chandra/HST proposal, suggest that the original modest request for HST time will not suffice to obtain reliable column density measurements for the UV absorber. In view of the new evidence, we need a a higher S/N in the proposed observations to allow for accurate UV column densities determination. Absorption features in both the UV and warm absorbers are known to be variable. Therefore, it will be highly unfortunate if the large investment of Chandra time will not be accompanied by enough simultaneous HST time to ensure an accurate measurements of the UV absorber. Without these it will be very difficult to draw conclusions concerning the relationship between the two absorbers. We therefore ask for 20 additional STIS E140M Echelle orbits to be simultaneously executed with the already approved 6.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9513
Title: "Binary" galactic nuclei and binary black holes
PI: Scott Tremaine
PI Institution: Princeton University Observatory

We propose to investigate two dynamical problems associated with black holes in galaxy centers. (1) The nucleus of the nearby galaxy M31 hosts a massive dark object, probably a black hole, of mass ~ 3*10^7Msun. The M31 nucleus is binary, as are the nuclei of other galaxies such as NGC 4486B. It is likely that these "binary" nuclei actually consist of a high-inclination stellar disk or ring, whose ansae appear double at low resolution. We shall construct a dynamical model of the nucleus of M31, which can be fit to two-dimensional HST photometry and extensive HST and ground-based spectroscopic measurements of the kinematics. The code can also be used to model other disks found by HST in galaxy centers. (2) Mergers of galaxies containing black holes lead to the formation of binary black holes. The detection of such objects would probe the galaxy formation and evolution process, and could reveal unique new physical phenomena. However, there is considerable uncertainty whether binary black holes can survive the dissipative processes (mainly dynamical friction and gravitational radiation) that lead to their orbital decay. We shall model the evolution of binary black holes in an HST-selected sample of nearby galaxies,

including the critical effects of oblateness and triaxiality on the rate of refilling the loss cone, and predict how the properties of surviving binary black holes depend on their host galaxies.

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Proposal Category: AR
Scientific Category: Star Formation
ID: 9514
Title: Unified Models and Instabilities of Protoplanetary Disks
PI: Eugene Chiang
PI Institution: University of California at Berkeley

Dusty disks surrounding young stars contain the raw material from which planets form. Both terrestrial planets and giant planet cores are built of silicates and ices that begin as circumstellar dust. How much condensable material resides in these disks and how is it distributed spatially? What is the range in grain sizes? What is the dust temperature field? We propose a theoretical investigation to answer these questions using state-of-the-art radiative transfer models. Our input data includes scattered light images obtained with the Hubble Space Telescope (HST), the thermal spectral energy distribution (SED), and mid-infrared and millimeter-wave maps. By combining these data sets under a unified multi-wavelength analysis, we break degeneracies in fitted disk parameters that arise when using data from a single bandpass. We propose further to explain the surprisingly rippled surface geometry of the disk surrounding TW Hydra, as measured with HST by Krist et al. (2000). Externally irradiated disks may be susceptible to the spontaneous growth of ripples in their photospheres. We ask whether ripples can amplify to the point where certain disk annuli are shadowed from central starlight, and whether they can transport angular momentum. Our investigations find direct application to the T Tauri systems TW Hya, GM Aur, HH 30, Haro 6-5b, and HK Tau/c, all of which have been extensively observed by HST.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9515
Title: Galaxy Interaction Simulations for Interpretation of HST Observations
PI: Joel Primack
PI Institution: University of California, Santa Cruz

There is mounting evidence from HST and ground-based observations that galaxy interactions and mergers were more common in the past, and may have been the dominant driver of star formation and galaxy evolution at early epochs. We propose to carry out an extensive suite of hydrodynamic simulations of galaxy interactions and mergers, including star formation and stellar population synthesis, over a range of redshifts z=0-3. The results will be used to create 'mock HST' images for direct comparison with archival WFPC2 and NICMOS and future ACS imaging data. Our proposed 'grid' of simulations will greatly extend previous work of this kind by covering a much larger parameter space of initial conditions, including high redshift, and by incorporating state-of-the-art understanding of disk formation theory and the properties of dark matter halos. We then propose to calculate structural and morphological statistics (such as concentration/asymmetry statistics, resolved colors, light profile and effective radius, etc.) on the mock and real images at a variety of wavelengths (rest UV to near-IR). This comparison will help to interpret the nature of the observed objects and the reasons for the preponderence of galaxies with disturbed morphology at high redshift.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9516
Title: Confronting HST Observations of Dwarf Spheroidals with Theory
PI: Nickolay Gnedin
PI Institution: University of Colorado at Boulder

We will use advanced cosmological simulations to model the formation and evolution of dwarfs spheroidal galaxies. The resolution of the simulations will be sufficient to fully resolve the internal structure of dwarf spheroidals. The results of the simulations will be compared to the observational data, including the color-magnitude diagrams of dwarfs spheroidals, obtained by the HST.

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Proposal Category: AR
Scientific Category: Hot Stars
ID: 9517
Title: Compressional Heating of Accreting White Dwarfs and

Classical Novae Ignition
PI: Lars Bildsten
PI Institution: University of California, Santa Barbara

We are proposing a broad theoretical study of the compressional (and nuclear) heating of white dwarfs (WDs) accreting at rates relevant to cataclysmic variables (CVs), where the fresh fuel is burned unstably in classical novae. Our work will yield the internal WD luminosity as a function of the time averaged accretion rate, <~angle M angle, WD mass and metallicity. We also include the recurrent heating and cooling of the WD throughout the classical novae limit cycle in order to find the WD core temperature and accumulated mass at ignition. Comparing these theoretical masses to the observed ejected masses will tell us whether the WD mass in CVs is secularly increasing or decreasing and whether CVs can actually be Type Ia progenitors. Several Dwarf novae systems have been observed in quiescence with HST/STIS, when the accretion rate is low and the WD photosphere can be directly detected. Initial comparisons of our theoretical work to these observations is encouraging and supports Sion's suggestion that gravitational energy release within the WD rejuvenates an otherwise cold WD into a much hotter state. Our work has immediate relevance to: (1) the STIS observations noted above and (2) HST searches for quiescent, low <~ angle M angle CVs in globular clusters (where the optical and UV magnitudes are affected by the hot WD).

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Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9518
Title: Astrometric Gravitational Microlensing: an HST perspective
PI: Bohdan Paczynski
PI Institution: Princeton University Observatory

Gravitational microlensing is developing into an important astrophysical tool with diverse applications. In the coming years, about 1000 microlensing events will be discovered annually, many in real-time. However, many applications suffer from the degeneracy between the lens mass, transverse velocity and the distances. The astrometric signature of microlensing partially breaks the degeneracy. The High-Resolution Camera of the Advanced Camera for Surveys will be an ideal instrument for measuring this effect. We propose to conduct a

theoretical study to prepare for such observations. These observations will lead to the first unique determination of the lens mass, and have significant impacts on the nature of the lenses toward the LMC, the model of the Galactic bar and the census of stellar mass black holes in the Galaxy. We will study what are the best microlensing events for HST astrometric studies, and the optimal strategy (frequency and duration) for such HST monitoring. The lensed stars lie preferentially on the far side of the Galactic bar due to the enhanced lensing probability by the stars on the near side. This bias leads to systematic differences in the proper motions and radial velocities of the lensed stars relative to the random stars in the Galactic bar. We will quantify these differences and their dependence on the bar model.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9519
Title: Simulating Galaxies with Supermassive Black Holes
PI: David Merritt
PI Institution: Rutgers University

Nuclei of roughly 130 galaxies have been or will be observed with STIS within the next few years with the goal of detecting supermassive black holes. About 1/2 of these data sets will consist of stellar absorption-line spectra. The research proposed here is directed toward understanding what such data can tell us about the formation histories of galactic nuclei and nuclear black holes. The structure and kinematics of galactic nuclei are fossil relics of the merger histories of galaxies and of the interaction between supermassive black holes and stars. For instance, black holes form bound pairs during galaxy mergers, which then eject stars via the gravitational slingshot, radically altering the structure of nuclei. Preliminary work indicates that many of the systematic properties of nuclei are explainable by interactions between single or binary black holes and stars. However simulations with existing N-body codes are severely limited in terms of the number of particles they can treat in a reasonable time. The main budget item would be a GRAPE-6 special-purpose computer which would be used in combination with novel N-body algorithms to permit a systematic study of black-hole nuclei using galaxy models containing up to 10^6 stars.

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Proposal Category: AR

Scientific Category: Quasar Absorption Lines and IGM
ID: 9520
Title: Theoretical Modeling of the Metagalactic Ionizing Radiation Background and IGM Metallicities
PI: Michael Shull
PI Institution: University of Colorado, Boulder

We propose a theoretical exploration of the metagalactic ionizing background radiation, applied to understanding the baryon content, metallicity, and nucleosynthetic history of the intergalactic medium (IGM). Photoionization by quasars and starburst galaxies appear to dominate the ionization of hydrogen, helium, and many heavy elements (C, Si, N, O) observed by Hubble and FUSE through quasar absorption-line systems. In order to make precision measurements of the total gas mass and metallicity, one must apply substantial ``ionization corrections" to the observed ion stages (e.g., H I, He II, Si III, Si IV, C III, C IV). New high-quality data from STIS and COS will require us to develop ionization models at higher level of precision from the present (Haardt & Madau 1996; Fardal, Giroux, & Shull 1998). These new models will include accurate atomic data, ionizing source spectra, IGM opacity, and cosmological radiative transfer calculations, with many underlying theoretical issues. We propose to develop a web-based tool designed to calculate the metagalactic ionizing background and ionization corrections at epochs from z ~ 6 down to the present. Our models will be available to the astronomical community on a CU-maintained website, which could be linked to the STScI. These precision calculations are a critical tool for the key absorption-line science done with spectrographs aboard HST (STIS, COS) and FUSE.

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Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9521
Title: Star Formation Histories of Local Group Galaxies
PI: Andrew Dolphin
PI Institution: National Optical Astronomy Observatories

The HST has provided a large quantity of deep photometry of the stellar content of Local Group galaxies, which can be used to understand their star formation histories (SFHs) to unprecedented accuracy. Because of the difficulties of measuring a SFH from a CMD, however, a significant amount of

this potential knowledge remains yet untapped. Many groups have developed tools to attempt this task; however differences of philosophy between the groups lead to conflicting results -- even when applied to the sam e data. We propose a comprehensive effort for the development, testing, and releasing of analysis tools that will remedy this limitation. The proposed project will allow us to scrutinize each of the algorithms that have been suggested in controlled test s, determine which are best-suited for the task, and produce a technique (or set of techniques) with which we can confidently measure the SFHs of Local Group galaxies previously observed by HST. These techniques will then be applied to our extensive WFPC 2 photometry database, and SFHs will be measured for the majority of Local Group galaxies. We believe that the accurate and unambiguous interpretation of CMDs -- the subject of dozens of WFPC2 programs -- can only be done textitafter the required tech niques and algorithms have been comprehensively examined, and that this project will allow these data to be used to their fullest potential.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9522
Title: Dynamics of Stars and Gas in Double-Barred Galaxies
PI: Linda Sparke
PI Institution: University of Wisconsin-Madison

About half of all spiral and S0 galaxies are barred: recent observations show that the main bar often harbors one, and sometimes two, smaller 'nuclear bars'. The gravitational potential of these inner bars will strongly influence the flow of gas in the central regions. Because dynamical times in the central galaxy are short, small nuclear bars can start growing well before the disk assembly is complete. Early in a galaxy's history, these central bars may have acted to funnel gas inward to allow rapid growth of the central black holes that power active nuclei, before the black hole's strengthening gravity shuts off the inflow, or destroys the bar. A central bar can also prevent a youthful disk from developing a larger, kiloparsec-scale bar, until the disk has grown far enough in radius to accomodate an outer bar that is suitably larger than the inner one. To explore these scenarios, we propose to use our novel method of emphinvariant loops, to investigate which combinations of bar mass, size, axis ratio and pattern speed allow `dynamically possible' double-bar systems. Using hydrodynamic simulations, we will follow the fate

of gas in such systems, and compare the flow patterns to those observed in STIS studies of galaxy centers. Finally, gravitational nbody simulations will allow us to build gravitationally-self-consistent double-bar models, and to predict stellar motions within them.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9523
Title: The Structure of Young Massive Star Clusters in Spiral Galaxies
PI: Jean Brodie
PI Institution: University of California Observatories / Lick Observatory

We propose to search the HST archive for images of nearby spiral galaxies and study in detail the structure of young massive star clusters previously discovered on ground-based images. The high angular resolution of WFPC2 images will make it possible to measure not only physical sizes for clusters, but also to derive their radial profiles. Combining the HST archive data with existing information about cluster ages (from ground-based photometry), we will study the evolution of the luminosity profiles of young stellar clusters as a function of age. The properties of clusters in our target galaxies will be compared with existing data for LMC clusters, thus providing new insight into the formation and evolution of young star clusters in different environments.

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Proposal Category: AR
Scientific Category: Star Formation
ID: 9524
Title: PHYSICALLY CONSISTENT PROTOPLANETARY DISK MODELS
PI: Nuria Calvet
PI Institution: Smithsonian Astrophysical Observatory

We propose to make our physically consistent models for protoplanetary disks, which are the most detailed so far, available to the community. We propose to make available two types of models. First, we will construct a complete grid of models where dust and gas are well mixed throughout the disks, which are relevant for the youngest, less evolved objects. Then, we propose to advance in our present modeling efforts to include the effects of dust coagulation

and settling towards the midplane on the structure and the emission of the disks. With our results, we propose to create a Web-based library of disk model results, including both scattered light images, as observed by the imaging detectors of HST, and far infrared to millimeter spectral energy distributions, to provide the community with the tools required for a comprehensive interpretation of protoplanetary disk data. Our proposed effort will provide the Star Formation users of HST with a powerful tool to best interpret their data and obtain key results for protoplanetary disk evolution.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9525
Title: Using the HST Archive to Compile a Comprehensive Inventory of LISM Structure and Physical Properties
PI: Jeffrey L. Linsky
PI Institution: JILA, University of Colorado

Analysis of high resolution archive spectra for at least 24 lines of sight to stars located within 100 pc, together with 41 lines of sight previously analyzed, will allow us to develop a comprehensive model for the local ISM describing the structure and physical properties of the important warm clouds. As Stage I of this program, we have already analyzed the STIS E230H and GHRS Echelle-B spectra of the Mg II and Fe II lines for these 24 lines of sight to determine the kinematics and morphological structure of these clouds. The requested archive investigation is Stage II of our program in which we will analyze the interstellar absorption lines of H I, D I, C II, N I, O I, Mg I, Al II, Si II, and Mn II in high resolution spectra for these lines of sight to determine the temperature, turbulent velocity, ionization, chemical abundances, and depletions in these clouds. When available we will include analyses of FUSE and optical spectra of additional ions for these same lines of sight. Our objective is to determine the physical properties (and their spatial variations) of the warm gas in these clouds for comparison with theoretical models based on the radiation field in the LISM. This comprehensive study of the warm gas in the LISM will become the guide for understanding physical processes in the ISM elsewhere in the disk of the Galaxy. This work will be a major part of Seth Redfield's PhD thesis.

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Proposal Category: AR

Scientific Category: Solar System
ID: 9526
Title: Characterization of Spatial Variations in the Transmission of WFPC2 Filter FQCH4N-D
PI: Erich Karkoschka
PI Institution: University of Arizona

The WFPC2 filter FQCH4N-D (890 nm) has probably a spatially variable transmission curve. This is estimated to cause photometric inconsistencies across the field of view of up to 30 percent, much larger than for other WFPC2 filters where flatfields describe the spatial photometric variation to better than 0.3 percent consistency according to the WFPC2 Handbook. This undocumented feature of FQCH4N-D affects a number of investigations with HST since this is one of the WFPC2 filters most often used for solar system studies. More than 600 images have been taken with FQCH4N-D. During Cycle 10, observations of Saturn with this filter will quantify the spatial variation of the filter transmission characteristics. I propose to analyze those observations and to provide the size and the direction of the effect, as well as estimates on how this may affect photometry based on imaging of giant planets and Titan with this filter. Similar data is published for ultraviolet filters with red leaks but still missing for FQCH4N-D. I successfully completed two previous investigations for the calibration of WFPC2.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9527
Title: The distribution of dark matter in cD galaxies with giant arcs: combining kinematic and lensing tracers
PI: Tommaso Treu
PI Institution: California Institute of Technology

We propose to develop a powerful method for measuring the shape of the dark matter halo in the inner region of clusters, thus testing a fundamental prediction of the Cold Dark Matter paradigm. Specifically, we will identify in the HST archive cD galaxies with associated giant arcs and measure their extended kinematic profiles using the Keck telescopes. We have already obtained data for 4 systems (2 newly-discovered ones) demonstrating the feasibility of the project. The combination of the two independent constraints

from dynamics and lensing on the same objects will allow us to overcome the degeneracies inherent to each method and thus to reliably measure the shape of the dark matter halo on 1-100 kpc scales. With this proposal we seek the necessary funding to: i) perfom a systematic search for arcs in the entire HST cluster archival data in order to collect a sample of 10-20 objects; ii) develop methods and software for the joint analysis of the kinematic and lensing constraints.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9528
Title: Compact Groups in the HST Archive: Playing the morphology card
PI: Stephen Odewahn
PI Institution: Arizona State University

Compact groups of galaxies have been the subject of intense observational and theoretical scrutiny, because they may well play a fundamental role in galaxy evolution. These objects are the sites of rapid merger events. We propose an archival search for moderate redshift compact groups to achieve these goals: beginenumerate em Use archival WFPC2, STIS, and ACS images to collect candidate compact groups at redshifts in the range 0.5 z 1. em Apply new Fourier-based image analysis methods to identify tidally disturbed group members, thereby increasing the likelihood of identifying true physical associations. em Carry out a program of spectroscopic followup (using the upgraded MMT) to confirm the group nature of these galaxy aggregates. endenumerate There is strong evidence for an epoch-dependent merger rate, and we will use our confirmed compact groups as probes for detecting this. If the merger rate does indeed increase substantially at z =0.5, then we expect to see a strong increase in the number of observed compact groups, the most extreme manifestations of merging

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Proposal Category: AR
Scientific Category: Hot Stars
ID: 9529
Title: The Local Environments of Supernovae
PI: Alex Filippenko
PI Institution: University of California, Berkeley

The locations of supernovae (SNe) in the local stellar and gaseous environment in galaxies, as measured in high spatial resolution WFPC2 images, contain important clues to their progenitor stars. They provide accurate determinations of any association of SNe with H II regions or star clusters. In cases where multi-filter observations are available, we can determine the local stellar population, setting constraints on the mass of the progenitor; we can also search for possible attenuation of the SN by dust in the host galaxy by studying the colors of the stars in its environment. By checking the fields for background sources, we can correct the existing SN light curves and luminosities if necessary. When a SN has been observed incidentally, information can be gained on its optical and UV emission. Deep HST images can be used to find light echoes of SNe, as well as recover SNe interacting with circumstellar material at very late times. A direct search for the progenitor stars of SNe can be made in pre-existing HST images of their locations; as the number of archival HST images steadily increases, along with the number of newly discovered SNe, positive identifications become progressively more likely. In Cycle 11 we plan to extend our successful work from previous cycles. A major improvement is that excellent ground-based coordinates are now available for numerous recent SNe.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9530
Title: Three-Dimensional Structure of Dust in Galaxy Nuclei
PI: William Keel
PI Institution: University of Alabama

HST imagery has demonstrated that dust features are ubiquitous in galactic nuclei. The occurrence of such features has been linked to recent interactions or dynamical processes trapping the ISM in small areas against the shearing which would normally disrupt discrete such structures. In addition, many of the structures seem to be either very thick or located well above the disk plane in spirals. This proposal would support a systematic examination of the rich archival data on this question, specifically aimed at reconstruction of the three-dimensional dust structure within the nuclei. These results will allow a more complete assessment of the typical dust masses and structural scales in nuclei, which together with the galaxy dynamics, will give survival

timescales for the features and imply energetics needed to maintain the observed frequency of these structures. Nonplanar dust structures will be examined particularly in a set of disturbed and merging galaxies, where they may play a significant radiative-transfer role.

Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9531
Title: The Role of Star-Formation in Active Galaxies: Uncovering Nuclear Star Clusters with NICMOS
PI: Jack Gallimore
PI Institution: Bucknell University

The phenomena associated with active galactic nuclei are generally thought to arise from the accretion of material onto a supermassive black hole. Bursts of star formation may also be required to account for certain properties. In support of this picture, recent studies have shown that circumnuclear starbursts are probably the source of the unpolarized "featureless continuum" of Seyfert galaxies. Seyfert nuclei reside in very dusty environments, however, and therefore optical/UV studies are not always the best suited for studying compact starbursts surrounding the AGN. We propose to analyze a survey of 41 Seyfert nuclei and other active galactic nuclei for which the archive holds multifilter NICMOS images. We will employ a rigorous and tested image decomposition algorithm to separate the relative contributions of the active nucleus (point source) and nuclear starburst or star cluster (extended emission). We show that NICMOS color analysis can provide unique constraints on the size, age, and bolometric contribution of a nuclear starburst within the central tens of parsecs of nearby AGNs. To the best of our knowledge, this proposed effort will be the first to examine systematically the starburst-AGN connection on such compact scales (i.e., size comparable to or smaller than the NLR) that might be relevant for fueling and unification.

Proposal Category: AR
Scientific Category: Hot Stars
ID: 9532
Title: Testing the magnetically and line-driven disk wind models of winds in cataclysmic variables

PI: Daniel Proga
PI Institution: JILA, University of Colorado

We propose a comprehensive program to study outflows from accretion disks in cataclysmic variables (CVs). These binary stars have been extensively observed with HST. Previous studies, including our own, show that such disks can produce winds driven by line radiation pressure. However, despite great progress in both observational and theoretical studies, many basic properties of the outflows are still poorly known. For example, the mass-loss rates, and the roles of radiation pressure versus magnetic forces in launching/accelerating/shaping the outflows, are very uncertain. We will continue to use the multi-dimensional, time-dependent, magneto-hydrodynamical code ZEUS to compute, from first principles, the structures of winds driven from accretion disks by line radiation pressure with and without magnetic fields. Results of the project will provide basic dynamical and kinematical properties of disk winds. We will use these properties to calculate theoretical wind diagnostics, such as line profiles, for direct comparison with UV observations taken with HST.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9533
Title: The Dependence of Environment on the Galaxy Merger Rate
PI: Christopher Conselice
PI Institution: Space Telescope Science Institute

Galaxy mergers drive the evolution of galaxies, yet we have little understanding of when, where, and how this process occurs. Galaxy merger rates in the richest clusters and in the field have now been measured out to z ~ 1, although the effect of environment on this process is not understood at all. We propose to address this question by using quantitative structural techniques that can identify which galaxies are undergoing mergers in extant images of high redshift clusters near z ~ 0.8. The merger rate in low density areas should increase faster with redshift than in denser clusters, but the gas fraction in cluster galaxies may increase with redshift more rapidly. These two effects may compete, thereby making it difficult for previous studies to determine differences in field and cluster merger rates. Understanding how the merger rate varies as a function of local number

densities in these clusters will help answer some fundamental questions concerning galaxy evolution. These include: (i) determining if the morphology-density relationship in clusters, in place at z ~ 0.5, is driven by galaxy mergers, (ii) if galaxy mergers identified by eye in previous studies of clusters are actual mergers, or galaxies losing mass from high-speed galaxy interactions and (iii) disentangling gas-rich and gas-poor interactions of a given strength in clusters at z ~ 0.8.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9534
Title: Interstellar Thermal Pressures from C I Fine-structure Excitation
PI: Edward Jenkins
PI Institution: Princeton University Observatory

We propose to analyze absorption features of interstellar C I in the STIS E140H spectra of about 60 early-type stars in the disk of the Galaxy, using chiefly the archival data produced by the Cycle 8 SNAP program of Lauroesch (to study ISM abundances). Our objective will be to expand on what we have recently learned about the distribution of interstellar thermal pressures from a survey of the relative populations of C I in excited fine-structure states toward 21 stars (Jenkins & Tripp 2001). We plan to invoke a very efficient, special analysis technique developed in the earlier study to unravel the blended features in different multiplets, a method that allows us to bypass time-consuming, iterative profile fitting procedures. Most of the earlier targets were confined to the CVZ, which limited the coverage of Galactic longitudes. The new archival survey will give more even coverage of the sky (and quadruple the number of sight lines), and it will allow us to investigate a broader range of circumstances for interesting phenomena we uncovered earlier, such as the link of pressure enhancements to the gas kinematics and the discovery of ubiquitous, small fractions of gas at extreme pressures (our interpretation is that they are probably produced by collisions of turbulent flows).

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Proposal Category: AR
Scientific Category: Solar System
ID: 9535

Title: Modeling of HST Observations of O I Emissions of Io in Eclipse
PI: David Goldstein
PI Institution: The University of Texas at Austin

Observations by Trauger et al with WFPC2 in May 1997 of several bright regions of O I 630nm emission from Io in eclipse, and lack of ionized S II emission, may be interpreted to yield information about how Io interacts with the Jovian magnetosphere. A patchy corona was seen along the limb at high altitude which was generally brighter on the side of Io facing the plasma stream. It also tended to be brighter in the plasma wake region near 340^o long., +20^o lat.. Yet these observations remain to be fully examined in terms of impingement of plasma from the Jovian torus on volcanic plumes and a sublimation atmosphere. We have recently been developing the ability to simulate the interaction of plasma particles with Io's neutral SO_2 atmosphere. We have integrated our Monte Carlo flow field modeling with a line-by-line radiation code so we can determine radiation and absorption spectra along any line of sight. We propose to utilize our existing computer code to sum together separate volcanic and sublimation solutions for the atmosphere at the time of the 1997 observations. Into such a 3D steady-state instantaneous flow field we can project a plasma stream bombardment to model the O I and S II emission using the recently developed "overlay" approach to model absolute surface brightness and spatial distribution from minor species. The proposed work is a collaboration between one of the original observers and modellers.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9536
Title: A New Approach in Studying AGN Intrinsic Absorbers
PI: Nahum Arav
PI Institution: UC Davis

Over the last few years we have shown that the traditional techniques for measuring absorption column densities: equivalent-width, curve of growth and Gaussian modeling, often yield misleading results when applied to AGN intrinsic absorbers associated with outflows. We propose to develop and refine alternative analysis tools that are based on deriving physical solutions for

the optical depth and covering of the absorbing flows, and make them available as a software package to the community. Using these techniques, we will re-analyze all the high-resolution spectroscopic observations of Seyfert outflows found in the HST archive (currently 133 orbits). The data products of this reanalysis will benefit researchers studying the relationship between the UV and X-ray warm absorbers, chemical abundances in the AGN environment and dynamical models of the outflows. We will expand our newly developed parameter-space approach to photoionization modeling to include the effects of: optically thick (bound-free) outflows, a wide range of incident ionizing spectra, and the effect of shielding on the flows. Once developed, we will make these models available to the community. To determine the physical properties of the outflows, we will apply these tools to the improved measurements from the UV data, as well as to the Chandra and FUSE absorption data from the same objects. We plan to achieve these goals over the course of a 3 years program.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9537
Title: A Multiwavelength Study of the Cassiopeia A Supernova Remnant
PI: Lawrence Rudnick
PI Institution: University of Minnesota

We propose to use the WFPC2 archive data on supernova remnant Cas A along with new and existing Chandra and VLA data, to construct a coherent physical picture of its multiple interacting thermal and relativistic plasmas. These multiple plasmas have distinct kinematics and their relationships are poorly understood. There have been very few multiwavelength studies of any SNRs to date and none have had the high-resolution detail now available with HST and Chandra. We will first examine the behavior of shocks in an inhomogeneous environment with a comparison of clump structures in the optical, X-ray, and radio images. Our second goal is to study the amplification and ordering of magnetic fields using the Rayleigh-Taylor fingers now seen for the first time with the HST data. These will be compared with our radio polarization and our radio and X-ray proper motion measurements to test this shear amplification picture. Finally, we will use ionization state, structure, compositional differences, and dynamical information derived from the the optical and X-ray

data to determine how cosmic ray acceleration, as measured by radio spectral index, is regulated in SNRs. The HST data now allow us to remedy the incomplete physical pictures derived from the individual wavebands separately, and make major steps in understanding the coupling between the multiple plasmas which control the dynamics and radiative properties of Cas A.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9539
Title: Dynamical Evolution of the Mass Function of Star Clusters in Different Host Galaxies
PI: Michael Fall
PI Institution: Space Telescope Science Institute

We will calculate the evolution of the mass and luminosity functions of star cluster systems (numbers of clusters per unit mass and luminosity) resulting from the disruption of clusters by two-body relaxation, gravitational shocks, dynamical friction, and stellar evolution. In particular, we will determine how the mass and luminosity functions vary with age, distance from the center of the host galaxy, and the mass, size, presence or absence of a disk, and other properties of the host galaxy. Our calculations will be made with extensions of the models recently developed by Fall & Zhang (2001). The results of these calculations will be compared with the many mass and luminosity functions of star cluster systems derived from HST and other observations. This will indicate how much the cluster systems have been eroded by disruption and how much of the field stellar populations in galaxies is the debris of disrupted clusters. Another outcome of this investigation will be a better understanding of when the peak of the luminosity function can or cannot be used reliably as a standard candle for distance determinations.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9540
Title: The WFPC2 Archival Parallels
PI: Stefano Casertano
PI Institution: Space Telescope Science Institute

We propose to process and combine with state-of-the-art tools the majority of

the WFPC2 images obtained as part of Archival Pure Parallel Program, consisting of observations of over 3,000 random pointings primarily in the wide WFPC2 UBVI filters. We will produce combined and cosmic-ray cleaned images, as well as object catalogs, for over 2,000 of these pointings. We will use these data to address a wide range of science topics: measuring the cosmic shear on scales from 20" to 2' , discovering ~ 50 starforming galaxies at z ~ 4 , finding optical counterparts to AGNs in wide-area radio and X-ray catalogs, improving the determination of the scale length of the Galactic disk, and studying stellar populations down to ~ 1 M(sun) for about 50 separate lines of sight in the LMC. The same data will be available to the astronomical community for a wide variety of other investigations, thus helping realize the legacy of WFPC2 parallel images.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9541
Title: Formation of Elliptical and S0 Galaxies in Clusters
PI: Pieter van Dokkum
PI Institution: California Institute of Technology

Establishing the formation mechanism of cluster galaxies gives direct information on the origins of the Hubble sequence and the morphology-density relation. Extensive studies with HST have led to a basic understanding of the star formation histories of cluster galaxies, but assessing the time and mechanism of their structural assembly has proven difficult, and has led to conflicting results. The main problem is the difficulty in distinguishing elliptical and S0 galaxies at high redshift. This proposal asks support to re-analyze the exquisite archival WFPC2 data on clusters at z~ 0.5 using two novel techniques, with the aim of determining objectively when and how elliptical and S0 galaxies in clusters were assembled. The goals are 1) to unambiguously distinguish elliptical and S0 galaxies in distant clusters using their ellipticities combined with spatially resolved kinematics, and 2) to determine the evolution of the galaxy merger fraction in clusters from the incidence of close pairs. Together, these projects give important new constraints on the assembly time of massive galaxies, and will put the "elliptical versus S0" controversy to rest. Keck spectroscopic data allowing measurements of spatially resolved kinematics are already obtained for 39 galaxies in four clusters. As a "bonus", the cluster-to-cluster scatter in

the intermediate redshift Fundamental Plane of early-type galaxies will be determined.

Proposal Category: AR
Scientific Category: Stellar Populations
ID: 9542
Title: Surface Brightness Profiles for Globular Clusters
PI: Karl Gebhardt
PI Institution: University of Texas at Austin

The central surface brightness and luminosity density profiles in any stellar system are crucial for understanding the governing dynamical processes. Those profiles for galaxies are well-measured by HST and have been used to make significant scientific progress. Globular clusters, on the other hand, do not have a well established dataset for their central surface brightness profiles. Yet, the archive is ripe with high signal-to-noise data on globular clusters. We will measure the central surface brightness profiles for about 30 globular clusters. We have searched the archives for those clusters with adequate signal to provide robust estimates of their central profile. This data will be combined with our extensive radial velocity dataset in the central regions to provide a unique opportunity to explore the central dynamics. The radial velocities show a dramatic increase in the rotational signature at small radii. Interpretation of this result requires a detailed understanding of the central surface brightness profiles. Any future endeavor to study globular cluster dynamics must include the central profiles. We have reached the point where the kinematics have been analysed to better spatial resolution, and this proposal addresses the need to place the surface brightness profiles on a more firm level.

Proposal Category: AR
Scientific Category: Galaxies
ID: 9543
Title: Exploring the "Bright Ages" in the "Other" Northern Hubble Deep Field
PI: Matthew Malkan
PI Institution: University of California at Los Angeles

We request support to reduce and analyze the third deepest HST field imaged to

date, centered on the z=2.39 radio galaxy 53w002 and an associated cluster of possible protogalactic clumps. We find that the summed images in F435W, F555W and F814W reach within 0.5--1 mag of the depth of the Hubble Deep Field North. We will merge our already fully reduced ground-based JHK imaging (to K=21.5) with the WFPC2 archival data, and deep U band imaging we are obtaining with Keck+LRIS-B. We will also put in a public archive the final reduced set of images, including our IR and U data. We will obtain photometric redshifts for all detectable galaxies in the field, and measure their morphologies and possible variability. These data products, along with the complete multiwavelength set of photometry will permit us to construct the redshift evolution of galaxy morphologies, and the global stellar mass and cosmic star formation rate as a function of redshift.

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Proposal Category: AR
Scientific Category: Hot Stars
ID: 9544
Title: Supernova Spectrum Synthesis for 3D Composition Models with the Monte Carlo Method
PI: Rollin Thomas
PI Institution: University of Oklahoma

Relying on spherical symmetry when modelling supernova spectra is clearly at best a good approximation. Recent polarization measurements, interesting features in flux spectra, and the clumpy textures of supernova remnants suggest that supernova envelopes are rife with fine structure. To account for this fine structure and create a complete picture of supernovae, new 3D explosion models will be forthcoming. To reconcile these models with observed spectra, 3D radiative transfer will be necessary. We propose a 3D Monte Carlo radiative transfer code, and improvements that will move it toward a fully self-consistent 3D transfer code. Spectroscopic HST observations of supernovae past, present and future will definitely benefit. Other 3D transfer problems of interest to HST users like AGNs will benefit from the techniques developed.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9545
Title: Understanding Intermediate-luminosity X-ray Objects and their Environments

PI: Andrew Ptak
PI Institution: The Johns Hopkins University

X-ray observations of normal galaxies with ROSAT, ASCA and Chandra have revealed that off-nuclear, compact, Intermediate-luminosity (L_X sim10^39-40 erg/s) X-ray Objects (IXOs) are quite common. On average, we find that 1 in every 5 galaxies contains one of these intriguing objects, based on our ROSAT HRI catalog, which is the most complete IXO catalog yet known. IXOs have received wide attention as putative intermediate-mass black holes with masses ~10^2-10^5 M, which would be quite interesting and puzzling. It is also possible that IXOs are "ordinary" X-ray binaries with stellar-mass black holes, and their X-ray emission is mildly beamed. Otherwise, little is known about the geometrical and physical properties of this exciting new class of astrophysical objects. X-ray observations of IXOs alone have not been able to provide good diagnostics. Deep, high spatial resolution optical imaging observations can provide important clues to their nature by examining the environment around the accreting black hole. We request funding to analyze 267 HST archival images for 38 IXOs from our catalog in order to search for individual stellar companions and star clusters that may be associated with IXOs, and to generally identify the nature of the regions harboring IXOs. This AR proposal is a companion to a SNAP proposal by PI Colbert, which proposes to image IXOs for which no HST imaging exists yet.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9546
Title: Observational Signatures of Nested Bars in Disk Galaxies
PI: Isaac Shlosman
PI Institution: University of Kentucky

vspace*-.4cm We propose to advance the spectroscopic method of detection of nuclear bars in nested bar systems. Stellar and gaseous bars on all scales dramatically change and speed up dynamical and secular evolution of disk galaxies. Due to the lack of a clear theoretical analysis of kinematic signatures of nuclear bars and of nested bar dynamics, only photometry is currently used to search for these strongest of departures from axial symmetry in disk galaxies. This leads to an underestimate of bar fractions and seriously undermines our understanding of stability and evolution of these

systems, especially on sub-kpc scales. Complete reliance on photometric studies of nuclear bars, along with theoretical 'vacuum', has also led to some erroneous results. By means of numerical study of gas and stellar dynamics in nested bar galaxies, we shall determine observational signatures of nuclear bars and will utilize available and future HST photometric and spectroscopic data, in conjunction with ground based observations. Specifically, we shall analyze and make testable predictions regarding the sense of rotation of nuclear bars, their extent with respect to the corotation radius, observed stellar velocity reversals, gas influx across the bar-bar interface, settling of the gas in the nuclear bars and distribution of shocked gas in nested bars. Nested bars can form a dynamic link between the nuclear regions and the galaxy at large. Understanding the nested bar dynamics, and gas and stellar contents, will expose their role in galactic evolution.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9547
Title: Using archival STIS kinematics to probe AGN fueling in the central 100 parsecs
PI: Paul Martini
PI Institution: Carnegie Observatories

Low-luminosity AGN far outnumber the more luminous quasars and may therefore be the dominant mechanism for cosmic black hole growth, yet the mechanisms that remove angular momentum from their fuel and cause it to accrete onto their central, supermassive black holes are essentially unknown. Demographic arguments suggest that the typical lifetime of AGN activity may be approximately 10^7 years and therefore spatially resolving the processes that give rise to AGN activity will require spatial resolution on scales where the dynamical timescale is less than this, or tens of parsecs. We propose to extract archival STIS spectra of nearby active and non-active galaxies to quantify their kinematic properties and form the basis for a future study of the circumnuclear kinematics of our previous HST imaging targets. In conjunction with our ground-based spectroscopy, we will investigate the kinematic properties of galaxies over the physical scales at which angular momentum must be removed from future AGN fuel.

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Proposal Category: AR

Scientific Category: ISM and Circumstellar Matter
ID: 9548
Title: Dynamics of the Inner Crab Nebula
PI: Jonathan Arons
PI Institution: University of California, Berkeley

The research proposed concerns the physics of the interaction of the relativistic winds from rotation powered neutron stars with their surrounding Pulsar-Wind Nebulae (PWN). The rich set of phenomena observed in the Crab Nebula and beginning to be observed in other PWN provide our best laboratory for the study of the physics of how the energy of a rotating, magnetized, compact central object converts, through a relativistic outflow, into the synchrotron radiation from the relativistic particles in the surrounding magnetized regions, a problem of general astrophysical significance, especially to studies of Gamma Ray Bursts and of AGN jets. The comparison of models of the interaction of the relativistic winds with their surroundings to HST and other observations also provides insight into the physics of the central engine itself. The proposed research focuses on the dynamics of interaction between the wind of the Crab pulsar and its synchrotron nebula. The structure of the relativistic shock wave which terminates the wind will be modeled, and used to construct synthetic, time dependent surface brightness maps in the optical and ultraviolet part of the spectrum which will be quantitatively compared to the recently completed observational campaign, in which a movie of the waves forming in the inner Crab nebula were observed in detail. The particle acceleration characteristic of such shock waves will also be investigated, in order to synthesize multiwavelength movies of the dynamics. From such comparisons of observation to theory, once can glean essential information on the magnetization and composition of such relativistic outflows, as well as information on the basic electrodynamics of the rotating magnetized object that powers the outflow.

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Proposal Category: AR
Scientific Category: AGN/Quasars
ID: 9549
Title: Iron Emission: A Powerful Probe of the Quasar Central Engine
PI: Marianne Vestergaard
PI Institution: The Ohio State University

We will study the optical and UV feii emission in a large sample of low-z active galaxies with the primary goal to constrain the origin of this emission and to gain insight into the unknown feii excitation mechanisms. This will enable significant progress to be made in the theoretical modeling of the complex feii spectrum. Understanding this spectrum is key as feii is THE major coolant of the broad line region (BLR), which is expected to be energetically important for the central engine. We will use mostly hst archival data but also available X-ray and ground-based data. We will apply our own improved version of the successful feii template fitting method to extract, accurately measure, and study the complicated feii emission spectrum, which is hard to measure with traditional methods. We will analyze the resulting unique database of feii emission spectra in two ways: (1) We will perform multivariate analyses to quantify how the UV feii relates to the X-ray and UV continuum properties and to the optical feii emission. (2) We will analyze the archival hst UV and available optical data from the AGN Watch monitoring program of NGC 5548 to assess how the UV and optical feii interrelate and respond to variations in the UV continuum, one of the potential feii drivers. Our broad goal is to ultimately quantify the conditions favorable for the generation of feii emission.

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Proposal Category: AR
Scientific Category: Cool Stars
ID: 9550
Title: CoolCAT
PI: Thomas Ayres
PI Institution: University of Colorado

A cool-star UV spectral catalog---CoolCAT--- will improve dramatically the accessibility and utility of the rich stellar archive of STIS E140M/H and E230M/H exposures. CoolCAT will contain digital spectral atlases--- echellograms processed to the same uniform standard, multiple observations graded and coadded, and adjacent wavelength regions concatenated---and a supporting catalog of line identifications, wavelengths, widths, and fluxes. Semiautonomous line fitting procedures will ensure a homogeneous and uniform treatment of the diverse spectral material. Valuable experience already has been gained with cycle 8 project 8280, which obtained full UV echelle coverage (1150--3000 Angstrom) of 13 representative late-type stars. My personal

interest in these data involves studies of gas dynamics in stellar outer atmospheres, traced by emission line Doppler widths and shifts. However, a wide range of other investigations---from the photochemical evolution of primitive planetary atmospheres to galactic population synthesis---will be enabled by CoolCAT.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9551
Title: The influence of blending on synthetic model-based interpretation of the HII region luminosity function
PI: David Thilker
PI Institution: National Radio Astronomy Observatory

The HII region luminosity function (HII LF), as determined from HAlpha photometry, reflects vital information regarding the process of OB star cluster formation. Despite a growing collection of published LFs there is still no true consensus on the detailed form of the LF in spiral galaxies of various Hubble types. Part of the problem can be traced to lack of uniformity in observations and method of source photometry, but it also stems from not making optimal use of realistic models for the HII region population and associated OB clusters. To address these deficiencies, we are engaged in a joint observational / modeling project to analyze HII LFs for a complete sample of 175 nearby spirals. Our interpretation of these LFs is founded on fitting observational data with synthetic HII LFs. We have reached an impass at which the influence of blending on the LF as a function of spatial resolution must be quantified at small scales (>~ 15 pc). Without this, we cannot fairly compare models against our seeing-limited data. We plan to analyze a collection of archival WFPC2 HAlpha images for 24 spirals taken from our ground-based survey. Using minimal spanning tree methods, we can characterize the clustering properties of HII regions on scales smaller than typically resolved from the ground. With this information, we will implement a blending correction to our synthetic models so they can be compared directly with our survey observations.

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Proposal Category: AR
Scientific Category: Cosmology
ID: 9552

Title: Using Bars as Signposts of Galaxy Evolution
PI: Kartik Sheth
PI Institution: California Institute of Technology

Recent studies of galaxy morphology with the Hubble Deep Fields have indicated a dramatic paucity of bars beyond a redshift > 0.5. This result is unexpected because the classical bar formation mechanism would predict that bars ought to be more common at higher redshifts because of dynamically colder galaxy disks and increased interactions. If the scarcity of bars is true, then serious constraints may be placed on the evolutionary stage of galactic disks. On the other hand, it is possible that the observations are misleading due to band-shifting and dust obscuration effects. While these criticisms have been suggested qualitatively, a quantitative analysis of the evolution of the bar fraction with redshift is missing. We propose to do such an analysis using the best dataset available for this type of a study, the NICMOS map of the Hubble Deep Field. For a control sample we will use a sample of spirals representative of the nearby Universe and simulate their appearance at different redshifts. From these simulated data, we will measure the bar fraction for comparison to our analysis of the NICMOS data.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9553
Title: The Birth and Evolution of Superbubbles
PI: Jesus Maiz-Apellaniz
PI Institution: Space Telescope Science Institute

We propose to analyze all the nebular WFPC2 observations of massive young clusters (MYCs) within 10 Mpc in order to understand the interaction with the surrounding medium which leads to the creation of superbubbles. In a previous analysis we detected a discrepancy between the measured and the expected size distribution of superbubble sizes around a small sample of nearby MYCs. We propose to measure the diameters of the hot cavities created around the clusters by the stellar winds and supernovae for all the objects in this extended sample. The data will be combined with ground-based high-spectral-resolution spectroscopic observations of a subsample of the clusters in order to relate the cavity size to the velocity dispersion of the warm gas. Our final goals are: (i) to verify the existence of the discrepancy between the

expected and the measured cavity size distribution and to find an explanation for it, and (ii) to discern which is the energy source that mantains the supersonic velocity dispersion of the warm gas in Giant H, ii Regions: gravity, stellar winds, radiation, or a combination of them. In order to do that we will generate 3-D hydrodynamic simulations which include the effects of gravity and radiation and compare them with the observed data.

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Proposal Category: AR
Scientific Category: ISM and Circumstellar Matter
ID: 9554
Title: Unveiling the origin of post-AGB winds through STIS data
PI: Carmen Sanchez Contreras
PI Institution: Jet Propulsion Laboratory/Caltech

The impact of fast, collimated jets on the spherical and slowly expanding circumstellar envelopes of AGB stars, is believed to be responsible for the remarkable bipolarity and high axial-velocities observed in most post-AGB objects (protoplanetary and planetary nebulae). We have recently discovered inner, post-AGB jets in the prototype protoplanetary nebula He 3-1475, through a preliminary analysis of STIS long-slit spectra. The high-spatial resolution achieved by the HST and the spectroscopic capabilities of STIS have allowed us for the first time to study the spatio-kinematic structure of post-AGB jets in the stellar vicinity, before they have been strongly altered by the interaction with the AGB shell. Such a study is crucial for understanding the (unknown) mechanism that powers and collimate the winds of post-AGB stars. We request funding to perform a comprehensive study of the STIS spectra for the whole set of slits and gratings available for He 3-1475 and another well studied PPN, HD 44179. A preliminary inspection of the data reveals also in this source, a fast, bipolar outflow at ~ 40 A.U. from the star. This is the first time that post-AGB winds are seen at such small scale. A detailed anaysis of the STIS data is needed to tightly constraint the physical properties of the post-AGB jets and, ultimately, to understand their origin.

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Proposal Category: AR
Scientific Category: Galaxies
ID: 9555
Title: A Kinematic Study of Disk Systems in Galaxy Cluster Cl0024+16 at z=0.39

PI: David Koo
PI Institution: University of California Observatories/Lick Observatory

For over twenty years, distant galaxy clusters have been a key arena for galaxy evolution studies. Despite many major discoveries, the physical mechanisms that drive cluster galaxy evolution remain a mystery and largely untested. Viable proposed processes include merging, "harassment", starbursts, ram-pressure stripping, and infall of groups, all of which involve disks and gas, and are expected to change the mass-to-light ratios of cluster galaxies. While recent studies have concentrated on bulge-dominated galaxies, we will instead focus on the evolution of disks in distant clusters. As an initial foray into this new area, we propose an intensive study of distant disks combining archival WFPC2 data of cluster Cl0024+16 with existing high-quality Keck spectra for 145 galaxies. A unique dimension of our Keck data is its spectral resolution, which is high enough to yield internal kinematics via velocity widths and rotation curves. HST data is essential to convert the raw kinematic measures into reliable velocities, and to convert these into masses. This will be the first study of distant cluster disks and their masses and will thus serve as a powerful discriminant among plausible physical mechanisms that drive cluster galaxy evolution.

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Proposal Category: AR
Scientific Category: Solar System
ID: 9556
Title: HST Images of Jupiter's UV Aurora: Mirrors of a Strongly Corotational Magnetosphere
PI: Gilda E. Ballester
PI Institution: University of Arizona

Over the past decade, the Hubble Space Telescope has acquired an impressive imaging dataset of the UV aurora of Jupiter. Signatures of the local energy deposition from energetic interaction processes with the magnetosphere, when viewed as whole, the patterms of emissions seen in these images are mirrors to the global state and configuration of the magnetosphere resulting from the most recent interaction with the impinging solar wind. A systematic study of the spatial and temporal behavior of the emissions, spanning different spatial and dynamic scales, is already in demand from members of the space and planetary community. The HST dataset is also special since it has spanned the

whole Galileo orbiter mission. We request funding for a systematic analysis and classification and other studies of the aurora with HST imaging dataset. We will set up a portable scenario for comparative studies of Galileo magnetic fields and particles data with HST iobservations. We will also begin to compare the imaging results with global models of the magnetospheric interactions on Jupiter in parallel with identifying other relevant infomation from Galileo. This will fully prepare us for the following year to carry out a full comparative study during the rare opportunity of the Cassini flyby coordinated with the Galileo mission.

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