

DIVISION E

SUN AND HELIOSPHERE

soleil et héliosphère

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on Solar and Stellar Environments,
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C-E Solar Eclipses,
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TRIENNIAL REPORT 2018-2021

1. Background

Division E encompasses the study of the Sun, its variability, activity and dynamics, as well as its impact on the Earth and other bodies located within the heliosphere. Division E science is intrinsically interdisciplinary, lying at the interface of astrophysics, atmospheric science, and plasma physics. It is thus not surprising that all of Division E's working groups are interdivisional. The Coordination of Synoptic Observations of the Sun working group is shared with Division B (Data Science), and it recently successfully proposed Resolution B3: on the preservation, digitisation and scientific exploration of

historical astronomical data at the recent General Assembly in Vienna. The Impact of Magnetic Activity on Solar and Stellar Environments working group involves Divisions F (Planets) and G (Stars), focusing on interdisciplinary science related to understanding the impact of stellar magnetic activity on the astrosphere. This working group has been proposed as a cross-Division Commission moving into the next triennium. The Solar Eclipses working group, co-sponsored by Division C (Education and Outreach) provides a variety of eclipse-related resources to the general public and supports activities such as the recent IAU Symposium 354 during the 2019 eclipse.

This triennium saw the advent of new international missions and projects that span the heliosphere. The Atacama Large Millimeter/submillimeter Array (ALMA) has opened a new window on the solar chromosphere, and NASA's Parker Solar Probe and ESA's out-of-the-ecliptic Solar Orbiter mission are dazzling us with closer views of the Sun and solar wind than ever before. On the ground, the 4-metre Daniel K. Inouye Solar Telescope (DKIST) has had spectacular first-light images and is on its way to full implementation with the goal of probing solar magnetism at fundamental scales.

Future telescopes are in development by India (Aditya) and China (ASO-S) and the U.S. (PUNCH). The Square Kilometre Array (SKA) will provide the opportunity to observe solar activity and its origins as never before. Finally, NASA's Interstellar Mapping and Acceleration Probe (IMAP) will look outwards to observe the interaction of the solar wind with the interstellar medium. From the Sun throughout the heliosphere, and all around the world, Division E science continues to expand!

This overview lists the most relevant meetings in our field along with noting some important publication statistics, databases, and reviews.

2. Developments within the past triennium

- Parker Solar Probe, launched in August 2018, has now observed flips in direction of the magnetic field in solar wind outflows, dubbed 'switchbacks', to be very common inside the orbit of Mercury. Corotation in the solar wind has also been observed, as has the dissipation of dust near the Sun and new complexities within energetic particle storms and coronal mass ejections and unprecedented small scales. (McComas et al 2019; Kasper et al 2019; Howard et al 2019; Bale et al 2019).

- The Daniel K. Inouye Solar Telescope, with first light in January 2020, has produced the highest resolution image of the Sun's surface ever taken (<https://nso.edu/press-release/inouye-solar-telescope-first-light/>)

- Solar Orbiter, launched in February 2020, is the first space mission observing solar plasma both in situ and remotely from a close distance in and out of the ecliptic (Müller et al 2020; Forveille and Shore 2020; Zouganelis et al 2020). First images revealed omnipresent miniature solar flares, dubbed 'campfires' (https://www.esa.int/Science_Exploration/Space_Science/Solar_Orbiter/Solar_Orbiter_s_first_images_reveal_campfires_on_the_Sun)

- ALMA is obtaining unprecedented observations of the chromosphere (Molnar et al 2019; Alissandrakis et al 2020; Guevara Gómez et al 2021), including the first observations of spicules at mm wavelenths (Yokoyama et al 2018).

- The Square Kilometer Array (SKA) Observatory, a new intergovernmental organisation dedicated to radio astronomy, was launched in February 2021. SKA's unique capabilities in terms of spatial, spectral, and temporal resolution, as well as sensitivity and show that they have the potential to provide major new insights in solar physics topics of capital importance (Nindos et al 2019).

- Imaging spectroscopy with the the Jansky VLA has been used to observe the tra-

jectories of electron beams (Chen et al 2018) and radio emission modulated by MHD waves (Yu and Chen 2019). The Mingantu Spectral Radioheliograph (MUSER; (Yan et al 2021)) is bringing new radio imaging spectroscopic capabilities online.

- The Expanded Owens Valley Solar Array quantified evolving magnetic fields in solar flares (Fleishman et al 2020; Chen et al 2020a) and the Mauna Loa Solar Observatory Coronal Multi-channel Polarimeter mapped the global magnetic field of the solar corona for the first time (Yang et al 2020)

- The Low Frequency Analyzer and Recorder (LOFAR) and Murchison Widefield Array are providing exciting new solar science using low-frequency radio observations, including demonstrating a clear continuous transition from a stationary to a drifting state of a Type II burst which, the first observation of its kind (Chrysaphi et al 2020) and the first imaging spectroscopy observations of solar drift pair bursts (Kuznetsov and Kontar 2019) as well as spectropolarimetric imaging of solar radio bursts (Beardsley et al 2019) and a rare spatially resolved diagnostic of a CME magnetic field (Mondal et al 2020).

- For the first time, a numerical model simulated the entire evolution of a solar flare from emergence to eruption (Cheung et al 2019).

- Solar eclipses in South America in 2019-2020 provided excellent scientific, educational and public outreach opportunities.

- International effort (JAXA-ESA-NASA) to establish priorities for a next generation solar physics mission, resulting in the recent start of the Solar-C (EUVST) mission (https://hinode.nao.ac.jp/SOLAR-C/SOLAR-C/Documents/NGSPM_report_170731.pdf).

- The Whole Heliosphere and Planetary Interactions (WHPI; <https://whpi.hao.ucar.edu>) launched an international initiative focused around the solar minimum period aiming to understand the interconnected sun-heliospheric-planetary system. Multiple community science meetings and observing campaigns were organized, and support provided for the the Parker Solar Probe Perihelion Campaigns with participation from dozens of ground and space-based observatories (<https://www.nasa.gov/feature/goddard/2020/nasa-parker-solar-probe-teams-up-with-observatories-around-solar-system-for-4th-solar-encounter>)

- A long-term scientific program in solar terrestrial physics was organised by SCOSTEP for 2020-2024 on Predictability of Variable Solar-Terrestrial Coupling (PRESTO): <https://www.bc.edu/content/bc-web/research/sites/institute-for-scientific-research/research/SCOSTEP/scostep-programs/scostep-presto.html>

- We entered Solar Cycle 25, and current predictions expect peak sunspot activity in 2025 (<https://www.weather.gov/news/201509-solar-cycle>).

3. Publications

Division E has publications in a wide range of topics. The number of publications in refereed journals give some indication of the proportion of work in various subfields. For the period from August 2018 to January 2021 (prior to this writing dated February 2021), the SAO/NASA Astrophysical Data Service tallies these counts according to the appearance of article keywords containing the word Sun (including the heliosphere and solar-terrestrial relations).

The total number of publications is 2559, distributed in the following subtopics that in several cases overlap.

Sun:

- Evolution: 37
- Helioseismology: 72
- Interior: 51
- Rotation: 39

- Oscillations: 191
- Magnetic fields: 549
- Sunspots: 194
- Granulation: 15
- Photosphere: 218
- Chromosphere: 272
- Faculae: 29
- Filaments/prominences: 159
- Transition region: 70
- Corona: 618
- Abundances: 36
- Activity: 474
- Flares: 486
- Coronal mass ejections: 156
- Solar wind: 509
- UV radiation: 127
- X ray, Gamma ray: 47
- Infrared: 9
- Radio radiation: 130
- Particle emission: 66
- Interplanetary medium: 122 Solar terrestrial relations: 25

4. Databases

- Solar flare model database: <https://star.pst.qub.ac.uk/wiki/doku.php/public/solarmodels/start>
- Multiple Coronal Mass Ejection databases: <https://www.affects-fp7.eu/services/cme-databases/>
- High-resolution observations of the solar atmosphere through ultraviolet spectroscopy and imaging, from 2013 to the present (Roupe van der Voort et al 2020).

5. Reviews

5.1. 2018 (after GA)

- Living Reviews in Solar Physics
 - Solar UV and X-ray spectral diagnostics (Del Zanna and Mason 2018)
 - The Sun's supergranulation (Rincon and Rieutord 2018)
 - Solar prominences: theory and models (Gibson 2018)
- Solar Physics (Invited Reviews)
 - The problem of the height dependence of magnetic fields in sunspots (Balthasar 2018)
 - 75th anniversary of 'Existence of Electromagnetic-Hydrodynamic Waves' (Russell 2018)
- First ten years of Hinode solar on-orbit observatory (Shimizu et al 2018)

5.2. 2019

- Living Reviews in Solar Physics
 - Quiet Sun magnetic fields: an observational view (Bellot Rubio and Orozco Suárez 2019)
 - Coronal bright points (Madjarska 2019)
 - Flare-productive active regions (Toriumi and Wang 2019)

- Asteroseismology of solar-type stars (García and Ballot 2019)
- The multi-scale nature of the solar wind (Verscharen et al 2019)
- Annual Review of Astronomy and Astrophysics Volume 57
 - The properties of the solar corona and its connection to the solar wind (Cranmer and Winebarger 2019)
 - New view of the solar chromosphere (Carlsson et al 2019)
- Achievements of Hinode in the first eleven years (Hinode Review Team et al 2019)

5.3. 2020

- Living Reviews in Solar Physics
 - Historical sunspot records (Arlt and Vaquero 2020)
 - Solar cycle prediction (Petrovay 2020)
 - Radiation hydrodynamics in simulations of the solar atmosphere (Leenaarts 2020)
 - Dynamo models of the solar cycle (Charbonneau 2020)
 - The Parker problem: existence of smooth force-free fields and coronal heating (Pontin and Hornig 2020)
- Solar Physics (Invited Reviews)
 - ICME evolution in the inner heliosphere (Luhmann et al 2020)
- Research in Astronomy and Astrophysics
 - Magnetic flux ropes in the solar corona: structure and evolution toward eruption (Liu 2020)
 - Some interesting topics provoked by the solar filament research in the past decade (Chen et al 2020b)
- Annual Review of Astronomy and Astrophysics
 - Magnetohydrodynamic waves in the solar corona (Nakariakov and Kolotkov 2020)

5.4. 2021

- Solar Physics (Invited Review) in press
 - Dibyendu Nandy, Progress in Solar Cycle Predictions: Sunspot Cycles 24-25 in Perspective

6. IAU Meetings (coordinated by Division E)

6.1. 2019

- June: IAUS 354 Solar and Stellar Magnetic Fields: Origins and Manifestations, Copiapó, Chile

6.2. 2020

- December: IAU 367 Education and Heritage in the Era of Big Data in Astronomy. The first steps on the IAU 2020-2030 Strategic Plan - VIRTUAL MEETING

6.3. 2021

- August: IAUS 365 Dynamics of Solar and Stellar Convection Zones and Atmospheres – POSTPONED

7. Non-IAU Meetings (includes 2018 post IAU GA)

From <https://soho.nascom.nasa.gov/community/>:

7.1. 2018

- September 3-7, 2018 BUKS2018: Waves and Oscillations in the Solar Atmosphere, in La Laguna, Tenerife, Spain.
- September 10-13, 2018 Hinode-12, in Granada, Spain.
- September 18-21, 2018 3rd Working Meeting: Use of Vector Synoptic Maps for Modeling, in Goettingen, Germany.
- September 24-28, 2018 XVIth Hvar Astrophysical Colloquium: International Study of Earth-affecting Solar Transients, ISEST 2018 Workshop, in Hvar, Croatia.
- September 24 - October 5, 2018 Solar Spectropolarimetry and Diagnostic Techniques, Fall School, in Estes Park, CO, USA.
- September 25-29, 2018 Polar Perspectives - Advancing Our Understanding of the Sun, in Boulder, CO, USA.
- October 8-11, 2018 ESAC Data Analysis and Statistics Workshop, in Madrid, Spain.
- October 15-18, 2018, The workshop on solar radio and IPS data analysis, in Tongliao, Inner Mongolia, China
- October 29-31, 2018 Third Meeting of the Italian Solar and Heliospheric Community - SOHE3, in Turin, Italy.
- October 29 - November 2, 2018 2018 SDO Science Workshop: Catalyzing Solar Connections, in Belgium.
- November 5-9, 2018 15th European Space Weather Week, in Leuven, Belgium.
- November 12-16, 2018 Particle Acceleration and Transport: from the Sun to Extragalactic Sources, in Universita della Calabria, Rende, Italy.
- November 26-28, 2018 MHD-Days and GdRI Dynamo Meeting, in Dresden, Germany.
- November 27-29, 2018 SOHO-29: 22 Years of GOLF and VIRGO: 2 Sunspot Cycles Seen by Seismology, in Nice, France.
- December 6-8, 2018 DKIST Critical Plan Workshop 5: Wave Generation and Propagation, in Las Cruces, NM.
- December 9, 2018 Impacts of Solar Spectral Irradiance Variability on Intermediate Timescales, at Goddard Space Flight Center, Greenbelt, MD, USA. Contact: James.A.Klimchuk@nasa.gov
- December 10-14, 2018 AGU Fall Meeting, in Washington, DC, USA.

7.2. 2019

- January 6-10, 2019 16th AMS Space Weather Conference, in Phoenix, AZ, USA.
- February 7-8, 2019 PROBA-2 Symposium: 9 Years of PROBA-2 Operations, in Redu, Belgium.
- February 12-15, 2019 Chapman Conference on Scientific Challenges Pertaining to Forecasting Space Weather Including Extremes, in Pasadena, CA, USA.
- February 25-28, 2019 Recent progress in heliospheric physics by direct measurements of unexplored space plasmas, in Nagoya, Japan.
- March 4-8, 2019 Solar helicities in theory and observations: implications for space weather and dynamo theory, in Stockholm, Sweden.
- March 25-28, 2019 African Geophysical Society (AGS) Conference on Space Weather 2019, in Cairo, Egypt.
- April 1-5, 2019 Space Weather Workshop, in Boulder, CO, USA.
- April 1-5, 2019 Symposium Axel Brandenburg 60th: Turbulence and magnetic fields - from the early universe to late-type stars, in Tuusula, Finland.
- April 7-12, 2019 EGU 2019, in Vienna, Austria.
- May 6-10, 2019 2nd China-Europe Solar Physics Meeting (CESPM), in Hvar, Croatia.

- May 20-24, 2019 International Space Weather Initiative Workshop, in Trieste, Italy.
- May 28 - June 1, 2019 18th RHESSI Workshop, in Minneapolis, MN, USA.
- June 3-7, 2019 Partially Ionized Plasmas in Astrophysics (PIPA2019), in Palma de Mallorca, Spain.
- June 4-7, 2019 1st NSO Community Science Program (NCSP) Data Training Workshop, in Boulder, CO, USA.
- June 9-13, 2019 AAS/SPD Meeting, in St. Louis, MO, USA.
- June 10-14, 2019 VarSITI Closing Symposium, in Sofia, Bulgaria.
- June 10-16, 2019 Solar Physics Summer School at Raman Science Center, in Leh, Ladakh, India
- June 11-14, 2019 Coronal Loops IX, in St. Andrews, Scotland, UK.
- June 24-28, 2019 European Week of Astronomy and Space Science (EWASS 2019), in Lyon, France.
- June 22-26, 2020 COOL STARS 21, in Toulouse, France.
- June 27-28, 2019 Preparing for When the Sun Wakes Up: Workshop on Deep-Space Sun-Earth L5/L1 Space-Weather Missions, in London, UK.
- July 1-5, 2019 ASTRONUM 2019: 14th International Conference on Numerical Modeling of Space Plasma Flows, in Paris, France.
- July 2-7, 2019 Towards Future Research on Space Weather Drivers, in San Juan, Argentina.
- July 8-11, 2019 Space Climate 7 Symposium, in Canton Orford, Quebec, Canada.
- July 8-12, 2019 CESRA 2019, in Potsdam, Germany.
- July 8-18, 2019 IUGG/IAGA General Assembly, in Montreal, Canada.
- July 8-19, 2019 Boulder Space Weather Summer School, in Boulder, CO, USA.
- July 15-19, 2019 Scintillating Science: Cutting-Edge Science Achieved Through the Observations of Radio Scintillation Workshop, in Hermanus, South Africa.
- July 23-25, 2019 Preparing for the Next Generation of Ground-based Solar Physics Observations, in Holmbury St. Mary, UK.
- July 28 - Aug 2, 2019 AOGS, in Singapore.
- July 29 - Aug 2, 2019 9th East-Asia School and Workshop on Laboratory, Space, and Astrophysical Plasmas, in Nagoya, Japan.
- August 5-9, 2019 SOLARNET Summer School for Solar Observers A week above the clouds, at Observatorio del Teide, Tenerife, Spain.
- August 5-9, 2019 SHINE 2019, in Boulder, CO, USA.
- Aug 26-30, 2019 9th Solar Polarization Workshop (SPW9), in Goettingen, Germany.
- Aug 26-30, 2019 Fifth UK-Ukraine-Spain Meeting on Solar Physics and Space Science (UKUS), in Kyiv, Ukraine.
- September 2-6, 2019 Hinode-13/IPELS 2019: Fundamental Plasma Processes in the Sun, Interplanetary Space, and in the Laboratory, in Tokyo, Japan.
- September 2-9, 2019 Ensemble Forecasts in Space Weather: Science and Operations, in Leiden, The Netherlands.
- September 9-14, 2019 SOLARNET School: Solar spectropolarimetry: From virtual to real observations, in Lugano, Switzerland.
- September 16-20, 2019 Machine Learning in Heliophysics, in Amsterdam, The Netherlands.
- September 24-26, 2019 Dynamics of the Sun and Stars: Honoring the Life and Work of Michael Thompson, in Boulder, CO, USA.
- September 26-27, 2019 Requirements for a Next Generation GONG Network: Research Requirements, in Boulder, CO, USA.
- October 1-3, 2019 L5 Consortium Meeting, in Palo Alto, CA, USA.

- November 4-6, 2019 Python in Heliophysics Fall 2019 Meeting, in Boulder, CO, USA.
- November 4-8, 2019 IRIS-10 Science Workshop, in Bangalore, India.
- November 11-13, 2019 7th METIS Workshop, in Padova, Italy.
- November 18-22, 2019 16th European Space Weather Week, in Liege, Belgium.
- November 19-28, 2019 XXXI Canary Islands Winter School of Astrophysics: Computational Fluid Dynamics in Astrophysics, in San Cristobal de La Laguna, Tenerife, Spain.
- December 9-13, 2019 AGU Fall Meeting, in San Francisco, CA, USA.

7.3. 2020

- January 6-17, 2020 COSPAR Capacity Building Workshop On Coronal and Interplanetary Shocks: Analysis of Data from Space and Ground-based Instruments in Kodaikanal, IIA, India
 - January 12-16, 2020 AMS Space Weather Conference and AMS 100th Meeting, in Boston, MA, USA.
 - January 13-15, 2020 2nd NSO Community Science Program (NCSP) DKIST-Data Training Workshop: Image Processing and Time Series, in California State University Northridge, CA, USA.
 - January 20-22, 2020 1st Artificial Intelligence Data Analysis (AIDA) School for Heliophysicists, in Bologna, Italy.
 - January 27-31, 2020 2020 Sun-Climate Symposium, in Tucson, AZ, USA.
 - January 28-30, 2020 International Symposium PSTEP-4 and ISEE-2: Toward the Solar-Terrestrial Environmental Prediction as Science and Social Infrastructure, in Nagoya, Japan.
 - February 3-7, 2020 5th Asia Pacific Solar Physics Meeting, in Pune, India.
 - February 10-14, 2020 COSPAR ISWAT Inaugural Working Meeting, in Port Canaveral, FL, USA. February 26-28, 2020 Michael Knoelker Symposium: from Solar Physics to Exoplanets, in Boulder, CO, USA.
 - March 2-5, 2020 1st International Workshop on Solar Imaging with ALMA: ALMA-SOL-IMG1, in Oslo, Norway.
 - March 3-4, 2020 Coherent Structure Tracking (CST) Workshop, in Orsay, France.
 - March 8-13, 2020 19th Annual International Astrophysics Conference: From the Sun's Atmosphere to the Edge of the Galaxy: A Story of Connections, in Santa Fe, NM, USA.
 - July 6-17, 2020 (VIRTUAL MEETING) NASA Heliophysics Summer School: Explosive Space Weather Events and their Impacts
 - July 7-8, 2020 - (VIRTUAL MEETING) RHESSI-19 Workshop: Preparing for the Next Decade in High-Energy Solar Physics Research
 - July 20-24, 2020 - (VIRTUAL MEETING) 3rd NCSP DKIST Data-Training Workshop Preparing for DKIST: Milne-Eddington Spectro-polarimetric Inversions
 - July 12-16, 2020 - (VIRTUAL MEETING) JpGU - AGU Joint Meeting 2020
 - August 3-7, 2020 - (VIRTUAL MEETING) Helio Hackweek 2020
 - September 14-15, 2020 (VIRTUAL MEETING) Whole Heliosphere and Planetary Interactions (WHPI) Show and Tell #1
 - November 2-6, 2020 (VIRTUAL MEETING) 1st European Space Weather Symposium (ESWS2020)
 - November 26, 2020 (VIRTUAL MEETING) 2nd SOLARNET Forum for telescopes and databases
 - December 3, 2020 (VIRTUAL MEETING) First PUNCH Public Science Meeting
 - December 7-11, 2020 (VIRTUAL MEETING) AGU Fall Meeting

- December 8-11, 2020 (VIRTUAL MEETING) MHD Coronal Seismology 2020: Twenty Years of Probing the Sun's Corona with MHD Waves
- December 14-18, 2020 (VIRTUAL MEETING) SPIE Astronomical Telescopes + Instrumentation

7.4. 2021

- January 10-14, 2021 (VIRTUAL MEETING) AMS Space Weather Virtual Conference
- January 21, 2021 (VIRTUAL MEETING) Whole Heliosphere and Planetary Interactions (WHPI) Show and Tell #2
- January 28 - February 4, 2021 (VIRTUAL MEETING) 43rd COSPAR Scientific Assembly
- January 31, 2021 (VIRTUAL MEETING) COSPAR 2021 Cross-Disciplinary Workshop: Machine Learning for Space Sciences
- February 1, 2021 (VIRTUAL MEETING) COSPAR 2021 Cross-Disciplinary Workshop: Autonomy for Future Space Science Missions
- February 2, 2021 (VIRTUAL MEETING) COSPAR 2021 Cross-Disciplinary Workshop: Cloud Computing for Space Sciences
- February 1-5, 2021 (VIRTUAL MEETING) International School of Space Science: Dynamical Systems and Machine Learning Approaches to Sun-Earth Relations
- February 12, 2021 (VIRTUAL MEETING) Celebrate a Solar Cycle of SDO Science!
- March 1-4, 2021 (VIRTUAL MEETING) IIA-50 "Advances in Observation and Modelling of Solar Magnetism and Variability"
- March 2-4, 2021 (VIRTUAL MEETING) Cool Stars 20.5 - virtually cool
- March 8-14, 2021 (VIRTUAL MEETING) Solar Activities and their influences in the Heliosphere and Planetary Atmospheres
- April 6-9, 2021 Solar Orbiter School: the multi-instruments space mission to the Sun, in Les Houches, France.
- April 12-13, 2020 (VIRTUAL MEETING) SOLARNET Public Engagement Training Workshop
- April 15, 2021 (VIRTUAL MEETING) Whole Heliosphere and Planetary Interactions (WHPI) Show and Tell #3
- March 11, 25; April 8, 15, 2021 (VIRTUAL MEETING) SDO Science Sessions
- April 19-30, 2021 (VIRTUAL MEETING) EGU General Assembly
- May 3-7, 2021 (VIRTUAL MEETING) Heliophysics 2050
- June 3-6, 2021 (VIRTUAL MEETING) Japan Geoscience Union Meeting 2021
- June 6-10, 2021 (VIRTUAL MEETING) AAS/SPD 2021
- June 14-18, 2021 (VIRTUAL MEETING) Parker One, at JHU/APL, Laurel, Maryland, USA
- June 15-22, 2021 2021 NASA Heliophysics Summer School: Long-Term Solar Activity: Earth and Space Climate, in Boulder, CO, USA.
- June 28 - July 2, 2021 (VIRTUAL MEETING) EAS 2021
- July 12-23, 2021 (VIRTUAL MEETING) 37th International Cosmic Ray Conference (ICRC 2021)
- August 1-6, 2021 (VIRTUAL MEETING) AOGS2021

Sarah Gibson
President of the Division

References

- Alissandrakis CE, Nindos A, Bastian TS, Patsourakos S (2020) Modeling the quiet Sun cell and network emission with ALMA. *Astronomy and Astrophysics* 640:A57, , 2006.09886
- Arlt R, Vaquero JM (2020) Historical sunspot records. *Living Reviews in Solar Physics* 17(1):1,
- Bale SD, Badman ST, Bonnell JW, Bowen TA, Burgess D, Case AW, Cattell CA, Chandran BDG, Chaston CC, Chen CHK, Drake JF, de Wit TD, Eastwood JP, Ergun RE, Farrell WM, Fong C, Goetz K, Goldstein M, Goodrich KA, Harvey PR, Horbury TS, Howes GG, Kasper JC, Kellogg PJ, Klimchuk JA, Korreck KE, Krasnoselskikh VV, Krucker S, Laker R, Larson DE, MacDowall RJ, Maksimovic M, Malaspina DM, Martinez-Oliveros J, McComas DJ, Meyer-Vernet N, Moncuquet M, Mozer FS, Phan TD, Pulupa M, Raouafi NE, Salem C, Stansby D, Stevens M, Szabo A, Velli M, Woolley T, Wygant JR (2019) Highly structured slow solar wind emerging from an equatorial coronal hole. *Nature* 576(7786):237–242,
- Balthasar H (2018) The Problem of the Height Dependence of Magnetic Fields in Sunspots. *Solar Physics* 293(8):120, , 1808.06426
- Beardsley AP, Johnston-Hollitt M, Trott CM, Pober JC, Morgan J, Oberoi D, Kaplan DL, Lynch CR, Anderson GE, McCauley PI, Croft S, James CW, Wong OI, Tremblay CD, Norris RP, Cairns IH, Lonsdale CJ, Hancock PJ, Gaensler BM, Bhat NDR, Li W, Hurley-Walker N, Callingham JR, Seymour N, Yoshiura S, Joseph RC, Takahashi K, Sokolowski M, Miller-Jones JCA, Chauhan JV, Bojičić I, Filipović MD, Leahy D, Su H, Tian WW, McSweeney SJ, Meyers BW, Kitaef S, Vernstrom T, Gürkan G, Heald G, Xue M, Riseley CJ, Duchesne SW, Bowman JD, Jacobs DC, Crosse B, Emrich D, Franzen TMO, Horsley L, Kenney D, Morales MF, Pallot D, Steele K, Tingay SJ, Walker M, Wayth RB, Williams A, Wu C (2019) Science with the Murchison Widefield Array: Phase I results and Phase II opportunities. *Publications of the Astronomical Society of Australia* 36:e050, , 1910.02895
- Bellot Rubio L, Orozco Suárez D (2019) Quiet Sun magnetic fields: an observational view. *Living Reviews in Solar Physics* 16(1):1,
- Carlsson M, De Pontieu B, Hansteen VH (2019) New View of the Solar Chromosphere. *Annual Review of Astronomy and Astrophysics* 57:189–226,
- Charbonneau P (2020) Dynamo models of the solar cycle. *Living Reviews in Solar Physics* 17(1):4,
- Chen B, Yu S, Battaglia M, Farid S, Savcheva A, Reeves KK, Krucker S, Bastian TS, Guo F, Tassev S (2018) Magnetic Reconnection Null Points as the Origin of Semirelativistic Electron Beams in a Solar Jet. *Astrophysical Journal* 866(1):62, , 1808.05951
- Chen B, Shen C, Gary DE, Reeves KK, Fleishman GD, Yu S, Guo F, Krucker S, Lin J, Nita GM, Kong X (2020a) Measurement of magnetic field and relativistic electrons along a solar flare current sheet. *Nature Astronomy* 4:1140–1147, , 2005.12757
- Chen PF, Xu AA, Ding MD (2020b) Some interesting topics provoked by the solar filament research in the past decade. *Research in Astronomy and Astrophysics* 20(10):166, , 2010.02462
- Cheung MCM, Rempel M, Chintzoglou G, Chen F, Testa P, Martínez-Sykora J, Sainz Dalda A, DeRosa ML, Malanushenko A, Hansteen V, De Pontieu B, Carlsson M, Gudiksen B, McIntosh SW (2019) A comprehensive three-dimensional radiative magnetohydrodynamic simulation of a solar flare. *Nature Astronomy* 3:160–166,
- Chrysaphi N, Reid HAS, Kontar EP (2020) First Observation of a Type II Solar Radio Burst Transitioning between a Stationary and Drifting State. *Astrophysical Journal* 893(2):115, , 2003.11101
- Cranmer SR, Winebarger AR (2019) The Properties of the Solar Corona and Its Connection to the Solar Wind. *Annual Review of Astronomy and Astrophysics* 57:157–187, , 1811.00461
- Del Zanna G, Mason HE (2018) Solar UV and X-ray spectral diagnostics. *Living Reviews in Solar Physics* 15(1):5, , 1809.01618
- Fleishman GD, Gary DE, Chen B, Kuroda N, Yu S, Nita GM (2020) Decay of the coronal magnetic field can release sufficient energy to power a solar flare. *Science* 367(6475):278–280,
- Forveille T, Shore S (2020) The Solar Orbiter mission. *Astron and Astrophys* 642:E1,
- García RA, Ballot J (2019) Asteroseismology of solar-type stars. *Living Reviews in Solar Physics* 16(1):4, , 1906.12262
- Gibson SE (2018) Solar prominences: theory and models. *Fleshing out the magnetic skeleton. Living Reviews in Solar Physics* 15(1):7,

- Guevara Gómez JC, Jafarzadeh S, Wedemeyer S, Szydlarski M, Stangalini M, Fleck B, Keys PH (2021) High-frequency oscillations in small chromospheric bright features observed with Atacama Large Millimetre/Submillimetre Array. *Philosophical Transactions of the Royal Society of London Series A* 379(2190):20200184, , 2008.04179
- Hinode Review Team, Al-Janabi K, Antolin P, Baker D, Bellot Rubio LR, Bradley L, Brooks DH, Centeno R, Culhane JL, Del Zanna G, Doschek GA, Fletcher L, Hara H, Harra LK, Hillier AS, Imada S, Klimchuk JA, Mariska JT, Pereira TMD, Reeves KK, Sakao T, Sakurai T, Shimizu T, Shimojo M, Shiota D, Solanki SK, Sterling AC, Su Y, Suematsu Y, Tarbell TD, Tiwari SK, Toriumi S, Ugarte-Urra I, Warren HP, Watanabe T, Young PR (2019) Achievements of Hinode in the first eleven years. *Publications of the Astronomical Society of Japan* 71(5):R1,
- Howard RA, Vourlidas A, Bothmer V, Colaninno RC, DeForest CE, Gallagher B, Hall JR, Hess P, Higginson AK, Korendyke CM, Kouloumvakos A, Lamy PL, Liewer PC, Linker J, Linton M, Penteado P, Plunkett SP, Poirier N, Raouafi NE, Rich N, Rochus P, Rouillard AP, Socker DG, Stenborg G, Thernisien AF, Viall NM (2019) Near-Sun observations of an F-corona decrease and K-corona fine structure. *Nature* 576(7786):232–236,
- Kasper JC, Bale SD, Belcher JW, Berthomier M, Case AW, Chandran BDG, Curtis DW, Gallagher D, Gary SP, Golub L, Halekas JS, Ho GC, Horbury TS, Hu Q, Huang J, Klein KG, Korreck KE, Larson DE, Livi R, Maruca B, Lavraud B, Louarn P, Maksimovic M, Martinovic M, McGinnis D, Pogorelov NV, Richardson JD, Skoug RM, Steinberg JT, Stevens ML, Szabo A, Velli M, Whittlesey PL, Wright KH, Zank GP, MacDowall RJ, McComas DJ, McNutt RL, Pulupa M, Raouafi NE, Schwadron NA (2019) Alfvénic velocity spikes and rotational flows in the near-Sun solar wind. *Nature* 576(7786):228–231,
- Kuznetsov AA, Kontar EP (2019) First imaging spectroscopy observations of solar drift pair bursts. *Astronomy and Astrophysics* 631:L7, , 1910.09864
- Leenaarts J (2020) Radiation hydrodynamics in simulations of the solar atmosphere. *Living Reviews in Solar Physics* 17(1):3, , 2002.03623
- Liu R (2020) Magnetic flux ropes in the solar corona: structure and evolution toward eruption. *Research in Astronomy and Astrophysics* 20(10):165, , 2007.11363
- Luhmann JG, Gopalswamy N, Jian LK, Lugaz N (2020) ICME Evolution in the Inner Heliosphere. *Solar Physics* 295(4):61,
- Madjarska MS (2019) Coronal bright points. *Living Reviews in Solar Physics* 16(1):2,
- McComas DJ, Christian ER, Cohen CMS, Cummings AC, Davis AJ, Desai MI, Giacalone J, Hill ME, Joyce CJ, Krimigis SM, Labrador AW, Leske RA, Malandraki O, Matthaeus WH, McNutt RL, Mewaldt RA, Mitchell DG, Posner A, Rankin JS, Roelof EC, Schwadron NA, Stone EC, Szalay JR, Wiedenbeck ME, Bale SD, Kasper JC, Case AW, Korreck KE, MacDowall RJ, Pulupa M, Stevens ML, Rouillard AP (2019) Probing the energetic particle environment near the Sun. *Nature* 576:223–227,
- Molnar ME, Reardon KP, Chai Y, Gary D, Uitenbroek H, Cauzzi G, Cranmer SR (2019) Solar Chromospheric Temperature Diagnostics: A Joint ALMA-H α Analysis. *Astrophysical Journal* 881(2):99, , 1906.08896
- Mondal S, Oberoi D, Vourlidas A (2020) Estimation of the Physical Parameters of a CME at High Coronal Heights Using Low-frequency Radio Observations. *Astrophys Journ* 893(1):28, , 1909.12041
- Müller D, St Cyr OC, Zouganelis I, Gilbert HR, Marsden R, Nieves-Chinchilla T, Antonucci E, Auchère F, Berghmans D, Horbury TS, Howard RA, Krucker S, Maksimovic M, Owen CJ, Rochus P, Rodriguez-Pacheco J, Romoli M, Solanki SK, Bruno R, Carlsson M, Fludra A, Harra L, Hassler DM, Livi S, Louarn P, Peter H, Schühle U, Teriaca L, del Toro Iniesta JC, Wimmer-Schweingruber RF, Marsch E, Velli M, De Groof A, Walsh A, Williams D (2020) The Solar Orbiter mission. Science overview. *Astron and Astrophys* 642:A1, , 2009.00861
- Nakariakov VM, Kolotkov DY (2020) Magnetohydrodynamic Waves in the Solar Corona. *Annual Reviews of Astronomy and Astrophysics* 58:441–481,
- Nindos A, Kontar EP, Oberoi D (2019) Solar physics with the Square Kilometre Array. *Advances in Space Research* 63(4):1404–1424, , 1810.04951
- Petrovay K (2020) Solar cycle prediction. *Living Reviews in Solar Physics* 17(1):2, , 1907.02107
- Pontin DI, Hornig G (2020) The Parker problem: existence of smooth force-free fields and coronal heating. *Living Reviews in Solar Physics* 17(1):5,

- Rincon F, Rieutord M (2018) The Sun's supergranulation. *Living Reviews in Solar Physics* 15(1):6,
- Roupe van der Voort LHM, De Pontieu B, Carlsson M, de la Cruz Rodríguez J, Bose S, Chintzoglou G, Drews A, Froment C, Gošić M, Graham DR, Hansteen VH, Henriques VMJ, Jafarzadeh S, Joshi J, Kleint L, Kohutova P, Leifsen T, Martínez-Sykora J, Nóbrega-Siverio D, Ortiz A, Pereira TMD, Popovas A, Quintero Noda C, Sainz Dalda A, Scharmer GB, Schmit D, Scullion E, Skogsrud H, Szydlarski M, Timmons R, Vissers GJM, Woods MM, Zacharias P (2020) High-resolution observations of the solar photosphere, chromosphere, and transition region. A database of coordinated IRIS and SST observations. *Astronomy and Astrophysics* 641:A146, , 2005.14175
- Russell AJB (2018) 75th Anniversary of 'Existence of Electromagnetic-Hydrodynamic Waves'. *Solar Physics* 293(5):83, , 1711.04876
- Shimizu T, Imada S, Kubo M (2018) First Ten Years of Hinode Solar On-Orbit Observatory, vol 449.
- Toriumi S, Wang H (2019) Flare-productive active regions. *Living Reviews in Solar Physics* 16(1):3, , 1904.12027
- Verscharen D, Klein KG, Maruca BA (2019) The multi-scale nature of the solar wind. *Living Reviews in Solar Physics* 16(1):5, , 1902.03448
- Yan Y, Chen Z, Wang W, Liu F, Geng L, Chen L, Tan C, Chen X, Su C, Tan B (2021) Mingantu spectral radioheliograph for solar and space weather studies. *Frontiers Astron Space Sci* 8:1
- Yang Z, Bethge C, Tian H, Tomczyk S, Morton R, Del Zanna G, McIntosh SW, Karak BB, Gibson S, Samanta T, He J, Chen Y, Wang L (2020) Global maps of the magnetic field in the solar corona. *Science* 369(6504):694–697, , URL <https://science.sciencemag.org/content/369/6504/694>, <https://science.sciencemag.org/content/369/6504/694.full.pdf>
- Yokoyama T, Shimojo M, Okamoto T, Iijima H (2018) ALMA Observations of the Solar Chromosphere on the Polar Limb. *Astrophysical Journal* 863(1):96, , 1807.01411
- Yu S, Chen B (2019) Possible Detection of Subsecond-period Propagating Magnetohydrodynamics Waves in Post-reconnection Magnetic Loops during a Two-ribbon Solar Flare. *Astrophysical Journal* 872(1):71, , 1901.05379
- Zouganelis I, De Groof A, Walsh AP, Williams DR, Müller D, St Cyr OC, Auchère F, Berghmans D, Fludra A, Horbury TS, Howard RA, Krucker S, Maksimovic M, Owen CJ, Rodríguez-Pacheco J, Romoli M, Solanki SK, Watson C, Sanchez L, Lefort J, Osuna P, Gilbert HR, Nieves-Chinchilla T, Abbo L, Alexandrova O, Anastasiadis A, Andretta V, Antonucci E, Appourchaux T, Aran A, Arge CN, Aulanier G, Baker D, Bale SD, Battaglia M, Bellot Rubio L, Bemporad A, Berthomier M, Bocchialini K, Bonnin X, Brun AS, Bruno R, Büchlin E, Büchner J, Bucik R, Carcaboso F, Carr R, Carrasco-Blázquez I, Cecconi B, Cernuda Cangas I, Chen CHK, Chitta LP, Chust T, Dalmasse K, D'Amicis R, Da Deppo V, De Marco R, Dolei S, Dolla L, Dudok de Wit T, van Driel-Gesztelyi L, Eastwood JP, Espinosa Lara F, Etesi L, Fedorov A, Félix-Redondo F, Fineschi S, Fleck B, Fontaine D, Fox NJ, Gandorfer A, Génot V, Georgoulis MK, Gissot S, Giunta A, Gizon L, Gómez-Herrero R, Gontikakis C, Graham G, Green L, Grundy T, Haberreiter M, Harra LK, Hassler DM, Hirzberger J, Ho GC, Hurford G, Innes D, Issautier K, James AW, Janitzek N, Janvier M, Jeffrey N, Jenkins J, Khotyaintsev Y, Klein KL, Kontar EP, Kontogiannis I, Krafft C, Krasnoselskikh V, Kretschmar M, Labrosse N, Lagg A, Landini F, Lavraud B, Leon I, Lepri ST, Lewis GR, Liewer P, Linker J, Livi S, Long DM, Louarn P, Malandraki O, Maloney S, Martinez-Pillet V, Martinovic M, Masson A, Matthews S, Matteini L, Meyer-Vernet N, Moraitis K, Morton RJ, Musset S, Nicolaou G, Nindos A, O'Brien H, Orozco Suarez D, Owens M, Pancrazzi M, Papaioannou A, Parenti S, Pariat E, Patsourakos S, Perrone D, Peter H, Pinto RF, Plainaki C, Plettmeier D, Plunkett SP, Raines JM, Raouafi N, Reid H, Retino A, Rezeau L, Rochus P, Rodriguez L, Rodriguez-Garcia L, Roth M, Rouillard AP, Sahraoui F, Sasso C, Schou J, Schühle U, Sorriso-Valvo L, Soucek J, Spadaro D, Stangalini M, Stansby D, Steller M, Strugarek A, Štverák Š, Susino R, Telloni D, Terasa C, Teriaca L, Toledo-Redondo S, del Toro Iniesta JC, Tsiropoula G, Tsounis A, Tziotziou K, Valentini F, Vaivads A, Vecchio A, Velli M, Verbeeck C, Verdini A, Verscharen D, Vilmer N, Vourlidas A, Wicks R, Wimmer-Schweingruber RF, Wiegmann T, Young PR, Zhukov AN (2020) The Solar Orbiter Science Activity Plan. Translating solar and heliospheric physics questions into action. *Astronomy and Astrophysics* 642:A3, , 2009.10772