

DIVISION E

SUN AND HELIOSPHERE

SOLEIL ET HÉLIOSPHERE

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TRIENNIAL REPORT 2021-2024

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 within the heliosphere. Earth's proximity to the Sun enables detailed investigation of its structure, the physical processes operating in its interior and atmosphere, as well as the radiation, the momentum, and energy that propagate outward, into the heliosphere. Dynamical phenomena include waves, flares, coronal mass ejections, shock fronts, propagation of transient events, and

the acceleration of particles in the interplanetary medium. This triennium finds solar and heliophysics research in a very advantageous position to address key questions on the above topics. The study of the Sun and its region of influence, the heliosphere, benefits from an unprecedented number of space missions and cutting-edge ground-based observatories providing multi-wavelength and multi-point measurements that span from the photosphere, chromosphere, and corona to the heliospheric in situ plasma, particles, and magnetic field observed from several vantage points at various heliocentric distances.

Based on the just mentioned areas of research, three Commissions are, historically speaking, part of Division E: Commission E1 (Solar Radiation and Structure), E2 (Solar Activity), and E3 (Solar Impact Throughout the Heliosphere). Starting on this triennium, the Working Group on Impact of Magnetic Activity on Solar and Stellar Environments became an inter-division commission, Commission E4, involving Divisions F (Planetary Systems and Astrobiology) and G (Stars and Stellar Physics). It focuses on interdisciplinary science related to understanding the impact of stellar magnetic activity on astrospheres. Two inter-division Working Groups participate in Division E. The Working Group on Coordination of Synoptic Observations of the Sun (involving Division B, Facilities, Technology, and Data Science) whose mission is to facilitate international collaboration in synoptic long-term solar observations, which include past, current, and future synoptic programs, preservation, calibration, and access to synoptic solar data products. The Working Group on Solar Eclipses (involving Division C, Education, Outreach, and Heritage) that provides a wide variety of material and links relevant to observing solar eclipses, all suitable for the general public as well as advanced amateur and professional astronomers.

This overview briefly lists some of the achievements of previous missions and instrumentation, pays a quick look at newly launched missions, and mentions other already proposed and approved, though not yet implemented, projects. The list is not at all complete and, probably, several have been overlooked. After this overview, the report includes a thorough list of review articles published during the triennium that demonstrate the degree of advancement of Division E related science topics. This is followed by the IAU symposia and focus meetings coordinated by the division, as well as non-IAU meetings, workshops or schools in the areas of competence of the division.

2. Overview of Missions and Projects: Recent, New, Underway

- Parker Solar Probe (PSP), launched on 12 August 2018 in the previous triennium, completed 18 of its 24 scheduled perihelion encounters on 28 December 2023 with a close approach of 10.4 solar radii from the solar surface. It will complete its 19th perihelion on 30 March 2024. The data provided by this NASA mission has led to significant discoveries and unveiled new phenomena (Raouafi et al 2023): flips in the magnetic field directions, dubbed switchbacks, took center stage due to their prominence inside 0.2 AU, the ubiquity of ion- and electron-scale waves, the deformation of the particle velocity distribution functions (VDFs) from an isotropic Maxwellian, and the kinetic processes connecting the waves and VDFs, new complexities within energetic particle storms and coronal mass ejections (CMEs) on unprecedented small scales. The first three to four years of the mission covered mostly quiet conditions allowing the exploration of the pristine young solar wind. Solar Cycle 25 is now rising toward its maximum when PSP will reach its ultimate orbit, expected on 19 June 2025; this higher magnetic activity will provide a new view of the innermost part of the heliosphere. Topical issues have been published gathering the main findings of PSP in the present triennium such as: <https://iopscience.iop.org/collections/apj-230531-01>

- Solar Orbiter (SolO), an ESA mission with NASA collaboration was launched on 10 February 2020 in the previous triennium. The probe is designed to obtain in situ and remote detailed measurements of the inner heliosphere and the nascent solar wind, as well as close observations of the polar regions because of its elliptic varying inclination orbit. SolO had its first close pass to the Sun at ≈ 60 solar radii at the end of March 2022. Images of the Sun's south pole taken in the EUV on 30 March 2022 revealed a population of faint, short-lived features associated with small jets of plasma ejected from the Sun's atmosphere challenging the assumption that the solar wind is produced only in a steady continuous flow (Chitta et al 2023). Topical issues have been published gathering the main findings of SolO in the present triennium such as: <https://www.aanda.org/component/toc/?task=topicid=1717>

- The Daniel K. Inouye Solar Telescope (DKIST), the 4m National Science Foundation (NSF) telescope, saw its first light in January 2020 during the previous triennium. DKIST's superb resolution and polarimetric sensitivity has started to enable astronomers to unravel many of the mysteries the Sun presents, including the origin of solar magnetism, the mechanisms of coronal heating and drivers of flares and coronal mass ejections (CMEs). Community proposal-based shared-risk observations are conducted by the DKIST operation team. Results obtained with its Visible SpectroPolarimeter (ViSP) have shown evidence of a serpentine topology in the quiet Sun and of a oscillatory behavior in a sunspot (Campbell et al 2023; French et al 2023).

- The Low Frequency Analyzer and Recorder (LOFAR) observations produced the best images of the radio low frequency domain for the solar corona allowing to better understand type II and type III bursts and CMEs (Zhang et al 2024; Nedal et al 2023). Moreover, LOFAR is becoming a tool for forecasting space weather in real time (see <http://lofar4sw.eu/>).

- The Expanded Owens Valley Solar Array (EOVSA) and the Karl G. Jansky Very Large Array (VLA) joint spectral images are revealing transient emission coming from the quiet corona (Mondal et al 2023). Moreover, the spectral polarimetric images produced by EOVSA, the Siberian Radio Heliograph, and the Mingantu Spectral Radiograph opened a new window to space weather and coronal studies in general (Tan et al 2023).

- Atacama Large Millimeter Array (ALMA) observations pose new constraints to present chromospheric models. For instance, Guevara Gómez et al (2023) compared simulations done with the code BIFROST to observations over plages at mm and sub-mm wavelengths and were able to identify MHD waves on the data. Moreover, for the first time it is possible to compare with similar spatial resolution observations in $H\alpha$ and radio (Molnar et al 2021; Tarr et al 2023; Pandit et al 2023). Today, thanks to the work of Henriques et al (2022) we have a catalog of solar observations with ALMA.

- The Chinese $H\alpha$ Solar Explorer (CHASE), also dubbed Xihe, Goddess of the Sun in Chinese legends, was successfully launched on 14 October 2021 (Zhang et al 2022b; Liu et al 2022; Zhang et al 2022a; Qiu et al 2022; Li et al 2022). The scientific payload of the CHASE mission is an $H\alpha$ Imaging Spectrograph (HIS), which acquires full-Sun or region-of-interest spectroscopic observations at $H\alpha$ (6559.7 – 6565.9 Å) and Fe I (6567.8 – 6570.6 Å) wavebands. After efforts of in-orbit experimental operation, the performance of the satellite met pre-launch expectations since 4 August 2022. The first results from the CHASE mission, which cover a broad range of topics, including spectroscopic observation of solar white-light flares, propagation of Moreton waves, formation and eruption of solar filaments, origin of the solar wind from coronal holes or active regions, modelling of solar eruptions matching observations, and Sun-as-a-star spectroscopic diagnostics of eruptive phenomena can be found at <https://iopscience.iop.org/collections/Focus-on-Early-Results-from-CHASE>.

- The Advanced Space-based Solar Observatory (ASO-S, Chinese nickname Kuafu-1), the first Chinese dedicated solar observatory in space (Gan et al 2019b,a, 2022a,b), was successfully launched on 8 October 2022. The four scientific objectives of ASO-S can be described as: (1) to simultaneously acquire non-thermal hard X-ray images of solar flares and dual-waveband images of CMEs in both Lyman α and visible light, (2) to simultaneously observe the full-disk vector magnetic field, (3) to record the response of the solar atmosphere to eruptions, and (4) to observe solar eruptions and the evolution of the magnetic field to support space-weather forecasts and warnings of hazardous events. To fulfil these scientific goals, three payloads are deployed: the Full-disk vector MagnetoGraph (FMG), the solar Hard X-ray Imager (HXI), and the Lyman-alpha Solar Telescope (LST). A detailed presentation of the satellite and instrumentation can be found in Gan et al (2023). Data was opened since 1 April 2023, while the commissioning phase was officially finished at the end of September 2023. A special issue describing ASO-S in-flight performance and early results is underway and can be found at <https://link.springer.com/collections/gjgieihdhc>.

- Aditya, Sanskrit name for the Sun, is an Indian satellite that was launched on 2 September 2023. The satellite is currently placed at the L1 orbit since 6 January 2024. Aditya-L1 carries four remote sensing and three in situ experiments to study the Sun and the local environment at L1 (Padma 2023). These are, remote sensing: (i) Visible Emission Line Coronagraph (VELC), (ii) Solar Ultra-violet Imaging Telescope (SUIT), (iii) Solar Low-Energy X-ray Spectrometer (SoLEXS), and (iv) High Energy L1 Orbiting Spectrometer (HEL1OS); in situ: (i) Plasma Analyzer Package for Aditya-L1 (PAPA), (ii) Aditya Solar wind Particle EXperiment (ASPEX), and (iii) MAGnetometer (MAG). The primary science objective of the mission is to study the chromospheric and coronal dynamics which are the major sources of space weather variability (see Vol. 38 of SCOSTEP-PRESTO Newsletter at https://cicr.isee.nagoya-u.ac.jp/site1/info_e/scostep_newsletter.html).

- The Polarimeter to UNify the Corona and Heliosphere (PUNCH) is a NASA Small Explorer mission that will make global 3D observations of the young solar wind, from the outermost solar atmosphere to the inner heliosphere. PUNCH is scheduled to launch in April 2025. The PUNCH mission consists of a constellation of four small satellites in Sun-synchronous low-Earth orbit that together will produce deep-field, continuous, 3D images of the solar corona as it makes a transition from 6 solar radii to 180 solar radii from the Sun. The PUNCH cameras sense normal visible light and its linear polarization which allows the 3D location of solar wind features to be measured. A review of how the PUNCH mission will measure the properties of the Alfvén surface and provide key constraints on theories of solar-wind acceleration has been published by Cranmer et al (2023).

- The PROBA-3 (PRoject for On-Board Autonomy-3) is a double-spacecraft formation flying mission of ESA to be launched by mid-2024. PROBA-3 will fly the externally occulted coronagraph ASPIICS (Association of Spacecraft for Polarimetric and Imaging Investigation of the Corona of the Sun) with the telescope on one satellite and the occulter on the other one, at 144m (see e.g. Galy et al 2023; Loreggia et al 2023). The scientific objective is to realize an artificial total solar eclipse to observe the lower Sun corona. The high accuracy metrology control is the core of the mission.

- SOLAR-C is the next-generation solar-observing satellite targeted to be launched in 2028. The SOLAR-C is a Japan Aerospace eXploration Agency (JAXA) mission, in collaboration with US (NASA) and countries in Europe (ESA). Its on board telescope EUVST (EUV High-throughput Spectroscopic Telescope) is being developed by ISAS (Institute of Space and Astronautical Science)/JAXA and NOAJ (National Astronomi-

cal Observatory of Japan). It is aimed to unravel the mysteries of the solar atmosphere by analyzing the spectrum of the Sun's extreme UV radiation. High-resolution observations will allow to investigate MHD fundamental processes acting in the solar outer atmosphere and to help understanding the mechanisms responsible for the heating of the upper atmosphere and other atmospheric phenomena. EUVST will carry out simultaneous observations of the solar atmosphere from the photosphere/chromosphere up to the corona with seamless temperature coverage, high-spatial resolution (0.4"), and achieving 0.5 sec high-temporal cadence.

- The Multi-slit Solar Explorer (MUSE) is a NASA medium-class explorer mission to be launched in 2027, which will carry a multi-slit EUV spectrograph for three narrow spectral bands and an EUV context imager for two narrow passbands. MUSE will provide high-cadence measurements at high-spatial resolution (better than 0.5") for spectral and imaging diagnostics of the solar corona. Thanks to its innovative multi-slit design, it will for the first time be able to "freeze" (at a cadence as short as 10 seconds) the evolution of the dynamic coronal plasma with a spectroscopic raster for an active-region size. The combination of the single-slit, high-resolution, wide-temperature coverage SOLAR-C EUVST spectrograph and the multi-slit, high-resolution MUSE spectrograph and imager is expected to provide unprecedented diagnostic tools to high-resolution solar physics (Spiga et al 2023; De Pontieu et al 2022).

- The Coronal Solar Magnetism Observatory (COSMO) is a unique ground-based facility designed to address current shortfalls in the capability to measure magnetic fields in the solar corona. The NSF National Center for Atmospheric Research (NCAR), University of Michigan, University of Hawaii, George Mason University, and Harvard Smithsonian Astrophysical Observatory (US) are the main COSMO partners. COSMO suite of instruments include: the 1.5-m aperture Large Coronagraph (LC) to observe the total and polarized light produced by multiple coronal emission lines from the visible to the near-infrared; the Chromospheric and prominence magnetometer (Chromag), an imaging polarimeter for magnetic and plasma diagnostics of the chromosphere and prominences; K-Cor, a white light coronagraph to observe the polarization of coronal light and characterize the lower and middle solar atmosphere and measure kinematic properties of CMEs. In 2020, NSF funded the three-year COSMO Site and Design Advancement (COSADA) project to determine the site for COSMO deployment and bring the COSMO-LC to final design. Six sites were selected to test with sky brightness, atmospheric seeing, and meteorological instruments. This site down-selection is underway and the COSMO-LC final design review will be completed by mid-2024.

- New instruments in the radio domain will shed new light on open questions. The Large Latin American Millimeter Array (LLAMA) gained momentum in the last three years, installations were built in the Alto Chorrillos site at 4800 masl in the Argentine Atacama region. The antenna is being assembled at the time of this writing and should have the first light in 2025 to observe the Sun at the ALMA bands 2+3, 5, 6, and 9. In the edge of the radio domain, where the Rayleigh-Jeans approximation is still valid, the High Altitude THz Solar photometer (HATS, Giménez de Castro et al 2020), the first solar telescope operating at 20 μm , was installed at Observatorio Felix Aguilar, San Juan, in 2023 and is now in the commissioning phase.

- The incredible spatial resolution of the Square Kilometer Array (SKA) along with its extremely high data-acquisition rate will bring new insights about solar transient phenomena. The ngVLA will improve the present sensitivity and spatial resolution of the VLA observations at microwaves. The Atacama Large Aperture Submillimeter Telescope (AtLAST), a single-dish telescope with 50 m aperture proposed to be built in the Atacama desert in Chile, will be able to provide unprecedented solar observational capa-

bilities (Wedemeyer et al 2024), while the Solar Submillimeter Telescope, the only solar subTHz facility, shall be renewed and improved in the mid-term (Giménez de Castro et al 2023).

3. Publications Related to Division E Topics

The number of publications in refereed journals give some indication of the proportion of work in the various sub-fields covered by Division E. For the period from August 2021 to early March 2024 (when this report was written), 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). These sub-topics in several cases overlap.

Sun:

- Evolution: 37
- Helioseismology: 89
- Interior: 61
- Rotation: 60
- Oscillations: 168
- Magnetic fields: 552
- Sunspots: 210
- Granulation: 19
- Photosphere: 197
- Chromosphere: 267
- Faculae: 24
- Filaments/prominences: 161
- Transition region: 84
- Corona: 800
- Abundances: 66
- Activity: 535
- Flares: 525
- Coronal mass ejections: 381
- Solar wind: 849
- UV radiation: 95
- X ray, Gamma ray: 56
- Infrared: 6
- Radio radiation: 184
- Particle emission: 91
- Sunspot cycle: 12
- Interplanetary medium: 122
- Solar terrestrial relations: 124

4. Review Articles during This Triennium

4.1. 2021 (after IAU XXX1 General Assembly Business Sessions)

Living Reviews in Solar Physics

- Magnetic fields in the solar convection zone (Fan 2021)
- Space weather: the solar perspective (Temmer 2021)
- The evolution of the solar wind (Vidotto 2021)

- Solar structure and evolution (Christensen-Dalsgaard 2021)
- Solar force-free magnetic fields (Wiegmann and Sakurai 2021)

Space Science Reviews

- Understanding the origins of problem geomagnetic storms associated with “stealth” coronal mass ejections (Nitta et al 2021)
- Linking the Sun to the heliosphere using composition data and modelling (Parenti et al 2021)
- Magnetohydrodynamic waves in open coronal structures (Banerjee et al 2021)
- Kink Oscillations of Coronal Loops (Nakariakov et al 2021)
- Sixty years of element abundance measurements in solar energetic particles (Reames 2021)

Annual Review of Astronomy and Astrophysics

- Carrington events (Hudson 2021)

4.2. 2022

Living Reviews in Solar Physics

- Surface and interior meridional circulation in the Sun (Hanasoge 2022)
- Extreme solar events (Cliver et al 2022)
- Magnetic reconnection: MHD theory and modelling (Pontin and Priest 2022)

Space Science Reviews

- Dust in and around the heliosphere and astrospheres (Sterken et al 2022)
- Turbulence in the outer heliosphere (Fraternali et al 2022)
- Solar energetic particles: Spatial extent and implications of the H and He abundances (Reames 2022)
- Backscattered solar Lyman- α emission as a tool for the heliospheric boundary exploration (Baliukin et al 2022)
- The structure of the large-scale heliosphere as seen by current models (Kleimann et al 2022)
- Observations of the outer heliosphere, heliosheath, and interstellar medium (Richardson et al 2022)
- The early history of heliospheric science and the spacecraft that made it possible (Zank et al 2022)
- Recent developments in particle acceleration at shocks: Theory and observations (Perri et al 2022)
- Neutrino-flux variability, nuclear-decay variability, and their apparent relationship (Sturrock 2022)
- Anomalous cosmic rays and heliospheric energetic particles (Giacalone et al 2022)
- The structure of the global heliosphere as seen by in situ ions from the Voyagers and Remotely Sensed ENAs from Cassini (Dialynas et al 2022)
- Novel data analysis techniques in coronal seismology (Anfinogentov et al 2022)

Annual Review of Astronomy and Astrophysics

- Magnetic field diagnostics in the solar upper atmosphere (Trujillo Bueno and del Pino Alemán 2022)

Solar Physics (Invited Reviews)

- Amplitudes of solar gravity modes: A review (West et al 2022)
- Invited Review: Short-term variability with the Observations from the Helioseismic

and Magnetic Imager (HMI) onboard the Solar Dynamics Observatory (SDO): Insights into flare magnetism (Kazachenko et al 2022)

- Coronal quasi-periodic fast-mode propagating wave trains (Shen et al 2022)

4.3. 2023

Living Reviews in Solar Physics

- Machine learning in solar physics (Asensio Ramos et al 2023)
- Models for the long-term variations of solar activity (Karak 2023)
- A history of solar activity over millennia (Usoskin 2023)
- Waves in the lower solar atmosphere: the dawn of next-generation solar telescopes (Jess et al 2023)

Space Science Reviews

- Dynamics of large-scale solar flows (Hotta et al 2023)
- HelioSwarm: A multipoint, multiscale mission to characterize turbulence (Klein et al 2023)
- Extreme solar events: Setting up a paradigm (Usoskin et al 2023)
- Solar cycle observations (Norton et al 2023)
- Understanding active region origins and emergence on the Sun and other cool stars (Weber et al 2023)
- Observationally guided models for the solar dynamo and the role of the surface field (Cameron and Schüssler 2023)
- Physical models for solar cycle predictions (Bhowmik et al 2023)
- Surface flux transport on the Sun (Yeates et al 2023)
- Long-term modulation of solar cycles (Biswas et al 2023)
- How do shock waves define the space-time structure of gradual solar energetic particle events? (Reames 2023)
- Parker Solar Probe: Four years of discoveries at solar cycle minimum (Raouafi et al 2023)
- Vortex motions in the solar atmosphere (Tziotziou et al 2023)

Annual Review of Astronomy and Astrophysics

- New insights from imaging spectroscopy of solar radio emission (Gary 2023)

Solar Physics (Invited Reviews)

- Defining the middle corona (West et al 2023)
- Recalibration of the sunspot-number: Status report (Clette et al 2023)
- The hazard of UV-induced oxidation to solar-viewing spacecraft optics (Tarrío et al 2023)

5. IAU Meetings (coordinated by Division E) during This Triennium

5.1. 2022

- August: IAU S372 The Era of Multimessenger Solar Physics, Aug 2 - Aug 4, Busan, South Korea.
- August: FM 5 Beyond the Goldilocks zone: the Effect of Stellar Magnetic Activity on Exoplanet Habitability, Aug 2- Aug 3, Busan, South Korea.
- August: Division E Days, Aug 5 and Aug 8, Busan, South Korea.

5.2. 2023

- August: IAUS S365 Dynamics of Solar and Stellar Convection Zones and Atmospheres, Aug 21 - Aug 25, Yerevan, Armenia.

6. Non-IAU Meetings, Workshops or Schools during This Triennium

The list in this section has been taken from <https://soho.nascom.nasa.gov/community/>. As a summary: 44 meetings/workshops/schools have taken place in America (North, Central or South), 21 in Europe, 11 in Asia, and 1 in Africa, while 23 have been only virtual (with a few being hybrid).

6.1. 2021 (*after IAU XXXI General Assembly Business Sessions*)

- September 27 - October 1, 2021 5th International Heliophysics Data Environment Alliance (IHDEA) meeting, virtual meeting.
- September 27 - October 1, 2021 COSPAR ISWAT2021 Virtual Working Meeting: Towards Community-Driven Living COSPAR Space Weather Roadmap - Part 2, virtual meeting.
- October 25-28, 2021 Hinode-14/IRIS-11 Joint Science Meeting, virtual meeting.
- October 25-29, 2021 17th European Space Weather Week, in Glasgow, Scotland, UK.
- November 1-5, 2021 Applied Space Environments Conference (ASEC2021), virtual meeting.
- November 3-5, 2021 2nd International Workshop on Solar Imaging with ALMA (ALMA-SOL-IMG2), virtual meeting.
- November 9-10, 2021 3rd Parker Solar Probe Scholars Meeting, virtual meeting.
- November 15-19, 2021 IPMU Workshop: Particle Acceleration in Solar Flares and the Plasma Universe, virtual meeting.
- November 17-18, 2021 The Multiview Observatory for Solar Terrestrial Science (MOST) Virtual Science Meeting, virtual meeting.
- December 1-3, 2021 FASR2021: Solar Physics with a Next Generation Solar Radio Facility, virtual meeting.
- December 13-17, 2021 AGU Fall Meeting, in New Orleans, LA, USA and virtual.

6.2. 2022

- January 4-8, 2022 URSI National Radio Science Meeting, in Boulder, CO, USA.
- January 23-27, 2022 19th Conference on Space Weather at 2022 AMS Meeting, in Houston, TX, USA.
- January 31 - February 4, 2022 5th NCSP DKIST Data-Training Workshop: Helium I Diagnostics in the Solar Atmosphere", virtual meeting.
- February 21-25, 2022 SCOSTEP's 15th Quadrennial Solar-Terrestrial Physics Symposium (STP-15), in Alibag, India
- January 25-28, 2022 PRACE Online School: Machine Learning for Heliophysics, virtual meeting.
- February 23-25, 2022 Heliophysics 2050: Measurement Techniques and Technologies Workshop, virtual meeting.
- March 8-11, 2022 Fifty Years of the Skumanich Relations, in Boulder, CO, USA
- March 21-25, 2022 Machine Learning in Heliophysics, in Boulder, CO, USA.
- April 3-8, 2022 EGU General Assembly 2022, in Vienna, Austria.
- April 11-14, 2022 Space Weather Operations and Research Infrastructure Workshop, Phase II, virtual.

- April 11-15, 2022 International School of Space Science: The different spatio-temporal scales of the solar magnetism, in L'Aquila, Italy
- April 22, 2022 Future Solar and Heliospheric Assets for Space Weather Prediction: Instruments, Modelling and Machine-Learning, virtual meeting.
- April 26-28, 2022 2022 Space Weather Workshop, virtual meeting.
- May 4-10, 2022 Pencil Code User Meeting 2022, in Bengaluru, India.
- May 16-20, 2022 US-Japan Workshop on Magnetic Reconnection, in Monterey, CA, USA.
- May 16-22, 2022 2022 Sun-Climate Symposium: Improved Climate-Record Reconstructions from Solar Variability and Earth System Observations, in Madison, WI, USA.
- May 22 - June 3, 2022 JpGU 2022, in Chiba, Japan (hybrid).
- May 30 - June 3, 2022 Solar Orbiter School 2022, in Sete, France.
- May 30 - June 3, 2022 2022 Python in Heliophysics Community (PyHC) Summer School, at ESAC, near Madrid, Spain..
- June 6-10, 2022 3rd Eddy Cross Disciplinary Symposium: Sun, Earth, Planet, Space, Atmosphere and Ocean, Vail, CO, USA..
- June 6-10, 2022 Partially Ionised Plasmas in Astrophysics (PIPA2022), Budapest, Hungary.
- June 6-10, 2022 2nd Iberian Space Science Summer School, Madrid, Spain.
- June 9-10, 2022 AstroParticle Physics European Consortium (APPEC) Town Meeting, Berlin, Germany.
- June 21-24, 2022 2nd Parker Solar Probe Conference, at APL, Laurel, MD, USA (hybrid meeting).
- June 27-28, 2022 EAS 2022: S10 Upcoming missions and recent advances to better understand our Sun, in Valencia, Spain.
- June 27 - July 1, 2022 SHINE 2022, in Waikiki, HI, USA.
- June 28 - July 1, 2022 10th Coronal Loops Workshop, in Paris, France.
- July 3-10, 2022 Second Summer School on Space Research, Technology and Applications, in Rozhen, Bulgaria.
- July 4-9, 2022 Cool Stars 21, in Toulouse, France.
- July 11-15, 2022 Solar Physics High Energy Research (SPHERE) Workshop, hybrid format with online access and two in-person locations: Southwest Research Institute (SwRI) in Boulder, CO, USA and Fachhochschule Nordwestschweiz (FHNW) in Windisch, CH.
- July 16-24, 2022 44th COSPAR Scientific Assembly and Associated Events (COSPAR 2022), in Athens, Greece.
- July 16-24, 2022 The Dynamic Sun at Small Scales to be held during the 44th COSPAR Scientific Assembly (COSPAR 2022), in Athens, Greece.
- July 17-22, 2022 SPIE Astronomical Telescopes + Instrumentation 2022, in Montreal, Canada.
- July 17-29, 2022 2022 Boulder Space Weather Summer School in Boulder, CO, USA.
- August 1-5, 2022 AOGS2022, virtual meeting.
- August 1-12, 2022 Heliophysics Summer School, virtual.
- August 7-10, 2022 Advances in Solar MHD Numerical Simulations in the Era of High-Resolution Observations, in Eastbourne, UK.
- August 8-12, 2022 SPD 2022: Triennial Earth-Sun Summit (TESS 2022), in Bellevue/Seattle, WA, USA
- August 12, 2022 PUNCH 3 Science Meeting, in Bellevue/Seattle, WA, USA
- August 17-19, 2022 Inaugural NASA Sounding Rocket Symposium, at Wallops Flight Facility, VA, USA.

- August 22 - September 2, 2022 Summer School on Solar Spectropolarimetry and Diagnostic Techniques, in Boulder, CO, USA.
- August 22-26, 2022 SunPy Coordination Meeting, virtual.
- September 6-8, 2022 Plasma Explosions in the Universe, in Kyoto, Japan.
- September 5-9, 2022 SOLARNET Summer School 'Solar corona - complex research from ground-based and space', in Tatranska-Lomnica, Slovakia
- September 6-9, 2022 CmPA retrospective in honor of Prof. Stefaan Poedts, in Leuven, Belgium.
- September 12-15, 2022 8th Solar Orbiter Workshop, in Belfast, Northern Ireland
- September 19-23, 2022 Hinode-15/IRIS-12, in Prague, Czech Republic
- September 19-22, 2022 Space Climate 8: Climate in Space and on Earth, in Krakow, Poland
- September 26-29, 2022 9th International Workshop on Planetary, Solar and Heliospheric Radio Emissions (PRE 9), in Dublin, Ireland
- September 26-30, 2022 COSPAR ISWAT2022 Working Meeting, in Coimbra, Portugal.
- October 3-7, 2022 SSWRF II: 2nd International Workshop on Small Satellites for Space Weather Research and Forecasting, in Laurel, MD, USA.
- October 3-7, 2022 International Heliophysics Data Environment Alliance (IHDEA) Meeting 2022, virtual.
- October 10-11, 2022 SOLARNET Public Engagement Workshop, at Northumbria University, Newcastle, UK
- October 14-15, 2022 High-Precision Solar Polarimetry (HPSP): International workshop in honor of Dr. Michele Bianda, in Locarno, Switzerland
- October 24-28, 2022 European Space Weather Week 2022 (ESWW2022), in Zagreb, Croatia.
- October 31 - November 4, 2022 20th Annual International Astrophysics Conference, in Santa Fe, New Mexico, USA.
- November 7-11, 2022 Polarization Workshop 10 (SPW10, in Kyoto, Japan.
- November 8-9, 2022 4th Parker Solar Probe Scholars Meeting, virtual meeting
- November 15-17, 2022 5th ISEE Symposium: Toward the Future of Space-Earth Environmental Research, in Nagoya, Japan.
- November 28 - December 2, 2022 Modelling, observing, and understanding flows and magnetic fields in the Earth's core and in the Sun, in Cambridge, UK.
- December 12-16, 2022 AGU Fall Meeting 2022, in Chicago, USA.

6.3. 2023

- January 8-12, 2023 AAS 241, in Seattle, WA, USA.
- January 9-13, 2023 FASR Workshop 2023: Microwave Data, Modeling, and Instrumentation, in Newark, NJ, USA.
- February 27 - March 2, 2023 RoCS/MUSE/IRIS (RoCMI): Confronting numerical models of the solar chromosphere and corona with high resolution observations, in Svalbard, Norway.
- February 23 - March 2, 2023 Space Weather Modelling Workshop, at ESA/ESOC, Darmstadt, Germany.
- April 10-12, 2023 4th ASO-S Meeting: Tutorials on ASO-S Data, virtual.
- April 16-21, 2023 5th COSPAR Symposium: Space Science with Small Satellites, in Singapore.
- April 17-21, 2023 Space Weather Workshop 2023, in Boulder, CO, USA.

- April 19-21, 2023 Machine Learning and Computer Vision in Heliophysics, in Sofia, Bulgaria.
- April 23-28, 2023 EGU General Assembly 2023, in Vienna, Austria.
- May 2-3, 2023 5th Parker Solar Probe Scholars Meeting, virtual meeting.
- May 8-10, 2023 International Solar Terrestrial Physics (ISTP) Next Workshop, at JHU/APL, Laurel, MD, USA.
- May 8-12, 2023 SOLARNET II: The Many Scales of the Magnetic Sun, in Potsdam, Germany.
- May 21-26, 2023 Japan Geoscience Union (JpGU) Meeting 2023, in Chiba, Japan.
- May 28 - June 2, 2023 AGU Chapman Conference on Advances in Understanding Alfvén Waves in the Sun and the Heliosphere, in Berlin, Germany.
- May 29 - June 2, 2023 SCOSTEP-UN-ISWI Workshop on the Predictability of the Variable Solar-Terrestrial Coupling (PRESTO), in Trieste, Italy.
- June 4-8, 2023 AAS 242, in Albuquerque, NM, USA.
- June 5 - July 28, 2023 2023 Los Alamos Space Weather Summer School, in Los Alamos, NM, USA.
- June 5-9, 2023 The Next Frontier: Linking Simulations with Observations of the Solar Atmosphere, in Palma de Mallorca, Spain.
- June 12-16, 2023 Solar Wind 16, Asilomar Conference Center, Pacific Grove, CA, USA.
- June 20-23, 2023 1st Waves and Instabilities in the Solar Atmosphere (WISA) meeting, in Newcastle upon Tyne, UK
- June 20-23, 2023 Solar Physics High Energy Research (SPHERE) workshop, in College Park, MD, USA.
- June 25-30, 2023 SOLARNET Summer School: Solar atmospheric dynamics - From waves to instabilities and jets, in Gyula, Hungary
- June 26-30, 2023 Iberian Space Science Summer School (i4s), in Coimbra, Portugal.
- July 3-7, 2023 CESRA Workshop 2023: Radio emission from the Sun to the Earth, University of Hertfordshire, Hatfield, UK.
- July 6-7, 2023 4th PUNCH Science Meeting, in Boulder, CO, USA.
- July 11-20, 2023 28th IUGG General Assembly, in Berlin, Germany.
- July 17-21, 2023 NASA Heliophysics Summer School (Part I), virtual.
- July 25-27, 2023 2023 SDO EVE Science Team Meeting, in Boulder, CO, USA.
- July 30 - August 4, 2023 AOGS2023, in Singapore.
- August 7-11, 2023 NASA Heliophysics Summer School (Part II), Boulder, CO, USA.
- August 7-11, 2023 SHINE 2023, Stowe, VT, USA.
- August 14-18, 2023 SPD 2023, in Minneapolis, MN, USA.
- September 5-7, 2023 SEPVAL 2023, in San Antonio, TX, USA.
- September 11-15, 2023 SOLARNET Congress: Sun in Science and Society, in Venice Mestre, Italy
- September 12-15, 2023 UK Space Weather and Space Environment Meeting I: Transitioning from the SWIMMR Space-Weather Programme, in Laurel, MD, USA.
- September 25-29, 2023 Hinode-16/IRIS-13, in Niigata, Japan.
- September 26 - October 4, 2023 ISWI Space Weather School and 6th African Geophysical Society (AGS) International Conference on "Advancing Science and Technology in Developing Nations", in Lusaka, Zambia
- October 2-6, 2023 Space Weather Observations throughout Latino America: Filling the Southern Gaps, in Ushuaia, Tierra del Fuego, Argentina. Contact: swol2023 at fcaglp.unlp.edu.ar

- October 9-11, 2023 Data, Analysis, and Software in Heliophysics (DASH), in Laurel, MD, USA.
- October 9-11, 2023 6th Asia-Oceania Space Weather Alliance Workshop (AOSWA 2023), in Selangor, Malaysia.
- October 29 - November 3, 2023 4th Eddy Cross-Disciplinary Symposium, in Golden, CO, USA.
- October 30 - November 3, 2023 Heliophysics in Europe, hybrid meeting, with in person component at ESA/ESTEC, Noordwijk, The Netherlands.
- November 18-19, 2023 SEPVAL 2023, in Toulouse, France.
- November 20-24, 2023 European Space Weather Week 2023 (ESWW2023): Bringing Space Weather, Space Climate and Engineering Together, in Toulouse, France.
- December 11-15, 2023 AGU Fall Meeting, in San Francisco, CA, USA.

6.4. 2024

- January 7-11, 2024 AAS 243, in New Orleans, LA, USA.
- January 24-26, 2024 9th Metis Workshop, in Museo Diocesano di Catania, Catania, Italy.
- February 29-March 1, 2024 Insights into the Physics of the Corona and Solar Wind (SpiroFest), in Boulder, CO, USA.
- April 7-12, 2024 Triennial Earth-Sun Summit (TESS 2024), in Dallas, TX, USA.
- April 7-12, 2024 Solar Orbiter/Parker Solar Probe/DKIST Workshop, in San Antonio, TX, USA
- April 9-12, 2024 DKIST/PSP/SO Joint Meeting, in San Antonio, Texas, USA.
- April 14-19, 2024 EGU 2024, in Vienna, Austria.

Cristina H. Mandrini
President of the Division

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