INTERNATIONAL SPACE SCIENCE INSTITUTE

Annual Report 2025

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The International Space Science Institute (ISSI) is a scientifically independent and neutral Space and Earth Science institute that advances science by facilitating open multi-disciplinary discourse in a stimulating environment, reaching out towards new scientific horizons.

From the President of the Board of Trustees

As the president of the Board of Trustees, it is my privilege to introduce the 2025 International Space Science Institute Annual Report.

This past year has seen profound institutional resilience and intellectual growth. In a world increasingly defined by rapid technological shifts and complex geopolitical dynamics, ISSI remains a steadfast 'neutral harbour'. It is a place where scientific excellence knows no borders and the global space community comes together to discuss and advance space sciences, which have a profound impact on our understanding of the Universe, our planet Earth, and humanity's place within it.

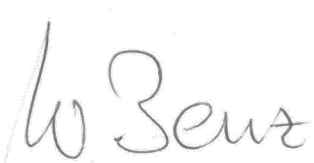
Unfortunately, 2025 was also a year of profound loss. The sudden passing of our Administrative Director, Prof. Dr. Maurizio Falanga, in March, left a void that is still deeply felt. Maurizio was more than an administrator; he was the welcoming heart of the institute for visitors and staff alike. At the time of this writing, we also learned of the passing of Prof. Dr. Roger-Maurice Bonnet, a visionary leader who leveraged his experience as the European Space Agency's (ESA) Director of Science to help establish from the beginning the International Space Science Institute (ISSI) as a premier hub for global scientific collaboration.

Despite these losses, ISSI's global footprints continue to expand. Our 2025 Call for Proposals received 50% more submissions than usual across Earth sciences, planetary sciences, astronomy and heliophysics, leading to the organisation of 69 scientific meetings and the visit of 964 scientists to ISSI in person during the year. This clearly shows that the 'ISSI model' of intensive, face-to-face discussions and synthesis is more relevant today than ever before.

In 2024, ISSI introduced a new format for tackling grand challenges in space sciences with its series of Breakthrough Workshops. These workshops have revolutionised international space science by convening leading experts in multidisciplinary "think tanks" that rapidly transform conflicting data into unified community consensus on the Universe's most urgent mysteries. In 2025, the focus was on 'Life beyond Earth: The Missing Link".

In 2025, ISSI has seen its financial support fully renewed by both the Swiss Confederation for the next period of two years (2026 and 2027) and by ESA, following a successful Ministerial Council in November 2025, for a period of three years (2026 to 2028). The Board would like to express its deepest gratitude to ESA, the Swiss Confederation, the Swiss Academy of Sciences, the University of Bern and the Japan Aerospace Exploration Agency for their continued support. ISSI's success, coupled with a steady increase in administrative complexity, led to changes being made to its administrative structure. In particular, Ms Sesil Ayri joined us as the new Head of Finance. The new structure was immediately put to the test when the Swiss Confederation requested a financial audit, which ISSI passed successfully. The Board of Trustees also welcomed a new member: Professor Dr Ravit Helled from the University of Zurich, who is replacing Professor Dr Georges Meynet from the University of Geneva. Finally, a joint search with the University of Bern for a successor to Prof. Dr. M. Falanga has begun, with the process expected to conclude in 2026.

As we look towards 2026, the Board remains committed to ensuring that ISSI provides the agility, intellectual freedom and multidisciplinary environment required to advance the discussion of space data and science for the benefit of humanity. Please take a look at the following pages, which detail our achievements and are a testament to the dedication of our staff and the engagement and achievements of our global community.



Willy Benz
Chair of the ISSI Board of Trustees
University of Bern
March 2026

From the Directors

We will always remember 2025 as a memorable year in the life of ISSI. Joy, sadness and resilience are at the core of this momentous year:

Joy, because we celebrated 30 years of advancing space science at ISSI. Born out of the vision of an extraordinary man, Prof. Johannes Geiss, ISSI is continuing, and expanding on, its fundamental mission of inviting scientists from around the world, to gather in Bern to discuss and debate, in a collegial, inclusive and neutral environment, the most relevant questions in astrophysics, heliophysics, Earth science and planetary science. On average each year a thousand visitors fill the ISSI hallways, and the debates are intense but constructive.

All our visitors are cordially welcomed by the efficient ISSI staff, and they are looked after for the duration of their visit, so that they can fully concentrate on the reason why they visit ISSI in a first place: to discuss important science, and publish their conclusions in the professional literature. See here for the publication output in 2025. This is the legacy of ISSI, moving science forward, one peer-reviewed paper and one book with article compilations after another, in addition to having created long lasting collaborations and friendships.

Sadness, because on March 6, 2025 we lost our esteemed colleague and distinguished scientist Prof. Dr. Maurizio Falanga, the youngest member of the Directors' team. This was unexpected and shocking, because Maurizio was an essential member of ISSI. He was the only Director residing in Bern 100% of his time, but most importantly, his larger-than-life personality had brightened the ISSI corridors for years. The void he left was immense.

He left a loving family with two young children, an array of students who were suddenly lost without their captain, and a big black hole in the field of high energy astrophysics, his professional passion.

The Staff were devastated. His colleagues at the University of Bern joined the ISSI Staff and his family in mourning and for several weeks the only thing on our collective minds was how much we missed him. We focused on honouring his premature and sudden passing to the best we could. See here is a collection of the memories that Maurizio left. As a final remembrance, we completed the small ISSI space museum that Maurizio always had wanted on the premises. A special event that will celebrate his scientific career and contributions to space science will be held at ISSI in May 2026. On this occasion, the ISSI small space museum will be dedicated to Maurizio. His colleagues and students will join his family and the ISSI Staff to pay a final collective tribute to his scientific life. He will be missed.

Resilience! In spite of this shattering event, ISSI had to stay on its course. The ISSI calendar was full with activities, planned months in advance, which had to be fulfilled. We are very proud of the ISSI team, who came together is a moment of need and outperformed for months, until we could reorganise the work, and hire new staff. The Directors spent more time at ISSI to be present for the Staff, and, together, we faced challenges that we would have never envisioned: a first financial audit and budget uncertainties. Maurizio was also the Director of Administration, and in that capacity, he was covering a large fraction of the administrative tasks that make ISSI function, in its day-to-day operations. We had to redistribute his tasks to the best of our collective abilities.

It is testament to ISSI' s resilience and to the dedication and commitment of the Staff that no meeting was delayed, no activity was postponed, or had to be cancelled. We are so very grateful for having been able to prove that even a small staff can outperform in time of need, setting aside the personal feelings and focusing on the task at end. And do it well.

At the end of the year, we reached stability again. The addition of an expert Head of Finance, Ms. Sesil Ayri, was essential to navigating the intricacies of the financial audit, and financial security was reached again.

We are grateful to our stakeholders: the Swiss Space Office, ESA and SCNAT for believing that ISSI's mission is of utter importance, especially in a divided world that desperately needs more collaborations, friendship and kindness.

We also reached stability on the Science Programme Manager front. After the departure of Dr. Mark

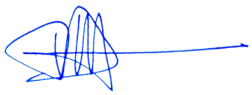
From the Directors

Sargent, we started a short but fruitful collaboration with Dr. Raphael Marschall, who eventually joined the professorship ranks of our neighbouring institution, the University of Bern. We were then fortunate to welcome to ISSI Dr. Sabina Raducan, who now joins the rest of team in offering a bright welcome to our visitors as ISSI Science Programme Manager.

Finally, ISSI always enjoys the presence of two ISSI Fellows at any given time. Having said farewell to Roland Hohensinn, we welcomed in the summer Dr. Htet Yamin Ko Ko and Dr. Brian Welch. Koko is an expert of Urban Heat Islands, and Brian uses JWST to study the chemical abundances of galaxies in the very early Universe, via gravitational lensing.

Together, we continue to believe that Science is the connection that unites communities worldwide beyond barriers and at ISSI, we are very proud we can continue playing that important role of bringing scientists together, under the same sky, or in front of our Universe mural!

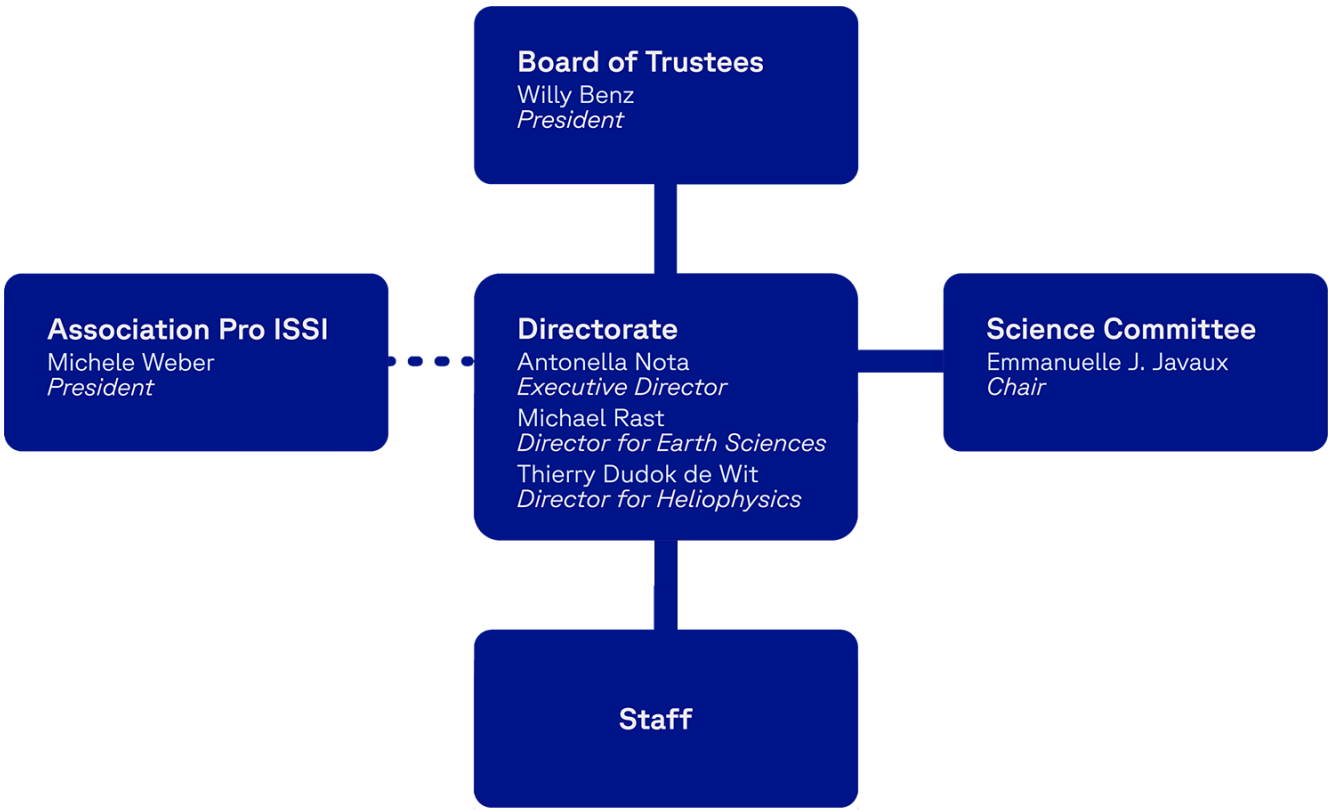
Antonella Nota



Thierry Dudok de Wit

Michael Rast

About the International Space Science Institute



The International Space Science Institute (ISSI) is a nonprofit organisation set up in Bern in 1995 as a foundation under Swiss law with an endowment by Contraves Space AG, later renamed Oerlikon Space AG and now part of Beyond Gravity. Three statutory bodies govern ISSI: the Board of Trustees, the Directorate, and the Science Committee. A fourth important body, the Association Pro ISSI, promotes the idea of ISSI, especially within Switzerland.

The European Space Agency (ESA), the Swiss Confederation, and the Swiss Academy of Sciences (SCNAT) provide the financial resources for ISSI's operation. The University of Bern contributes through a grant to a Director and in-kind facilities. The Institute of Space and Astronautical Science (ISAS/JAXA) is supporting ISSI with an annual financial contribution.

The **Board of Trustees** oversees the work accomplished at the Institute, exerts financial control, and appoints the Directors and members of the Science Committee. It consists of representatives of the funding Institutions. In addition, the Board of Trustees may nominate up to five personalities representing the national and international scientific community, space industry and space politics for a term of three years. The Board of Trustees is presided over by Willy Benz.

The **Science Committee,** chaired by Emmanuelle J. Javaux, is made up of internationally renowned scientists active in the fields covered by ISSI. The Science Committee advises and supports the Directorate in the establishment of the scientific agenda, providing a proper equilibrium among the activities, and reviews and grades the Team proposals in response to the annual call. Science Committee members serve a three-year term (with a possible extension of one year).

The **Directorate** is in charge of the scientific, operational, and administrative management of the Institute. It interacts with the Funding Agencies, the Swiss authorities, the Board of Trustees, the Science Committee and the Association Pro ISSI. The Directorate consists of Antonella Nota (Executive Director), Thierry Dudok de Wit and Michael Rast.

The **Association Pro ISSI** promotes the idea of ISSI by organising public lectures, when internationally known scientists introduce their results. Summaries of these talks are published in the journal SPATIUM. The Board of the Association Pro ISSI is presided over by Michele Weber.

Scientific Activities in 2025: The 30th Year

The Programme and its Elements

ISSI's mode of operation is generally fivefold: multi- and interdisciplinary Workshops, Working Groups, International Teams, Fora, and Visiting Scientists. 964 international scientists participated in ISSI's scientific activities in person in 2025, 595 of them from ESA Member States and ESA. 479 visited ISSI for the first time.

Fora are informal and free-ranging debates among some 15 to 20 participants, to discuss future directions, innovations and challenges. These can be of a scientific nature or to do with science policy matters. Fora need not produce formal recommendations or decisions, but outcomes are often captured as white papers, roadmaps or journal publications. A total of six fora took place in 2025.

Breakthrough Workshops are designed to address key questions in science, by gathering the main experts on the topic, inviting them to spend a week in a neutral and welcoming environment, to discuss and to produce one high visibility, high impact, open access peer-reviewed paper providing the community consensus on the topic in question, including what there is agreement on, and where there is not, to be submitted within three months from the completion of the Workshop. The number of participants is capped at 45 scientists. ISSI organised one Breakthrough Workshop in 2025.

Workshops consist of up to 45 invited scientists exchanging their views on a scientific theme, typically over one week. Workshops always lead to a volume of the Space Science Series of ISSI and in parallel as issues of Space Science Reviews or Surveys in Geophysics. During 2025, five workshops took place.

International Teams consist of about 15 external scientists, addressing a specific scientific topic in a self-organised fashion. The results of these activities are customarily reported in scientific journals. 52 International Team Meetings were organised in 2025.

Working Groups have a smaller number of members and meet as often as necessary to achieve the assigned objective. Five Working Group Meetings took place. One of them concerned to a new Working Group that had started its project in 2025. The results of the Working Groups are in general published as titles of ISSI Scientific Report Series or in the scientific literature.

Visiting Scientists spend between one week and two months at ISSI to work on a research project of their own, or to collaborate with ISSI's staff and/or with research institutes in Switzerland.

The **Johannes Geiss Fellowship (JGF)** is established to attract to ISSI – for limited duration visits – international scientists of stature, who can make demonstrable contributions to the ISSI mission and increase ISSI's stature by their presence and by doing so will honour Johannes Geiss for his founding of ISSI and his contributions to ISSI, and for his many contributions to a broad range of space science disciplines.

Additionally, ISSI has dedicated funding to support the involvement of **Early-Career Researchers** in all its activities. This enables Early-Career Researchers to build international collaborative networks and contribute to multidisciplinary research.

How to enquire for a Scientific Project

As a general rule, any member of the community can submit a proposal for any of the ISSI opportunities. Once an activity is approved, the financial support for invited scientists covers the local accommodation expenses and a per diem while in Bern.

International Teams: A call for proposals is released every year in mid-January for a deadline in mid-March. These proposals are evaluated by the Science Committee and approved by the Directorate. Over the past years the number of accepted Teams is about 30 per year.

Breakthrough Workshop, Workshops, Working Groups, and Fora: The scientific community may suggest at any time Workshops, Working Groups, and Fora. Proposal templates can be found at www.issibern.ch. Interested applicants should always liaise with an ISSI staff member when preparing a proposal. The Science Committee will evaluate these suggestions and the Directorate will make the final decision.

Towards building a European Heliophysics Community and Advancing the Multi-Disciplinary Field of Heliophysics Research

29–31 January 2025

Europe has a large and highly active heliophysics community. However, this community has historically been subdivided into various groups and areas, such as neutral-charged atmospheric interactions, ionospheres, magnetospheres, the solar wind, and solar and planetary plasmas. This diversity has sometimes made communication and collaboration between these groups unwieldy, even though fundamental plasma physics and techniques are a common thread.

The aim of the Forum on "Towards building a European Heliophysics Community and advancing the multi-disciplinary field of heliophysics research" was to discuss ways to advance heliospheric science by improving communication and coordination between those working in the aforementioned sub-disciplines and by setting up a European Heliophysics Community (EHC) body to better communicate with and support European scientists, especially early-career ones.

The Forum brought together 21 researchers. The main task was to pave the way for the establishment of an EHC, which involved identifying the relevant disciplines, discussing the optimal structure, addressing modes of interaction with existing initiatives, and planning concrete actions. The Forum's format was ideally suited to this, as it enabled open, free-flowing — and often intense — discussions.

The first tangible outcomes of the forum are a white paper with recommendations [Nakamura et al., Annales Geophysicae 43 (2025) doi: 10.5194/angeo-43-855-2025], a community website [https://www.heliophysics.eu/], and a series of sessions that have or will be organised at scientific meetings.

The main actions or recommendations are:
- Set up low-threshold communication channels with a mailing list, a regular newsletter, a Linked-In account [https://www.linkedin.com/company/heliophysics], etc.
- Give special attention to early-career researchers, to train them and help them establish their professional network. For that reason, a series of HelioMeet webinars has been initiated;
- Because heliophysics is connected to many other fields of science, there is a special need to facilitate information exchange on data sources, facilities, and tools;

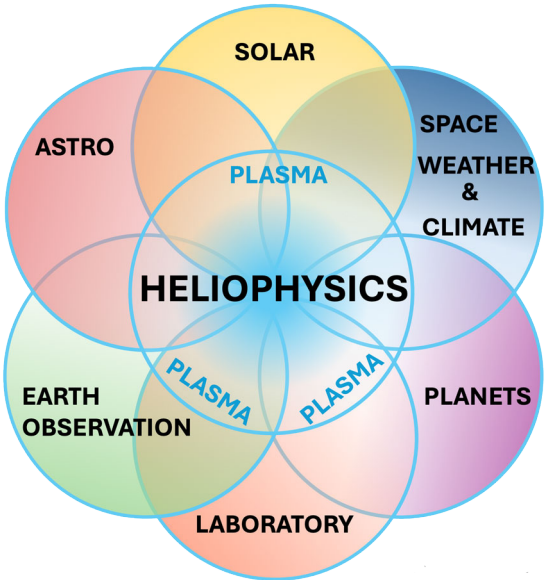


Illustration of the interconnected areas and topics of heliophysics and neighbouring disciplines and communities, plasma and heliophysics being denoted as crucial components of all surrounding disciplines. (Image Credit: Heli Hietala)

- Likewise, to enable interdisciplinary heliophysics, data and software must be recognised as critical scientific outputs;
- Encourage outreach activities, with the systematic use of the keywords "Heliophysics" and "EHC" to increase the discipline's visibility and foster community cohesion.

Following this Forum, a low-overhead approach structure with four working groups has been set up. The next major community event will be the EHC workshop that will take place at ESTEC on 21-25 September 2026.

This Forum was convened by Rumi Nakamura (IWF/OEAW, Austria & ISSI), Geraint Jones (ESA), and Thierry Dudok de Wit (Univ. of Orléans & ISSI).

Thierry Dudok de Wit

Network of oceanic LIDARs for the Validation of Ocean Colour Satellite Missions

20–22 May 2025

The Forum participants are experts on oceanic Lidar. Light Detection and Ranging (LIDAR) is a remote sensing technology that uses laser light to measure and map the ocean environment.

The Forum gathered 24 participants from China, France, Italy, Poland and USA, 21 in-person and 3 online. There was a mix of ocean colour specialists, lidar instrumentation developers, and atmospheric lidar specialists from academia and private companies.

The Forum consisted in a mix of presentations on ocean colour, lidar applications and lidar instrumentation development. Private companies developing lidars were invited to present their solutions. Five main topics were tackled leading to recommendations and proposals for Actions.

The first topic concerned the Lidar instrumentation development. Four recommendations were made: 1) There is a high interest in developing a network of oceanic profiling lidar; 2) Preference for a ship-borne lidar or at fixed stations; 3) Minimum requirements should be defined as a community; 4) Need to better define the objectives and the scientific questions.

The second topic concerned the objectives and the scientific questions of this network. Four recommendations were proposed: 1) The National Science Foundations and the space agencies need to provide clear pathways for funding dedicated to the development of oceanic profiling lidar and such a network; 2) Possibilities to install lidars on ship of opportunities and research vessels, whereby lidars should be installed alongside other sensors when possible (Ferrybox, ADCP); 3) Create an excel sheet for discussing different configurations of an oceanic profiling lidar; 4) Create a Task Force to look deeper at the technical characteristics from different communities.

The third topic concerned Lidar algorithms. Two recommendations were proposed: 1) Efforts are still necessary to improve the existing algorithms and 2) Inter-comparisons of lidar algorithms should be developed for a better understanding of their limitations and for further improvements. These recommendations led to a proposed Action: To develop a round-robin comparison of the algorithms on the basis of real and synthetic lidar and OC data.

The fourth topic concerned the data. Two actions were proposed: 1) Create a Task Force to develop a protocol on how to perform and process ship-borne lidar measurements; 2) To share the codes of current simulators

Lastly the topic concerning training and knowledge transfer was discussed. Two recommendations were proposed: 1) Need to attract optical and lidar engineers to the ocean colour community; 2) Need to develop summer schools dedicated to oceanic lidar. These recommendations led to one proposed Action: Train new generation of scientists on the data processing of lidar. The participants will try to organise a follow-up meeting at ISSI or at another venue.

Cederic Jamet

Observational Tests of the Dynamical Models for Outer Solar System Formation

2–4 September 2025

The minor planet populations of the outer solar system, including trans-Neptunian objects (TNOs), Centaurs, Trojans, irregular satellites, and comets, preserve crucial evidence from the epoch of planet formation. Their orbital distributions, surface compositions, and physical properties record the dynamical history of the giant planets and the processes that have shaped the solar system over billions of years.

Over the past two decades, models of giant planet instability and migration have successfully reproduced many observed features of the outer solar system. At the same time, several key observations remain difficult to explain within this framework alone. These include the properties of detached objects such as Sedna, the possible clustering of extreme trans-Neptunian objects, relative numbers of objects in mean-motion resonances, and aspects of the Oort Cloud structure. Alternative or complementary mechanisms, such as perturbations from a distant massive planet, stellar flybys, or the Sun's birth cluster environment, have therefore been proposed.

The Forum aimed to evaluate how current observations support, constrain, or challenge these different dynamical scenarios. The Forum brought together experts in dynamical modelling, stellar encounters, galactic dynamics, and observations of orbital, surface, and physical properties of outer solar system bodies. Particular emphasis was placed on defining observational tests that can distinguish between competing models in the era of large surveys such as Rubin Observatory's LSST and facilities such as JWST and the ELTs.

The main themes discussed included:
- The current dynamical architecture of the trans-Neptunian region and its implications for giant planet migration and instability models.
- The Planet Nine hypothesis and rogue planet scenarios: expected dynamical signatures and testable predictions.
- The role of stellar flybys, galactic tides, and the Sun's birth environment in shaping the Kuiper Belt and Oort Cloud.
- The formation and evolution of the Oort Cloud as inferred from the dynamics of long-period comets.
- The impact of collisional, thermal, and irradiation processes on the surface and physical properties of outer solar system bodies.
- The diagnostic power of size distributions, binary fractions, rotational properties, spectral diversity and relative numbers across dynamical populations.
- Observational strategies and survey priorities that can provide decisive constraints in the next decade.

The Forum gathered 25 participants from multiple countries and research communities, including experts in numerical simulations, small-body dynamics, stellar dynamics, spectroscopy, photometry, and survey science. The programme was structured around thematic sessions combining invited talks and extended discussions. This format encouraged direct comparison between models and data, and fostered collaboration across disciplinary boundaries.

The discussions highlighted both areas of agreement and persistent uncertainties. There is broad consensus that planetesimal formation by streaming instability provides a common starting point, and that giant planet migration played a central role in shaping the trans-Neptunian region. However, the origin of detached objects and the detailed structure of the inner Oort Cloud remain open questions. Participants identified specific observables, such as resonance occupation statistics, the orbital distribution of long-period comets, binary survival rates, and correlations between colour and dynamical class, that offer strong discriminatory power between models.

A central outcome of the Forum is a structured review paper that connects dynamical models, physical processes, and observable properties of outer solar system populations. The paper will outline a set of prioritised observational tests designed to exploit forthcoming data from LSST, JWST, ELTs, and complementary ground-based programmes. By clarifying which measurements are most diagnostic, the Forum aims to guide both observational campaigns and theoretical developments over the coming decade.

Rosita Kokotanekova

Exploring the Synergies between Space and Laboratory Plasma Physics

22–24 September 2025

The plasma state is by far the most common state of visible matter in the Universe. Plasmas are partially or fully ionised gases that exhibit interesting collective behaviour. Examples for space and astrophysical plasmas include the solar wind, planetary magnetospheres, stars, the interstellar medium, accretion discs around compact objects, and even the gas between galaxies in galaxy clusters. In addition to a strong general interest in the fundamental physics of plasmas as complex systems, plasmas also have a high technological value. Therefore, plasma physics is also actively studied in laboratory environments on Earth.

This interdisciplinary Forum brought together world-leading experts in space plasma physics and laboratory plasma physics to explore and discuss the synergies between both research strands and scientific communities. Given the breadth of the realm of plasma physics, these two communities often operate very independently and with limited interaction across discipline borders.

However, our common interest in the discovery and understanding of fundamental processes in complex plasma systems offers great opportunities for cross-fertilisation and bi-directional exchange of ideas, the exploration of common themes and concepts, and the sharing of experience in the application of diagnostic techniques and measurement tools. The central goals of this Forum were the breaking down of barriers between the communities and the opening of pathways towards more detailed and larger-scale, synergistic follow-on research projects and collaborations.

The scientific scope of our Forum lain in the physics of fundamental processes that can play a significant role in defining the behaviour of both space and laboratory plasmas. These processes include, amongst others, magnetic reconnection, turbulence and waves, nonequilibrium effects and instabilities, shocks, Coulomb collisions, dynamo effects, and heat conduction.

The Forum gathered 21 participants (18 face-to-face and three remotely) from nine countries, including four early-career researchers from both the space and laboratory plasma communities. We extensively discussed the synergies between both communities by brainstorming over the following Guiding Questions:

- How can laboratory plasma experiments inform our understanding of fundamental space-plasma processes?
- How can space-plasma observations inform the design and interpretation of laboratory plasma experiments?
- Which diagnostic methods and techniques are transferrable between both research communities?

The discussions revealed great commonalities between the involved research communities and exciting opportunities for future collaborations across discipline boundaries. Although some plasma conditions and parameters make a direct comparison between space and laboratory systems challenging, we found that an appropriate scaling between both environments can often help us explore the same plasma processes and physics. Moreover, we discovered great commonalities in terms of novel diagnostic approaches that can be used to measure charged particles and electromagnetic fields in natural and artificial plasmas. It became clear that both communities will significantly benefit from cross-disciplinary interactions like this Forum. By learning from each other, we can maximise the potential to drive forward our fundamental understanding of plasma physics that is important both in space and on Earth.

Following the Forum, a white paper on the synergies between space and laboratory plasma physics will be published in the journal Reports on Progress in Physics. The Forum was convened by Daniel Verscharen (University College London), Sara Molisani (University of Padova), Matteo Zuin (Consorzio RFX and CNR/ISTP Padova), and Rumi Nakamura (IWF/OEAW and ISSI).

Daniel Verscharen and Rumi Nakamura

Climate Extremes in Our Warming World

6–8 October 2025

Climate extremes are the primary channel through which societies experience the impacts of climate change, and recent years have witnessed a marked increase in their frequency, severity, and spatial extent. Characterising and understanding the occurrence of current extreme weather events, their drivers and interactions shed light on what to expect in the near future, especially with respect to unprecedented extremes, and which are the implications for climate adaptation. The Forum was aimed at discussing these major questions related to changing weather and climate extremes under global warming. The Forum gathered over 20 scientists with complementary expertise in Earth observation, climate data analyses and statistics, and data and numerical modelling. The discussions held during the meeting identified the key scientific challenges and research priorities associated with the detection, attribution, and anticipation of the most impactful and unprecedented extremes. The participants examined how climate extremes are responding to global warming. They focused on assessing the capabilities and limitations of current monitoring systems and evaluating the evolving roles of numerical modelling and data-driven approaches. Importantly, attention was also paid to the implications for risk and how to find ways to enhance societal preparedness through improved understanding of dynamic processes, predictive capabilities, and communication strategies, in a rapidly warming climate.

A first key outcome of the Forum was the recognition that climate extremes must be understood as dynamic, multi-scale phenomena driven by the interplay of thermodynamic forcing, large-scale circulation, local processes, and human influences. Robust evidence exists for increasing heat extremes, heavy precipitation, and marine heatwaves, but changes in other type of weather extremes, such as wind extremes or hail, are more uncertain due to observational gaps and limitations in model representation of atmospheric dynamics. Addressing these challenges requires a stronger focus on process-based understanding through an improved representation of dynamics across scales and the use of multiple lines of evidence, rather than reliance on single datasets or methods.

A second major outcome was the identification of critical needs in monitoring and data integration. The discussions underscored that current observational systems remain spatially uneven, fragmented, and biased towards the Global North, with especially limited coverage for precipitation extremes, subsurface ocean conditions, and impact data. Even though extended Earth observation capabilities and emerging commercial satellite constellations offer unprecedented opportunities for near-real-time monitoring, their effective use depends on ensuring data continuity, homogeneity, and transparency. With respect to other types of datasets, the Forum highlighted the urgent need for global, standardised, and open impact datasets to enable impact-based attribution, risk assessment, and evaluation of adaptation strategies.

Participants in the Forum gathered at ISSI to debate about the climate extremes

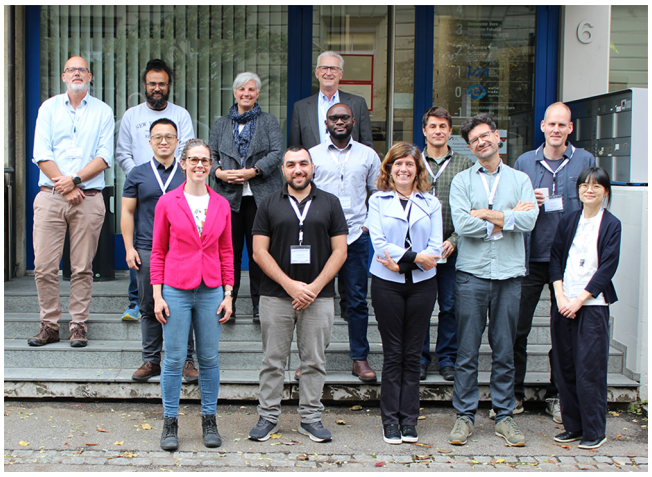
Finally, the Forum converged on the importance of moving beyond retrospective analysis towards anticipation, preparedness, and societal relevance. Participants emphasised that the most damaging outcomes often arise not from isolated hazards, but from compound, cascading, or unprecedented events that fall outside historical experience. In this context, worst-case thinking, storyline approaches and large-ensemble methods were identified as essential tools for exploring plausible high-impact futures.

The Forum concluded that advancing the science of climate extremes requires not only technical innovation, but also a closer integration across disciplines and stronger engagement with societal needs, that enable risk-informed planning and adaptation in a rapidly warming world.

Marta Marcos

Forest Genetic Resources and the Future Biomass in Forests

22–24 October 2025



The Forum participants in front of the ISSI building

The Forum brought together experts for an open, in-depth exchange aimed at producing a collaborative publication. Discussions focused on: (a) incorporating forests' capacity to respond to change, grounded in their (phylo)genetic and functional diversity into predictions of future forest dynamics and Earth system impacts, and into understanding human influences and actions; and (b) advancing the role of Earth Observation (EO) in quantifying and monitoring change to inform models, management, and policy.

A central principle was to prioritise knowledge application. The Forum's direction was guided by the needs of participants who use data products and algorithms to generate predictions, design interventions, and co-develop strategies, particularly linking data producers with applied scientists and decision-relevant contexts.

Fourteen participants contributed perspectives spanning genetic diversity and adaptive potential, biomass and water cycling, EO programmes, and the science–policy interface. Discussions identified critical gaps in understanding future forest states and their Earth system impacts, and explored how to better integrate data, models, and tools to address these gaps. Concrete examples of such integration were examined, and drafting of a joint manuscript began during the meeting.

Fora are informal and free-ranging debates among some 15 to 20 participants, to discuss future directions, innovations and challenges. These can be of a scientific nature or to do with science policy matters. Fora need not produce formal recommendations or decisions, but outcomes are often captured as white papers, roadmaps or journal publications.

Key insights were synthesised and shared publicly, and participants have continued collaborating since the Forum. By December 2025, core messages and illustrations were defined; integration case studies are being added in early 2026, with manuscript submission planned for mid-2026.

Michael Rast

Breakthrough Workshop

Life beyond Earth: The Missing Link

16–20 June 2025

Breakthrough Workshops are specifically designed to address core questions in science, by gathering a diverse set of experts on the topic, inviting them to spend a week in a neutral and welcoming environment, to discuss the issues, and produce one high visibility peer reviewed paper to state the current understanding on the topic in question. The topic of the 2025 Breakthrough Workshop was: Life Beyond Earth: the missing link.

The field of exoplanet science is less than thirty years old, but in that short time, the discovery that there are planets orbiting around stars other than our Sun have revolutionised the way we see the Universe and our place in it. Since the first discovery of an exoplanet, almost 6000 exoplanets have been discovered. Thanks to new ambitious space missions and ground-based search facilities in place, the number keeps rising, with even smaller Earth-like objects being detected. Facility space observatories, like the Hubble Space Telescope, which were not originally designed to study exoplanets, creatively exploited indirect techniques such as observing the exoplanets during their transits in front of the host star, to pioneer exoplanet atmosphere studies, obtaining the first atmospheric spectra and detecting key chemical elements such as water and methane.

When JWST came online, the exquisite combination of sensitivity and resolution coupled to state-of-the-art spectroscopic capabilities opened planetary physics studies to new dimensions. Complex molecules are being detected, and the study field has grown, combining astrophysics with planetology and chemistry. The existential question on whether the Universe is full of life seems within reach of our technology and has galvanised researchers from different disciplines and research agencies. The next decades could be decisive for the corresponding disciplines, potentially marking a key moment that will see spectacular progress in our understanding of the conditions and mechanisms for the origin of life.
This Breakthrough Workshop was held at ISSI on June 16-20, 2025 and was organised around big questions centred on the theme of “life in the Universe.” The conveners were Didier Queloz (ETH), Laura Kriedberg (MPIA Heidelberg), Jonathan Lunine (NASA JPL) and Antonella Nota (ISSI).

Approximately 30 experts met in Bern to answer the questions: What planetary environment should be considered as a potential cradle for life? Starting from our own planet Earth and our own Solar System, what are the conditions necessary for life? A large number of exoplanets have been found to have atmospheres and to be located in temperate zones that are potentially habitable. The recent discovery of Hycean exoplanets, with hydrogen-rich atmosphere and oceans added new context and interest to this question. How do we search for geological and biological signatures? JWST is enabling, for the first time, accurate spectroscopic measurements of the isotopic composition of volatiles in the atmosphere of active asteroids and water-rich satellites (see for example the measurements of deuterium and carbon-13 contents on dwarf planet Eris). The return of samples from asteroids such as Bennu and others is further informing the conversation on how best to explore geological signatures. The debate on what the term “biological signature” even means in the light of the new JWST results was topic of lively debate among astronomers, astro-chemists and astro-biologists.
In a truly multidisciplinary fashion, this Breakthrough Workshop brought together experts from cognate disciplines, to interact and produce a corresponding paper on the current status of the community understanding, in relation to the questions above. The paper is close to submission.

Antonella Nota

Breakthrough Workshops are designed to address key questions in science, gathering the main experts on the topic. They are invited them to discuss, deliberate and produce one high-visibility, high-impact, open-access peer-reviewed paper providing the community consensus on the topic in question, to be submitted within three months from the completion of the Workshop. Breakthrough Workshops have a format that includes an abundance of moderated discussions and collaborative paper writing.

What's under the H0od?
Towards consensus on the local value of the Hubble constant

24–28 March 2025

Workshop participants standing on the Grosse Schanze in Bern, smiling against a backdrop of the old town and distant Swiss Alps hidden by the clouds.

Nearly forty experts met with the objective of reaching a community consensus view on the state-of-the-art knowledge of the local distance ladder using the broadest possible variety of methods available today. The goal was to obtain the most robust determination of the local value of the Hubble Constant to date, and to strengthen the collective understanding of the "Hubble Tension". The Conveners of this workshop were Stefano Casertano (STScI), Richard Anderson (EPFL), Eleonora Di Valentino (Sheffield), Adam Riess (STScI/JHU), Licia Verde (Univ. Barcelona), and Antonella Nota (ISSI).

The Hubble Tension is the apparent conflict between the value of the Hubble constant measured locally and the value inferred from the favored cosmological model of the Universe, ΛCDM. The ΛCDM has provided for decades a successful explanation of the observed properties of galaxies and the structure of the Universe itself. With the extremely detailed measurements of the Cosmic Microwave Background now available, coupled with the physics of the early Universe, this model predicts with great precision the value of the Hubble constant, the rate of expansion of the Universe at the present time. But the Hubble constant can also be measured directly in the local Universe, from distance estimates to individual objects and their measured redshift. Distance estimates are often based on a series of steps involving multiple distance indicators, forming the so-called "distance ladder", which ultimately measure the distance of supernovae or other far-reaching distance indicators in the expansion flow. We know that the measured value of the Hubble constant, using multiple versions of the distance ladder, does not agree with the value predicted by the ΛCDM model, with the discrepancy estimated to be at least 5-6σ. Resolution of the Hubble tension promises to either identify significant, undiscovered anomalies in a large amount of collected data, or uncover new physics affecting the expansion and evolution of the Universe. Despite several years and dozens of

attempts, no conclusive explanation or convincing interpretation has emerged for this discrepancy.

The ability to constrain the local distance ladder has evolved significantly over the last several years. Different distance indicators have been studied in greater detail, and now provide partially independent, comparable paths to distance estimates of the same objects; these include, for example, the period-luminosity relation for Cepheids; the luminosity of the tip of the red giant branch; the luminosity of the J-region of the asymptotic giant branch; the luminosity of oxygen-rich Mira variables; the angular size of Type II supernovae; and the amplitude of surface brightness fluctuations in galaxies. Multiple classes of distance indicators reach into the Hubble flow and provide independent ways to sample the expansion of the Universe; these include, for example, the standardised luminosity of Type Ia supernovae; the fundamental plane of elliptical galaxies; and megamasers. Together, these indicators have led to the development of a complex "distance network", in which separate or partially overlapping paths can be followed to arrive at an estimate of the Hubble constant. However, in many cases different indicators share common elements, such as anchors, distance calibrations, or other types of common uncertainties, and thus cannot simply be averaged together. The only way to properly combine all these measurements into a coherent, single estimate of the local value of the Hubble constant is to fully understand the extent to which they share uncertainties and, conversely, the extent to which they provide independent constraints for the same quantity.

All independent groups working on this topic were invited to join. Through detailed discussions and a thorough analysis, supported by expert knowledge and deep understanding of the details of each approach, the participants were able to quantify the interrelations among all methods and build a full statistical model of the diverse constraints on the local distance scale. Such a comparison has never been carried out with full information and rigor; having the world's experts together in the same room, in a neutral and welcoming environment, working to confirm each other's methodology, has provided the answer to the question: "What is the best local value of the Hubble constant based on all evidence available today?"

As a result, this analysis yielded the most precise **direct** measurement to date of the current expansion rate of the Universe. In a paper published in March 2026 in the journal Astronomy & Astrophysics, the H0 Distance Network (H0DN) Collaboration reports a value of the Hubble constant of $H_0 = 73.50 \pm 0.81$ **km s^{-1} Mpc^{-1}**, corresponding to a precision of just over 1%.

Workshops are selected by the ISSI directorate in consultation with the Science Committee. The Workshop programme and speakers are selected by a group of highly qualified experts acting as convenors. Each Workshop lasts a week and has up to 45 participants. Workshop participants work together to produce an on-line collection of peer-reviewed articles in Space Science Reviews or Surveys in Geophysics. This collection of review papers is then also published as a volume of the Space Science Series of ISSI (SSSI). All Workshop publications have open access status.

Beyond delivering the most precise direct measurement of the Hubble constant to date, the Local Distance Network establishes a flexible and extensible framework for the future. With a flood of new observatories, improved calibrations, and additional geometric distance anchors becoming available, they can be integrated into the network to further refine our understanding of cosmic expansion and provide definitive clues about the resolution of the Hubble tension.

Antonella Nota

Stellar Magnetism and its Impact on (Exo)Planets

2–6 June 2025

Stellar magnetism influences the radiative, particulate, and magnetic output of stars across a vast diversity of timescales, ranging from seconds, decades, to millennia and indeed stellar and planetary evolutionary timescales. This magnetically mediated activity has a profound influence on stellar astrospheres and the (exo)planets within them. In recent times, space-based observations from our own solar system, other exoplanetary systems and novel computational modelling approaches have revealed the varied and rich new physics at play that bridges stellar magnetism to planetary impacts. In this Workshop, our objective was to take stock of the status of the field, discuss outstanding challenges, envision potential future research directions, and brainstorm necessary space missions and observations that can spur the development of this emerging area of research with footprints across solar and stellar physics, heliospheric physics, and (exo)planetary sciences.

The Workshop gathered about 40 scientists from around the world to discuss the consequences of stellar magnetic variability on (exo)planetary space environments and atmospheric evolution which influence planetary habitability. A session was dedicated to future instrumentation initiatives that can provide important observational constraints and new discoveries in this domain of study. Over five days of deliberation, several pedagogical style lectures and focused talks on recent research results, touched on diverse important topics of this interdisciplinary and rapidly emerging field.

41 lectures were scheduled, out of which five were keynote lectures. The keynote lectures were designed to provide a pedagogical overview of the various themes, and the rest of the lectures focused on state-of-the-art and recent advances in topics such as solar-stellar magnetic variability across diverse timescales, extreme stellar (radiation and energetic particle) events, stellar winds, forcing of heliospheric and astrospheric environments, coupled evolution of star-(exo)planet systems, star-planet interactions, consequences of these phenomena on habitability and new space-and ground-based instrumentation that can further this interdisciplinary field of exploration. Separate discussion sessions were conducted to plan the review articles to be published by Space Science Reviews. A specially organised, brief session was dedicated to the memory of Maurizio Falanga, one the ISSI Directors who was helping with the organisation of this Workshop before his untimely demise.

The Workshop broadly covered the following areas:
1. Stellar variability of relevance to (exo)planets
2. Forcing of heliospheric and astrospheric environments
3. Star-planet interactions: Planetary space weather to atmospheric evolution
4. Magnetism and stellar forcing: Consequences for (exo)planetary habitability
5. Instrumentation Initiatives

Several exciting deliberations characterised the Workshop. Some of the new insights to emerge from the Workshop relate to the long-term behaviour of stellar hosts including the diversity of activity that they display, the nature and frequency of extreme stellar events and the challenges of detecting them, the impact of stellar coronal mass ejection and plasma winds on close-in hot Jupiter type planets and far-out Earth-like rocky planets, the intriguing feedback mechanisms of close-in planets on the activity of their host stars, the challenges of constraining and discovering the magnetism of exoplanets that are located far away, and the nuances of habitability in the context of magnetically mediated star-planet interactions. The Workshop highlighted many open questions and uncertainties, reinforcing that this is a field rich with exciting challenges and poised for major progress in the years to come.

As an outcome six peer-reviewed articles – written in collaboration between the participants – are being prepared for publication.

The Workshop was convened by Rim Fares (United Arab Emirates University, UAE), Silva Järvinen (AIP Potsdam, Germany), Emre Isik (MPI for Solar System Research, Germany), Heidi Korhonen (MPI for Astronomy, Germany), Co-Convener, Cristina Mandrini (IAFE, UBA-CONICET, Argentina), Dibyendu Nandi (IISER Kolkata, India), Convener and Krisztian Vida (Konkoly Observatory, Hungary).

Dibyendu Nandi

Unsolved Mysteries of the Uranian System

13–17 October 2025

Almost four decades after the lone in-situ encounter of the Uranian system by the Voyager 2 spacecraft, our understanding of the system is still significantly lacking, with many more open questions than answers. This is increasingly true as the community sets its sights towards future exploration of the system and revisits previous analyses and conclusions armed with new insights based on orbital investigations from other planets such as Jupiter and Saturn, new modelling capabilities, and new remoted-sensing datasets from assets such as Hubble and JWST. This workshop aimed to bring together leading experts across the planetary science community to review recent results in the context of our current understanding of the Uranian system, as well as knowledge from other planetary and exoplanetary systems, to identify the major unsolved mysteries that would need to be addressed by future investigations.

Uranus presents a compelling scientific target for the planetary science community, providing a unique opportunity to explore an ice giant system with its five classical satellites, which boast drastic surface features, and a dynamically full and apparently haphazard system of rings and small moons, in addition to the planetary and magnetospheric effects of its highly tilted rotational axis being almost in Uranus's orbital plane and its strongly multipolar intrinsic magnetic field. In particular, new results over the past few years have renewed much debate over significant outstanding questions about the system. First, it is unclear where and when the Uranus system formed. Many solar system formation models struggle to produce the current planetary configuration without strongly bound initial conditions. Similarly, questions remain as to how the planet's dense rings and numerous moons formed and what processes dominate their dynamics, let alone how the system was affected and evolved after whatever cataclysmic event knocked the planet onto its side. Another ongoing debate surrounds whether any of the classical moons in the system may be potential ocean worlds, as a growing body of new evidence, based on a combination of the reanalysis of Voyager 2 measurements, new spectral observations from JWST, and new modelling studies, may suggest. Finally, new debate has arisen around the nature and characteristics of the Uranian magnetosphere with new results suggesting that the notably low plasma densities observed by Voyager 2 may be a result of anomalously strong solar wind pressure and/or the plasma dynamics driven by the planet's extremely high obliquity and the strong tilt of its magnetic field. The workshop aimed to review progress in our modern understanding of the Uranian system, based on new observations and simulations, the reanalysis of Voyager 2 data, and knowledge gained from other Giant planet systems, while also considering broader cross-disciplinary applications. The Workshop gathered 48 scientists (36 in-person and 12 remote) from 28 institutions across nine countries, including 12 early career scientists, from across multiple sub-disciplines of planetary science research. The workshop was organised to highlight the following topical areas of the Uranus system: the origin and evolution of the planet and system, the interior and deep atmosphere, the dynamo and intrinsic magnetic field, the middle atmosphere, the upper atmosphere and ionosphere, the surfaces and interiors of the classical satellites, the rings and small satellites, and the magnetosphere. Following the Workshop, a collection of comprehensive papers outlining our current understanding of the Uranian system and highlighting the outstanding mysteries that remain will be published in a volume of the Space Science Series of ISSI and as a Topical Collection in Space Science Reviews by Springer, to be organised in 16 chapters.

Group picture of the Workshop participants.

The Workshop was convened by (in alphabetic order) Chloe Beddingfield (JHU/APL, USA), Ian Cohen (JHU/APL, USA), Matthew Hedman (Univ. of Idaho, USA), Ravit Helled (Univ. of Zurich, Switzerland), Alice Lucchetti (INAF/OAPD, Italy), Rumi Nakamura (OEAW/IWF, Austria), Yasuhito Sekine (Institute of Science Tokyo, Japan), and Amy Simon (NASA/GSFC, USA).

Ian H. Cohen

Eclipses and Beyond: Unveiling the Mysteries of the Sun's Visible Corona

17–21 November 2025

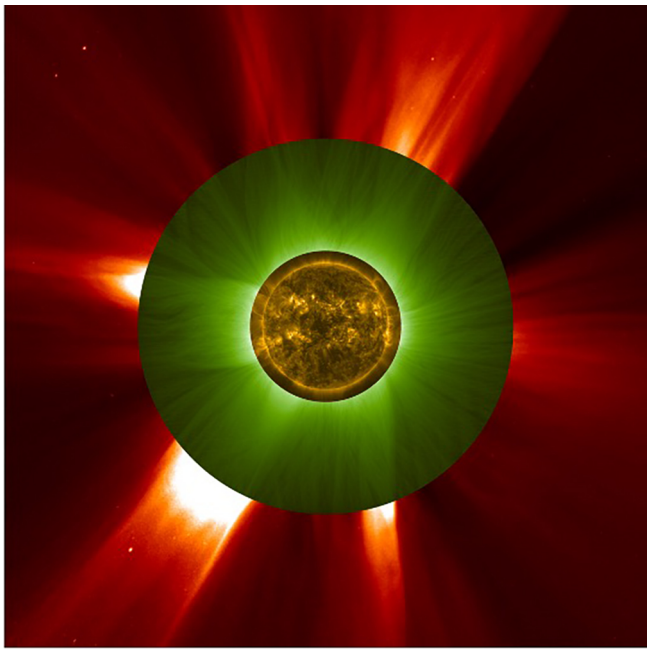
Most solar events that influence the heliosphere (and play a significant role in space weather) develop their defining physical properties in the inner solar corona, which is located roughly between 1.5 and 5 solar radii. For almost half a century, our view of the inner corona has been limited to the delicate shimmer of white light observations made during eclipses. This has gradually changed. New missions such as PUNCH and PROBA3 have begun to offer us a new perspective on this region, and the sungrazing Parker Solar Probe satellite now flies into structures that we previously only observed in projection.

This Workshop was organised in response to the urgent need to review our understanding of the inner corona and develop a framework for describing its three-dimensional structure. Such a framework is needed to create three-dimensional, time-dependent reconstructions of the coronal density, to cross-calibrate different instruments, to help connect white-light observations to the topology of the coronal magnetic field, to make better use of new machine learning tools, and more. Additionally, we are missing a uniform description of the large collection of structures that are observed in the corona. Even defining the inner corona is a challenge.

45 participants attended the Workshop. The schedule, which left considerable time for open discussions, was organised around three questions:
1. What is the 3D morphology of the corona?
2. What are the equations of state (density, temperature, speed, magnetic field) of the inner corona?
3. How does the coronal structure evolve in scales from seconds (arcseconds) to hours (arcminutes)?

The main outcome of this Workshop is a series of seven review papers, which will be compiled into a legacy book. These reviews will provide context for the field and explore new areas. The general idea is to provide the community with a roadmap that will guide it from scattered observations towards a comprehensive understanding of the corona.

The stunning images of solar eclipses have enormous outreach potential, so a public "Astronomy on Tap" event was held at Bern railway station in conjunction with the Workshop. The event was attended by over 90 people.



Composite image based on instruments from different missions. It features a white light image of the inner corona (green) taken by the ASPIICS coronagraph on the recently-launched PROBA3 satellite (Credit ESA).

This Workshop was convened by Angelos Vourlidas (APL, USA), Frédéric Auchère (IAS, France) Madhulika Guhathakurta (USA), Yeimy Rivera (CfA, USA), Marco Romoli (Univ. of Florence, Italy), Marco Velli (UCLA, USA) and| Thierry Dudok de Wit (Univ. of Orléans & ISSI).

Thierry Dudok de Wit

Opening up Earth Observations for Climate Adaption

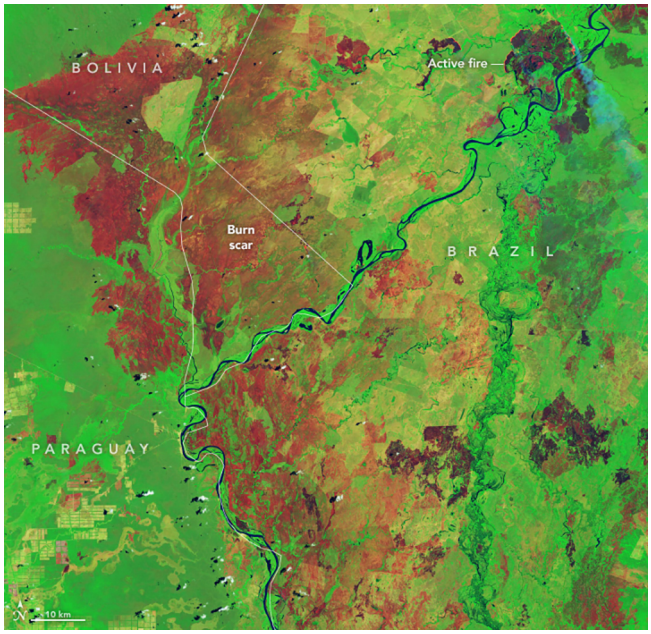
8–12 December 2025

Earth Observation (EO) systems provide long-term, global, and systematic measurements essential to climate science. This interdisciplinary Workshop, convened by the International Space Science Institute and the World Climate Research Programme's My Climate Risk Lighthouse Activity brought together experts from climate science, EO, adaptation practice, and social sciences to assess how EO can better support local climate adaptation within an Open Science framework.

Participants emphasised that access to EO data alone does not ensure usability. At local scales, adaptation efforts face challenges related to data availability and continuity, spatial and temporal resolution, interoperability, and the translation of observations into decision-relevant information. These issues are compounded by institutional, technical, and capacity constraints, particularly in climate-vulnerable regions, risking inequities in who can effectively use EO and contributing to epistemic injustice. The workshop moved beyond technical considerations to address governance, values, and knowledge integration. Key objectives included evaluating EO usability at local and regional scales; identifying technical, institutional, and epistemic barriers; integrating community-defined indicators and local knowledge; linking global EO data to local decision-making through approaches such as causal networks and storyline methodologies; and identifying pathways to strengthen governance, capacity, and collaboration.

Discussions highlighted both the promise and limitations of scientific EO for adaptation. While EO data are vital for understanding climate risks, ensuring their just, inclusive, and decision-relevant use requires attention to usability, equity, governance, and sustained institutional support. The Workshop fostered a shared understanding of how EO can be better aligned with local adaptation needs and is informing two peer-reviewed publications on openness, indicators, case studies, and institutional structures.

Michael Rast



A satellite-derived map of South America shows fire activity and burned area for 2019, with hotspots spread across multiple distinct ecosystems rather than concentrated solely in the Amazon rainforest. (Image Credit: NASA Earth Observatory images by Wanmei Liang, using MODIS data from NASA EOSDIS LANCE and GIBS/Worldview and Landsat data from the U.S. Geological Survey)

Working Groups

Incoherent Scatter – An Invaluable Tool in the Field of Space and Plasma Physics

Developed in the 1960s, the 'incoherent scatter radar (ISR) technique' represents one of the best examples of a cohesion between plasma theory, signal processing techniques and instrument design.

Data from ISRs have proved invaluable across a wide range of scientific disciplines including ionospheric and atmospheric physics, magnetospheric physics and fundamental plasma physics. These large scale facilities (of which there are currently 11 around the world) also provide valuable research hubs for a wide range of complementary instrumentation such as optical and radio equipment, allowing for coordinated atmospheric and space observational campaigns. Many Earth-orbiting spacecraft missions also coordinate their orbits with the location of ISRs to allow a combination of in-situ and ground based measurements as well as exploiting the ISRs as a calibration source – a ground-truth, for their plasma measurements. The data from ISRs also form part of the International Reference Ionosphere (IRI) model, a model used throughout the scientific community. ISRs have also been fundamental in driving cutting edge signal and data processing techniques and antenna design.

Despite the prevalence of ISR generated data and techniques across multiple scientific research fields and peer-reviewed papers (for example, there are 2640 papers listed on the EISCAT website), there exists no definitive textbook which fully covers the subject. Over the last 20 years technology and signal processing capabilities have also made significant leaps forward - all of these are yet to be documented in a coherent format. The newest facility, EISCAT-3D, (which is on the ESFRI roadmap) comes online later this year and represents the most advanced ISR system in the world which will revolutionise our understanding of the near-Earth environment. Now is the time to bring the community together to provide a solid platform with which to capture the knowledge of the current generation but also to inspire the next generation of physicists, computer programmers and engineers.

The purpose of the Working Group (WG) is to create the first definitive textbook which covers all aspects of incoherent scatter radar (ISR) techniques, theory and application. The first physical meeting of the 16 members of the WG took place at ISSI, from 7 to 11 April 2025. The majority of the WG members were in Bern with a few attending online. At that meeting, the backbone structure of the book was identified, as well as chapter leads from within the WG. Co-authors for chapters (outside the WG) were also identified. A timeline for publication of 2027/2028 was also agreed upon. The format of the book was agreed to open access, ISSI Scientific Report Series, aimed at Masters and PhD students level over a broad academic audience including plasma physicists, radio scientists, space physicists, and engineers.

Since then the group has been meeting online to discuss progress with the various chapters. The next physical meeting will take place in Bern in June 2026.

Lisa Baddeley, Gareth Perry and Lindsay Goodwin

Working Groups are set up for specific tasks, especially tasks of an applied or technical nature. Working Groups meet several times at ISSI to work on their project. Their work is often published as volumes of the ISSI Scientific Report Series (SR), or in the peer-reviewed scientific literature. All SR volumes have Open Access status.

Further Working Groups met in 2025

Their purposes are described in previous Annual Reports

Global Assessment of Limnological, Estuarine and Neritic Ecosystems (GALENE)
Sessions at ISSI: 5–7 February and 26–27 May 2025

Disentangling Pulse Profiles of (Accreting) Neutron Stars
Session at ISSI: 10–14 March 2025

Auroral Research Coordination: Towards Internationalised Citizen Science (ARCTICS)
Session at ISSI: 5–9 May 2025

International Teams

International Teams consist of up to 15 researchers with complementary scientific expertise, affiliated with institutions in at least four different countries worldwide. They hold a series of two one-week meetings over a period of 24 months, with the possibility of a third meeting in well-justified cases.
The aim of the Teams is to carry out a focused research project leading to publications in peer-reviewed scientific journals. Teams are set up in response to an Annual Call by ISSI, and proposals are evaluated and prioritised by the Science Committee.

Listed are Teams that had a meeting at ISSI during the 30th business year. A rationale is given only for the Teams selected in 2025; for the others see the previous Annual Reports.

Teams selected in 2021

Modelling Mercury's Dynamic Magnetosphere in Anticipation of BepiColombo
Team leaders: Deca J. (US) & Aizawa S. (FR)
Session:June 4–6, 2025

The Early Milky Way
Team Leader: Else Starkenburg, University of Groningen, the Netherlands
Session: March 31–April 4, 2025

Teams selected in 2022

Timing and Processes of Planetesimal Formation and Evolution (ISSI – ISSI Beijing Team)
Team Leader: Wladimir Neumann, Technical University Berlin, Germany
Session: March 3–7, 2025

Beam plasma interaction in the solar wind and the generation of Type III radio bursts
Team Leader: Vladimir Krasnosselskikh, Université d'Orléans, CNRS, France
Session: June 23–27, 2025

Teams selected in 2023

Quantitative Comparisons of Solar Surface Flux Transport Model
Team Leader: Graham Barnes (team leader) North-West Research Associates, USA
Session: May 12–16, 2025

Models and Observations of the Middle Corona
Team Leaders: Giulio Del Zanna, University of Cambridge, Cambridge, UK and Matthew West, Southwest Research Institute, Boulder, USA
Session: September 29 – October 3, 2025

Shocks, Waves, Turbulence, and Suprathermal Electrons in the Very Local Interstellar Medium
Team Leaders: Frederico Fraternale, University of Alabama, USA and Stella Ocker, Cornell University, USA
Session: May 19–23, 2025

Constraining Trade-Cumuli Feedback by Means of Process Understanding
Team Leaders: Geet George, TU Delft, Germany and Hauke Schulz, University of Washington, USA
Session: May 5–9, 2025

Exploiting Intracluster Light for Cosmology and Galaxy Evolution with Next Generation Facilities
Team Leader: Nina Hatch, University of Nottingham, UK
Session: March 10–14, 2025

The Extremely Low Surface Brightness Universe: Calling for Synergy between the ESA Euclid and ARRAKIHS Space Missions
Team Leaders: Kate Isaak and René Laureijs, European Space Agency, the Netherlands
Session: September 9–11, 2025

Perspectives on Stratospheric Aerosol Observation
Team Leaders: Corinna Kloss, Forschungszentrum Jülich GmbH, Jülich, Germany and CNRS, Orléans, France and Mahesh Kovilakam, ADNET Systems Inc / NASA Langley Research Center, Hampton, USA
Session: March 17–19, 2025

Meteors and Phenomena at the Boundary between Earth's Atmosphere and Outer Space
Team Leaders: Alexander Kozlovsky, Sodankylä Geophysical Observatory of the University of Oulu, Finland and Renata Lukianova, Institute of Seismology, Kazakhstan
Session: June 10–13, 2025

International Teams

Development of Galaxy Zoo: JWST
Team Leader: Karen Masters, Haverford College, USA
Session: March 17–21, 2025

REASSESS - gRound and spacE-bAsed analySis of Strong sEp eventS and Study of their terrestrial effects
Team Leader: Alexander Mishev, University of Oulu, Finland
Session: March 31– April 4, 2025

Tomographic Inversion of Synthetic White-Light Images: Advancing Our Understanding of CMEs in 3D
Team Leaders: Erika Palmerio, Predictive Science Inc., USA and David Barnes, Rutherford Appleton Laboratory, UK
Session: May 5–9, 2025

Unveiling Energy Conversion and Dissipation in Non-Equilibrium Space Plasmas
Team Leaders: Oreste Pezzi, University of Calabria, Italy and Paul Cassak, West Virginia University, USA
Session: September 15–19, 2025

Bridging the Gap: From Terrestrial to Icy Moons Cryospheres
Team Leaders: Ana-Catalina Plesa, DLR, Germany and Julia Kowalski, RWTH Aachen University, Germany
Session: October 6–10, 2025

"Genes from Space" – Leveraging Earth Observation Technologies to Monitor Essential Genetic Diversity
Team Leaders: Meredith C. Schuman and Claudia Röösli, University of Zurich, Switzerland
Session: January 20–24, 2025

Evolution of Turbulence in the Expanding Solar Wind
Team Leaders: Luca Sorriso-Valvo, KTH – Royal Institute of Technology, Stockholm, Sweden and Lina Hadid, Laboratoire de Physique des Plasmas, Palaiseau, France
Session: February 15–19, 2025

Jupiter's Non-Auroral Ionosphere
Team Leader: Tom Stallard, Northumbria University, UK
Session: September 15–19, 2025

A Multi-Mission Approach to Close the Gaps in Understanding of the Structure and Variability in the Mars Upper Atmosphere
Team Leader: Ed Thieman, University of Colorado at Boulder, USA
Session: January 13–17, 2025

The Thermal and Petrological History of Mercury's Heterogeneous Mantle
Team Leaders: Nicola Tosi, DLR, Berlin, Germany and Olivier Namur, KU Leuven, Belgium
Session: January 17–21, 2025

Tracking Plasma Flows in the Sun's Photosphere and Chromosphere: A Review & Community Guide
Team Leaders: Benoit Tremblay, National Solar Observatory, and Maria D. Kazachenko, University of Colorado, Boulder, USA
Session: July 7–11, 2025

International Teams

Teams selected in 2024

Satellite-Based Evaluation of Stratospheric Transport in Chemistry-Climate Models
Team Leader: Marta Ábalos Álvarez, Universidad Complutense de Madrid, Spain
Session: September 22–29, 2025

How does the emerging cosmic web shape the galactic baryon cycle?
Team Leaders: Yannick Michael Bahé, EPFL, Switzerland, and Allison Noble, Arizona State University, USA
Session: September 8–12 , 2025

Active Region Evolution Under the Spotlight, with Unprecedented Coordinated High-Resolution Stereoscopic Observations and Numerical Simulations
Team Leader: Krzysztof Barczynski, PMOD/WRC, Switzerland
Session: February 10–14, 2025

Multiphase Outflows in Galaxies at Cosmic Noon
Team Leaders: Sirio Belli, University of Bologna, Italy, and Rebecca Davies, Swinburne University of Technology, Australia
Session: March 24–28, 2025

EXploiting Precision AstroNomical Distance INdicators in the Gaia (EXPANDING) Universe (ISSI–ISSI Beijing Team)
Team Leader: Anupam Bhardwaj, Inter University Center for Astronomy and Astrophysics (IUCAA), Pune, India
Session: no meeting at ISSI in 2025

Small-scale eruptions in the Sun (ISSI-ISSI Beijing Team)
Team Leaders: Jie Chen, National Astronomical Observatories of China, China and Robertus Erdelyi, University of Sheffiled, UK
Session: no meeting at ISSI in 2025

Small-scale magnetic flux ropes under the microscope with Parker Solar Probe and Solar Orbiter
Team Leaders: Iulia Chifu and Maria Madjarska, Max Planck Institute for Solar System, Germany
Session: January 6–10, 2025

Understanding the Onset of Solar Eruptions
Team Leaders: Georgios Chintzoglou, Lockheed Martin Solar & Astrophysics Laboratory and Tibor Török (US)
Session: July 7–11, 2025

Opening new avenues in identifying coherent structures and transport barriers in the magnetised solar plasma
Team Leaders: Suzana de Souza e Almeida Silva and Viktor Fedun, University of Sheffield, UK
Session: June 30 – July 4, 2025

Energetic Particle Transport in Space Plasma Turbulence
Team Leaders: Frederic Effenberger, Ruhr-University Bochum, Germany and Eugene Engelbrecht, North West University, South Africa
Session: March 3–7, 2025

1-100 keV Electrons in the Earth's Magnetosphere: Unique and Unpredictable?
Team Leaders: Natalia Ganjushkina and Michael Liemohn, University of Michigan, USA
Session: July 21–25,2025

A First Peek at the Galactic Center with JWST
Team Leaders: Daryl Haggard, Mc Gill University, Canada and Sebastiano von Fellenberg, Max-Planck Insitute for Radio Astronomy, Germany
Session: June 30 – July 4, 2025

KHIWI: Kelvin-Helmholtz Instability Wave Investigation
Team Leader: Kyoung-Joo Hwang, Southwest Research Institute, USA
Session: no meeting at ISSI in 2025

Excitation and Dissipation of Kinetic-Scale Fluctuations in Space Plasmas
Team Leader: Kristopher Klein, University of Arizona, USA
Session: March 24–28, 2025

Physical Processes and Drivers of Particle Acceleration in the Heliospheric Tail As Seen Through ENAs and Interstellar Lyman-alpha Absorption
Team Leader: Marc Kornbleuth, Boston University, USA
Session: June 10–13, 2025

Advancing Titan's Atmospheric Chemistry Knowledge (ATACK)
Team Leaders: Panayotis Lavvas, Université de Reims Champagne-Ardenne, and Athena Coustenis, Paris-Meudon Observatory, France
Session: February 10–14, 2025

Multi-scale Understanding of Surface-Exosphere Connections (MUSEC)
Team Leaders: Liam Morrissey, Memorial University,

International Teams

Canada and Sébastien Verkercke, LATMOS/CNRS, Sorbonne Université, France
Session: February 24–28, 2025

The search for the most chemically and physically pristine material of the early Solar System
Team Leader: Raphael Marschall, Observatoire de la Côte d'Azur, France
Session: July 14–18, 2025

The Impact of Solar Flare Irradiance on the Earth's Ionosphere
Team Leaders: Ryan Milligan, Queen's University Belfast, UK, and Louise Harra, PMOD, World Radiation Center, Switzerland
Session: January 20–24, 2025

INFO-QBO: INvestigating the Feedback from Ozone in the Quasi-Biennial Oscillation
Team Leaders: Alison Donna Ming, University of Cambridge, UK, and Clara Orbe, NASA Goddard Institute for Space Studies, US
Session: March 31 – April 4, 2025

Climate Impacts of Stratospheric Water Vapour
Team Leaders: Felix Plöger and Christian Rolf, Forschungszentrum Jülich GmbH Germany
Session: May 19–23, 2025

The nature and fate of obscured massive galaxies: from the HST-dark galaxies to the JWST red dots
Team Leaders: Giulia Rodighiero, University of Padova, and Carlotta Gruppioni, INAF - Osservatorio Astronomico di Bologna, Italy
Session: February 17–21, 2025

What must we learn to make accurate space-weather predictions?
Team Leaders: Andrey Samsonov, University College London, UK, and Ute Amerstorfer, GeoSphere Austria
Session: May 12–16, 2025

Snow/Sea Ice Emission and Backscatter Modelling
Team Leaders: Melody Sandells, Northumbria University UK, and Christian Mätzler, University of Bern, Switzerland
Session: January 6–10, 2025

Bringing PASSAGEers together from around the world to solve the Epoch of Reionization
Team Leaders: Claudia Scarlata, University of Minnesota, USA and Matthew Hayes, Stockholm University, Sweden
Session: January 20–24, 2025

AsteroSHOP: large Spectroscopic surveys HOmogenisation Program
Team Leader: Guillaume Thomas, Instituto de Astrofísica de Canarias IAC, Spain
Session: February 3–7, 2025

Quantifying Space Weather Impacts caused by Extreme Solar Energetic Particle Events
Team Leaders: Simon Thomas, ESSP-SAS Spain and Stephanie Yardley, Northumbria University, UK
Session: June 30 – July 4, 2025

Magnetosheath structures as seen by spacecraft observations and numerical simulations
Team Leader: Martin Volwerk, Austrian Academy of Sciences, Austria
Session: March 10–14, 2025

Precipitation of Energetic Particles from Magnetosphere and Their Effects on the Atmosphere
Team Leaders: Dedong Wang, Deutsches GeoForschungs- Zentrum GFZ, Germany, and Chao Yu, Beijing University, China
Session: August 25–29, 2025

Multi-scale Variability in Solar and Stellar Magnetic Cycles
Team Leader: Teimuraz Zaqarashvili, University of Graz, Austria
Session: February 24–28, 2025

International Teams approved in 2025

Teams selected in 2025

The following listed Teams have been selected for implementation from the proposals received in response to the 2025 Call for International Teams:

Next-Generation Solar Flare Modelling: Bridging the multi-dimensional gap
Team Leaders: Joel Allred, NASA/GSFC, USA, and Malcolm Druett, University of Sheffield, UK
Session: 2–6 March 2026
Abstract: Understanding solar eruptions such as flares, jets, and coronal mass ejections is a central goal of space physics. New observations and advances in theory and computing now allow increasingly realistic modelling of flare processes, from global magnetic field evolution to particle acceleration and transport across vast spatial scales. While no single model captures the full multiscale complexity, several state-of-the-art codes describe complementary aspects of flare evolution. The Team systematically compares and validates leading flare models, including MPI AMRVAC, MURaM, Bifrost, and RADYN plus FP, using multi wavelength observations to test their predictions. By identifying key physical processes and methodological gaps, we aim to guide the development of next generation end-to-end flare models and strengthen the interpretation of new solar observations.

Impacts and Monitoring of Climate Change on the Middle and Upper Atmosphere
Team Leader: Juan Antonio Añel, Universidade de Vigo, Spain
Session: 14–18 September 2026
Abstract: The mounting evidence of climate change's impacts on the middle and upper atmosphere highlights the urgent need for observational data to monitor and understand these trends. In this regard, numerous critical scientific questions remain unanswered, emphasising the necessity for additional research and international cooperation in this area. Current challenges in satellite monitoring of the middle and upper atmosphere over the next decade are concerning, particularly owing to limited data series available for these layers. To address these issues, the goals of the Team are to advance the study of climate change in the middle and upper atmosphere, enhance data availability, and devise strategies for evaluating and monitoring climate change through satellite observations. The Team comprises a diverse group of international experts covering diverse atmospheric layers, including the stratosphere, thermosphere, and ionosphere, as well as aspects of space debris and Earth observation.

Unlocking the Mysteries of the Phaethon-Geminid System
Team Leaders: Karl Battams and Matthew Knight, United States Naval Academy, USA
Session: To be scheduled
Abstract: The Geminid meteor shower is one of the most intense annual showers, yet its origin remains puzzling. Unlike most showers linked to comets, its parent body, asteroid (3200) Phaethon, appears asteroidal in nature, raising questions about how the Phaethon–Geminid system formed and evolved. Recent heliophysics spacecraft observations have revealed new details of Phaethon's activity, including the first white-light detections of the Geminid stream core. Together with the upcoming JAXA DESTINY+ mission encounter in the early 2030s, these discoveries make a comprehensive reassessment timely. The Team gathers experts in heliophysics imaging, small bodies, meteoroid streams, and dust properties to synthesise recent advances, redefine key questions, and produce an authoritative, up to date study of the Phaethon–Geminid system.

Magnetospheric Cusps: Multiscale Plasma Dynamic and Energy Flows
Team Leaders: Yulia Bogdanova, STFC Rutherford Appleton Laboratory, UK, and Simon Wing, Johns Hopkins University Applied Physics Laboratory, USA
Session: 23–27 March 2026
Abstract: Earth's magnetospheric cusps are key entry points for solar wind plasma through magnetic reconnection, controlling energy and plasma transfer into the magnetosphere and ionosphere. Despite extensive study, important questions remain about their multiscale structure and variability. This project brings together experts in data analysis and modeling to investigate small- and medium-scale plasma fluctuations, longitudinal variability linked to reconnection geometry, and the impact of asymmetries in the magnetosheath and magnetosphere on energy transport. The Team uses coordinated observations from Cluster, THEMIS or MMS, and low-altitude missions such as DMSP and Swarm. The results will improve understanding of solar wind magnetosphere ionosphere coupling and help define science priorities for future missions including TRACERS, SMILE, and Bepi Colombo.

WAVE-GAP – Watching Atmospheric Variability Evolve in the Global Absence of Satellite Platforms
Team Leaders: Martina Bramberger, NCAR, USA, and Corwin Wright, University of Bath, UK
Session: May 11–15, 2026
Abstract: For the last twenty years we have been able to monitor stratospheric dynamics in extraordi-

nary detail, facilitated by an effective and comprehensive high-resolution global satellite measurement network. However, this network is aging and will likely be entirely gone by the late 2020s, with no current plans to replace it. This is a major problem for the continuing development of weather and climate models, an increasingly large fraction of which incorporate a resolved high-resolution stratosphere. While missions are currently under consideration by both NASA and ESA to fill this gap, they are yet to be approved and even if selected would not launch until the mid-2030s. In WAVE-GAP, the Team identifies and comprehensively assess a range of approaches to filling this data gap, including the use of lower-resolution satellites, ground-based and in-situ observations, dynamical modelling and ML/AI approaches. The researchers focus on the specific case of small-scale atmospheric gravity waves playing a key role in atmospheric dynamics, using these as a test bed to develop robust and adaptable solutions to the lack of observations. Building on this example, the Team further aims to produce broad recommendations which will be transferable to other atmospheric dynamical and chemical variables affected by the gap.

Energization Processes of the Ionospheric Plasmas across the Magnetosphere

Team Leader: Jeremy Dargent, École Polytechnique, France

Session: February 23–27, 2026

Abstract: The Team investigates how ionospheric plasma is energised as it travels through the magnetosphere. Magnetospheric plasma originates from both the solar wind and the ionosphere, but ionospheric plasma starts at much lower energies and is often below instrument detection thresholds despite its significant density. To understand its global evolution, the Team members combine large scale magnetohydrodynamic simulations with local kinetic studies and spacecraft observations. Global models will identify regions where significant heating is expected, while kinetic simulations and measurements will characterise the responsible processes. Our goal is to provide, for each major ionospheric plasma source, a comprehensive description of its transport and energisation throughout the magnetosphere.

The Origin of Multiple Populations in Globular Clusters

Team Leaders: Mark Gieles, ICREA & University of Barcelona, Spain, and Paolo Padoan, Dartmouth College & University of Barcelona, USA

Session: April 13–17, 2026

Abstract: Globular clusters (GCs) are dense stellar systems, with ages comparable to the age of the Universe, which are found in nearly all galaxies. Thanks to the revolutionary observations of the Hubble Space Telescope (HST) and follow-up spectroscopy from the ground, we discovered that most stars in GCs have anomalous abundances, in the form of increased helium abundances and variations in other light elements. These abundances are telltales of hydrogen burning at temperatures well in excess of the central temperatures of the stars themselves. All old GCs display these “multiple populations” (MPs), but they have remained elusive in young massive clusters and their origin is shrouded in mystery. A long-standing question that this proposal aims to address is: "What is the origin of these anomalous light-element abundances?" The Team investigates the scenario in which extremely massive stars (~10^3 solar masses) - that may have existed in GCs in the early Universe - polluted GCs during their formation. The novelty lies in the combination of hitherto disconnected approaches, using space- and ground-based observations, stellar evolution and nucleosynthesis calculations and direct modelling of GC formation. This project sheds light on the formation of GCs at high redshift and provide insights into fundamental problems in astrophysics, such as the stellar initial mass function (IMF) and star and galaxy formation at high redshift. Solving this problem now is timely given our ability to directly observe GC formation in the earliest phases of galaxy formation with the James Webb Space Telescope (JWST).

Global Inertial Modes: Bridging Solar and Stellar Physics

Team Leaders: Laurent Gizon, Max Planck Institute for Solar System Research, Germany, and Rhita-Maria Ouazzani, Observatoire de Paris, France

Session: October 5–9, 2026

Abstract: Recent advances in solar and stellar physics reveal that inertial modes, global oscillations driven by the Coriolis force, provide powerful probes of internal structure and rotation. In the Sun, long time series have identified rich spectra of inertial modes, including high latitude modes that help maintain the observed pole to equator temperature contrast. In intermediate mass stars, gravito-inertial and Rossby modes detected by Kepler constrain core rotation, stratification, and magnetic activity, while broader stellar samples show characteristic features linked to unresolved modes. These results establish inertial modes as key diagnostics of stellar interiors and convection. However, research in the solar and stellar communities has largely progressed separately. The Team unites experts from both fields to exchange methods, develop joint analyses, and

advance a unified understanding of inertial modes across stars.

Beryllium-10 for Earth and Solar Tracing (BEST)
Team Leaders: Kseniia Golubenko, University of Oulu, Finland, and Hella Wittmann, GFZ Potsdam, Germany
Session: January 26–30, 2026
Abstract: Beryllium-10 is produced by cosmic rays in the atmosphere and preserved in ice cores, sediments, and soils, making it a key proxy for past solar activity, cosmic ray flux, geomagnetic changes, and extreme solar events. However, interpreting Beryllium-10 records is challenging because atmospheric transport, stratospheric circulation, and climate variability also influence its deposition, introducing uncertainties in reconstructions of solar cycles and extreme solar energetic particle events. The Team combines expertise in solar physics, atmospheric science, and isotope geochemistry to refine Beryllium-10 as a quantitative solar proxy. By integrating high resolution records with advanced atmospheric transport models, we will reassess known extreme events such as those in 774 CE and 993 CE and search for previously unidentified events. The project aims to improve reconstructions of past solar variability and better constrain the risks of future extreme solar activity.

Effects of the Star-Forming Environment on Low-Mass Star Formation and Early Stellar Evolution
Team Leader: Mario Guarcello, INAF, Italy
Session: March 9–13, 2026
Abstract: Star formation occurs in a wide variety of environments. The understanding of star formation in the solar neighbourhood is biased toward low-mass star-forming regions (typically hosting a few hundred to a few thousand members) with solar metallicity (i.e., an abundance of chemical elements heavier than hydrogen and helium similar to that of the Sun). This is unfortunate, as a significant fraction of stars form in massive star-forming regions, which host rich populations of massive stars. These stars regulate the formation of low-mass stars and their planets through their intense high-energy radiation and stellar winds. As a result, the outcomes of the star formation process and the early stellar evolution in massive environments can differ from those in low-mass regions. Additionally, the metallicity of the star-forming region is expected to play a crucial role. Exploring star formation at low metallicity is particularly important, as it provides insights into the products of star formation in the early epochs of cosmic evolution when metallicity was low and star formation was especially intense. The project aims to fully exploit the capabilities of the James Webb Space Telescope to determine the efficiency of very low-mass star formation and their early evolution in the most massive young stellar clusters in the Milky Way, as well as in low-metallicity environments in the Magellanic Clouds. The exceptional performance of JWST is essential, as both massive and low-metallicity star-forming environments are located at large distances from us and are typically affected by significant interstellar extinction (especially the former).

Beyond Diffusion: Advancing Earth's Radiation Belt Models with Nonlinear Dynamics
Team Leaders: Miroslav Hanzelka, GFZ Helmholtz Centre for Geosciences, Germany, and Oliver Allanson, University of Birmingham, UK
Session: November 3–7, 2025
Abstract: Advances in plasma theory during the 1950s and 1960s led to the development of comprehensive models of Earth's radiation belts capable of describing and forecasting many observational phenomena. These early models, developed with sparse and technically limited wave and particle measurements, were based on quasi-linear theory, treating particle transport as purely diffusive. However, recent high-fidelity spacecraft data (collected by Cluster, THEMIS, Van Allen Probes, Arase, MMS, SAMPEX, POES, GPS, CubeSat missions, and others) have repeatedly challenged this modelling approach, revealing discrepancies that highlight the need to incorporate non-diffusive irreversible processes that take place on small timescales. Addressing these gaps requires tackling fundamental questions on nonlinear particle acceleration, transport, and loss. These advancements are critical not only for improving model accuracy but also for addressing societally important challenges, including forecasting radiation hazards in the near-Earth space environment and understanding the impact of energetic particle loss on the atmosphere. This project brings together a diverse team of leading international experts to: (i) unify current knowledge of relativistic particle dynamics in the radiation belts; (ii) investigate key processes beyond classical diffusion, such as radial advection and nonlinear wave-driven acceleration; and (iii) provide recommendations for future spacecraft missions to enable critical breakthroughs in radiation belt research.

Maximising Science from Solar Orbiter's Solar Flare Campaigns
Team Leaders: Laura Hayes, Dublin Institute for Advanced Studies, Ireland, and Hannah Collier, FHNW, Switzerland
Session: April 20–24, 2026
Abstract: Solar Orbiter's Major Flare Solar Orbiter Observing Plan (SOOP) campaign has provided

unprecedented datasets to investigate how solar flares release energy, accelerate particles, and heat plasma in the solar atmosphere. Successfully conducted in 2024, capturing over 22 flares, and with another campaign planned for 2025, these observations captured high-cadence, high-resolution flare data resolving rapid plasma evolution on fine spatial and temporal scales. The campaign leveraged extreme ultraviolet (EUV) imaging from the High-Resolution Imager (HRIEUV) on the Extreme-Ultraviolet Imager, which operated in short-exposure mode to provide 2-second-cadence, non-saturated EUV flare observations, offering an unparalleled view of flare ribbons and loop dynamics. Simultaneously, hard X-ray imaging spectroscopy from STIX provided continuous measurements of flare energy release and particle acceleration, enabling a multi-wavelength investigation of energy transport and reconnection processes. Additionally, SPICE captured spectroscopic flare plasma observations at multiple temperatures in selected events, further constraining energy deposition and the atmospheric response. This Team brings together an international group of experts to fully exploit these datasets, with three key aims: (1) develop optimised data analysis techniques and create community resources, including catalogues, pre-processed datasets, and documentation; (2) analyse high-cadence Solar Orbiter observations of flare ribbons and loop dynamics to investigate energy transport; (3) and refine observing strategies for future Solar Orbiter campaigns and next-generation missions like MUSE and Solar-C. By combining observational data-driven analysis and strategic planning, this team will maximise the scientific return of Solar Orbiter's major flare campaigns, and address fundamental questions about how flares release energy, accelerate particles, and heat plasma in the solar atmosphere.

Lights on Formation and Evolution of the Outermost Solar System

Team Leader: Daniel Hestroffer, Observatoire de Paris, France

Session: February 16–20, 2026

Abstract: Small bodies beyond Neptune – from Trans-Neptunian Objects to the Oort cloud – trace the formation and dynamical evolution of the outer Solar System. Their orbits reflect the combined influence of giant planets, stellar encounters, and the Galactic potential as the Solar System moves through the Milky Way. The Team aims to quantify how this stellar and galactic environment has shaped the Outermost Solar System over 4.5 Gyr. By combining new observational constraints (including Gaia and forthcoming Rubin/LSST surveys) with dedicated N-body simulations, we will model the long-term evolution of distant small bodies and compare predictions with observed orbital distributions. This interdisciplinary effort will provide new constraints on the Solar System's birth environment and on the formation and structure of the Oort cloud.

The Contribution of Auroral Precipitation to Ozone Changes in the Middle Atmosphere

Team Leaders: Allison Jaynes, University of Iowa, USA, and Lynn Harvey, LASP University of Colorado, USA

Session: March 23–27, 2026

Abstract: Energetic auroral precipitation, particularly from pulsating aurora, produces nitric oxides (NOx) in the mesosphere and lower thermosphere. During polar night, NOx can descend into the stratosphere – enhanced by the polar vortex and modulated by planetary waves – where it catalytically destroys ozone, sometimes causing months-long depletion after a single strong event. However, the overlap between regional auroral NOx sources, planetary wave structure, and vortex dynamics remains poorly quantified. Current models underestimate NOx production and transport, although high-resolution WACCM-X simulations show that resolved gravity waves significantly enhance descent. Coarse-resolution models still miss this effect, limiting our understanding of Sun–Earth coupling. The project aims to determine how the atmospheric state controls the impact of energetic electron precipitation on ozone and middle-atmosphere chemistry.

Beyond What Our Eyes Can See: A New Era of Mesoscale M-I Coupling

Team Leaders: Larry Kepko, NASA, USA, and Sara Gasparini, University of Bergen, Norway

Session: February 2–6, 2026

Abstract: Earth's magnetosphere couples to the ionosphere through field-aligned currents (FACs) and particle precipitation, shaping ionospheric conductivity and dynamics. While large-scale current systems are well known, mesoscale structures (tens to hundreds of kilometres, minutes in duration) remain poorly understood owing to observational limitations. The new EZIE mission will provide 2D maps of ionospheric currents, revealing the temporal evolution of mesoscale systems, but lacks in-situ measurements. Conversely, Swarm delivers precise FAC and convection data without the broader context of imaging. Combined with new high-resolution ground-based datasets (e.g., SuperDARN, TREx) and data-assimilation tools such as Lompe, there is now an unprecedented opportunity to resolve mesoscale auroral electrodynamics. The Team integrates space- and ground-based observations to advance under-

standing of mesoscale magnetosphere–ionosphere coupling.

Structure and Composition of Planetary Cores and Mantles
Team Leaders: Amir Khan and Paolo Sossi, ETH Zurich, Switzerland
Session: February 23–27, 2026
Abstract: The structure and composition of planetary crusts, mantles, and cores provide key insights into their thermal state, chemistry, origin, and evolution. Recent advances, including improved seismic models suggesting a denser Earth outer core, machine-learning approaches to interior properties, and more precise laboratory measurements, offer new opportunities to refine models of terrestrial planet interiors, from Earth and Mars to the Moon and Vesta. The Team combines seismology, geophysics, mineral physics, and geo- and cosmochemistry to better constrain the structure and formation of rocky planets. Using data from ground- and space-based missions (e.g., LAGEOS, InSight, Apollo), the results will also support upcoming missions such as Bepi-Colombo and the lunar Farside Seismic Suite, with implications extending to exoplanetary systems.

Deciphering Radiation Belt Drift Phase Structures
Team Leader: Solene Lejosne, University of California Berkeley, USA
Session: March 16–20, 2026
Abstract: Drift phase structures appear as organised peaks and valleys in radiation belt spectrograms and are now recognised as a common feature of planetary radiation belts. Although they are generally linked to radial transport, their origin remains debated. They may result from impulsive electric field perturbations, producing drift echoes, or from drift resonance with ultra-low-frequency waves. The relative importance and efficiency of these mechanisms are still unclear, as is their overall impact on global radiation belt dynamics. This project combines satellite observations with theoretical and numerical modelling to determine the dominant generation processes of drift phase structures. The researchers also quantify their role in radiation belt acceleration and validate model results against observations to improve current radiation belt paradigms.

Thermonuclear X-ray Bursts: From Simulations to Multi-Wavelength Observations
Team Leaders: Zhaosheng Li, Xiangtan University, China, and Duncan Galloway, Monash University, Australia
Session: To be scheduled
Abstract: Thermonuclear X-ray bursts result from unstable nuclear burning of material accreted onto a neutron star from a companion via Roche lobe overflow. Renewed interest in these events is driven by new multi wavelength observations, discoveries of previously unknown burst behaviour, and data from recent missions such as NICER, Insight-HXMT, and NinjaSat. Different burning regimes produce short bursts, intermediate-duration bursts, and superbursts. Studying these events probes nuclear reaction physics and constrains neutron star masses, radii, and the equation of state. This project integrates multi wavelength observations, laboratory experiments, and numerical simulations to understand burst mechanisms, burst disk interactions, and their connection to jet production.

Understanding Nuclear Spin Temperatures in Astronomical Environments
Team Leaders: Manuela Lippi, INAF, Italy, and Geronimo Villanueva, NASA Goddard Space Flight Center, USA
Session: February 9–13, 2026
Abstract: The relative abundance of nuclear spin configurations in multi-hydrogenated molecules such as H_2O, H_2, H_2CO, and NH_3 depends on formation temperature. Because spin states cannot easily change after formation, spin ratios have long been used as cosmogonic thermometers to infer formation conditions in the interstellar medium, protoplanetary disks, and comets. However, growing observational datasets and improved modelling have revealed discrepancies that question the reliability of spin temperatures. Nuclear spin conversion may occur in some environments, such as cometary comae or during ice processing in disks and the interstellar medium. The Team updates the spin temperature datasets, incorporate recent results including JWST observations, reassess laboratory and theoretical constraints, and clarify how spin ratios should be interpreted in the context of planet formation.

Maximizing the Potential of X-ray Polarimetric Data to Understand Accreting Black Holes
Team Leaders: Honghui Liu, University of Tübingen, Germany
Session: April 20–24, 2026
Abstract: Accreting black holes emit radiation across the electromagnetic spectrum, with X-rays arising from the innermost regions near the event horizon. X-ray spectroscopy and timing have greatly advanced our understanding of accretion processes, but model degeneracies and uncertain emission geometries limit our ability to answer key questions, such as the distribution of black hole spins. The

launch of IXPE in 2021 reopened the X-ray polarimetry window, providing geometry-sensitive measurements that can break these degeneracies. While IXPE has already delivered important results for accreting black holes, a comprehensive framework integrating spectral, timing, and polarimetric data is still missing. This Team develops such a synergy framework and addresses new puzzles raised by IXPE, combining expertise in observations, theory, modelling, and simulations.

Multiscale Investigation of Kinetic Processes Governing Solar Wind Evolution

Team Leaders: Mihailo Martinovic, University of Arizona, USA, and Rodrigo Lopez, Research Center in the Intersection of Plasma Physics, Matter, and Complexity (P2mc), Chile

Session: July 6–10, 2026

Abstract: The solar wind is a natural laboratory for space plasma physics. In-situ measurements show that nonthermal features in particle velocity distribution functions, such as ion beams, are shaped by wave-particle interactions that drive the plasma toward quasi-steady non-equilibrium states. While linear, quasi-linear, and nonlinear theories describe many relevant processes, their relative importance in the evolving solar wind remains poorly constrained by observations. With high-resolution data from Parker Solar Probe and Solar Orbiter, including the former's closest perihelion at 9.5 solar radii, we can now test these theories in the young solar wind. This project will unite experts in theory, simulations, and observations to determine how multiscale plasma models can explain solar wind evolution. The Team compares proton and alpha particle populations with linear and quasi-linear predictions, and use particles in cell and hybrid simulations to link small-scale kinetics with large-scale expansion effects, advancing multiscale models of the inner heliosphere.

Relationship between the Atlantic Meridional Overturning Circulation and Coastal Sea Level: New Insights from Next-Generation Satellite Observations

Team Leaders: Christopher Piecuch, Woods Hole Oceanographic Institution, USA, and Julius Oelsmann, Tulane University, USA

Session: January 19–23, 2026

Abstract: Changes in the Atlantic meridional overturning circulation (AMOC) and sea level are major risks of global warming. A weakened AMOC could alter heat transport, storms, rainfall, and temperatures, while sea level rise threatens coasts. Because ocean circulation and sea level are closely linked, understanding their past relationship is essential for reliable future projections. Models suggest the AMOC may decline or even collapse this century, enhancing sea level rise along North Atlantic coasts. However, direct AMOC observations are short and sparse, leaving no robust benchmark to evaluate historical simulations and future projections. The Team combines observations, modelling, and theory to clarify the AMOC-sea level link and assess how satellite sea level data can improve ocean monitoring. This timely effort helps constrain past AMOC changes and refine projections of climate impacts.

Impact of Solar Energetic Particles on Mars: Enhancing Space Weather Insights for Future Exploration

Team Leaders: Marco Pinto, Laboratory fo Instrumentation and Experimental Particle Physics, Portugal, and Laura Rodríguez-García, European Space Agency, Spain

Session: July 6–10, 2026

Abstract: Solar energetic particles (SEPs) are intense bursts of protons, electrons, and ions accelerated in solar flares and coronal mass ejection shocks, reaching energies up to GeV. They pose serious risks to space exploration by damaging electronics, endangering astronauts, and disrupting planetary atmospheres. At Mars, SEPs can trigger global auroras and cause prolonged radio blackouts, threatening communication for future robotic and crewed missions. The mechanisms driving these disruptions, especially the role of different particle populations, remain unclear. The investigates how SEPs are accelerated and propagate from the Sun to Mars, and how they affect the Martian atmosphere and ionosphere. By combining expertise in particle physics, atmospheric science, instrumentation, and modelling, the Team aims to assess SEP impacts and improve space weather preparedness for Mars exploration.

Impact of Stellar Wind Plasma Turbulence on Planetary Magnetospheres in the Heliosphere and Beyond

Team Leaders: Francesco Pucci, CNR-ISTP, Italy, and Giulia Cozzani, LPC2E, CNRS, France

Session: July 6–10, 2026

Abstract: The heliosphere contains the turbulent solar wind, a plasma flow shaped by the Sun's magnetic field. Turbulence plays a central role in energy dissipation, magnetic reconnection, particle acceleration, and shock dynamics. Yet, most global simulations of solar wind–planet interactions still treat the solar wind as laminar, despite clear observational evidence of its turbulent nature. A new 3D global kinetic code, Menura, now enables realistic simulations of the turbulent solar wind interacting

with planetary magnetospheres. The Team combines such simulations with spacecraft observations to investigate how turbulence affects bow shocks, foreshock and magnetosheath regions, and overall magnetospheric dynamics in the Solar System and beyond. The project aims to constrain the role of turbulence in wind–planet interactions and advance both planetary and exoplanetary research.

Why Does the Geomagnetic Response to the Solar Wind Saturate?
Team Leaders: Nithin Sivadas, Catholic University of America, USA, and Maria-Theresia Walach, Lancaster University, UK
Session: April 27 – May 2, 2026
Abstract: Geomagnetic indices, used to quantify solar-wind-driven geomagnetic activity, appear to saturate during extreme solar wind conditions. The cause of this nonlinear response is unclear and may reflect uncertainties in solar wind measurements rather than true physical saturation. If so, the geomagnetic impact of extreme space weather events could be underestimated. As solar maximum approaches and the likelihood of severe storms increases, the Team focuses on two key questions: what drives the observed nonlinear geomagnetic response, and how does geomagnetic activity respond to extreme solar wind parameters? By analysing a comprehensive database of solar wind data and geomagnetic indices, the researchers determine whether the apparent saturation is real or a statistical artifact. This work will improve understanding of extreme space weather and strengthen preparedness for future geomagnetic storms.

Precision Cosmology from ESA/Euclid Data Release 1
Team Leader: Alessio Spurio Mancini, Royal Holloway University of London, UK
Session: January 19–22, 2026
Abstract: Euclid is ESA's flagship cosmology mission, launched in 2023 to map the distances, shapes, and positions of 1.5 billion galaxies over the past 10 billion years. A cornerstone of its science programme is the joint analysis of weak lensing and photometric galaxy clustering, known as the 3x2pt method, which enables precise tests of the standard cosmological model. To fully exploit Euclid Data Release 1, advanced modelling of systematics and improved inference methods are required. This project unites experts in data analysis, theory, statistics, and machine learning to develop optimised tools for the 3x2pt analysis. The initiative delivers high-impact publications, open software, and robust methodologies for future large scale surveys, maximising the scientific return of Euclid and strengthening the cosmology community.

The Superhalo Enigma: Characterising Energetic Electrons in the Inner Heliosphere
Team Leader: Domenico Trotta, European Space Agency ESAC
Session: July 13–17, 2026
Abstract: Collisionless plasmas throughout the Universe contain suprathermal particle populations that extend beyond the thermal distribution. In the solar wind, electrons form four populations: a thermal core, an isotropic halo, a field aligned strahl up to about 2 keV, and a persistent higher-energy superhalo above about 2 keV whose origin remains unknown. Understanding the superhalo is key to explaining how electrons are injected into suprathermal energies and prepared for further acceleration. With new high-resolution measurements from Solar Orbiter, complemented by Parker Solar Probe and missions at 1 AU such as Wind and STEREO, we can now investigate this population in unprecedented detail. The Team combines observations and modelling to determine the origin of the electron superhalo and its evolution from the Sun to 1 AU.

Polarimetric Insights into Extreme Magnetism
Team Leaders: Sergey Tsygankov, University of Turku, Finland, and Roberto Taverna, University of Padova, Italy
Session: February 9–13, 2026
Abstract: Neutron stars are natural laboratories for extreme physics, where accretion, radiation, and strong magnetic fields interact. X-ray polarimetry was expected to clarify emission mechanisms and geometry, but recent observations from IXPE have revealed unexpected complexities that challenge current models. A major open issue is how to properly include quantum electrodynamics effects and radiation propagation in models of magnetar and X-ray pulsar atmospheres, where different approaches remain in disagreement. With next-generation X-ray polarimeters such as eXTP planned within the next five years, it is crucial to establish a robust theoretical and observational framework. This effort will help resolve current discrepancies and ensure accurate interpretation of future polarimetric data.

Flare Ribbon Fine-Structure: Where Does It Come From and What Can It Tell Us?
Team Leaders: Peter Wyper, Durham University, UK, and Joel Dahlin, University of Maryland, USA
Session: May 11–15, 2026
Abstract: Flare ribbons are chromospheric brightenings produced by energy deposition from particles accelerated during magnetic reconnection in solar flares. They display complex fine-scale structures that may provide key diagnostics of the reconnec-

tion process, yet their origin and interpretation remain unclear. This Team – combining observers and modellers – systematically characterises ribbon fine structure, assesses how well current models reproduce it, and determine what it reveals about coronal reconnection and energy release. The Team also defines new observational and modelling strategies to advance the field. This effort is timely given new high-resolution datasets from ground-based and space missions and increasingly realistic flare simulations that now reproduce ribbon fine structure.

Little Red Dots, Big Open Questions: Unravelling the Mystery of the James Webb Space Telescope's Most Debated Discovery
Team Leaders: Mengyuan Xiao, University of Geneva, Switzerland, and Rohan Naidu, MIT, USA
Session: February 2–6, 2026
Abstract: The James Webb Space Telescope (JWST) has revealed a population of compact, red high-redshift sources known as Little Red Dots. These objects show broad Balmer lines, unusual V-shaped spectral energy distributions, and diverse properties that defy clear classification. They may represent the earliest growing black holes or extremely compact, massive galaxies, but no consensus has yet emerged. The Team combines multiwavelength observations, theoretical modelling, and JWST expertise to determine the nature of these sources. Using JWST archival data, dedicated programmes, and complementary observations from ALMA and Chandra, the researchers characterise their emission, environments, and possible active galactic nucleus signatures. Through focused meetings, the Team develops new analysis methods and refines models to clarify the role of Little Red Dots in early galaxy evolution and black hole growth.

What Are the Spins of Stellar-Mass Black Holes?
Team Leaders: Andrzej Zdziarski, Nicolaus Copernicus Astronomical Center, Poland, and Alexandra Veledina, University of Turku, Finland
Session: April 13–17, 2026
Abstract: Black holes are defined by mass, charge, and spin, with spin ranging from zero to maximal rotation. Recent observations reveal a striking discrepancy: black holes in merging binaries detected by LIGO Virgo typically have low spins around 0.1, while those in accreting X-ray binaries often show high spins above 0.7, with many near maximal rotation. This tension challenges current models of black hole formation and evolution. The Team investigates three possible explanations: different formation channels for merging and accreting systems, systematic biases in X-ray spin measurements, and spin up through accretion during binary evolution. By bringing together experts in black hole formation, binary evolution, and accretion physics, the researchers analyse recent multi messenger data and refine theoretical models to establish reliable benchmarks for black hole spin estimates.

Johannes Geiss Fellow Ben Poulter

Watching a Warming World: A Portrait of Johannes Geiss Fellow Ben Poulter

Watch the full interview with Ben Poulter and explore other discussions with leading scientists on ISSIcast: https://www.issibern.ch/outreach/issicast/

ISSI has named Ben Poulter as the Johannes Geiss Fellow 2025, recognising his long-standing contributions to Earth system science, remote sensing, and climate policy at the interface of science and society.

Currently a senior scientist at Spark Climate Solutions, Ben traces his fascination with space science back to his early work in botany and field research. Observing first-hand how humans were altering natural landscapes, he became interested in accessing long-term records of environmental change, a path that led him to satellite remote sensing. He recalls purchasing a single Landsat image during his PhD for USD 550, a stark contrast to today's open access to decades of global satellite observations stretching back to the 1970s.

During his fellowship at ISSI, Poulter is using the opportunity to step back from day-to-day research and focus on a pressing and relatively under-explored topic: climate overshoot. Overshoot refers to the period during which global temperatures temporarily exceed the 1.5 °C or 2 °C warming thresholds, a scenario for which observation strategies remain poorly defined. Poulter is exploring pilot studies and use cases to assess how current Earth-observing satellite architectures perform under these conditions and how they can inform the design of future missions better suited to monitoring a rapidly changing planet.

Identifying as both a space scientist and an Earth scientist, Poulter emphasises the deep connections between planetary science and climate research. "We live in space on planet Earth," he notes, highlighting how understanding Earth's systems can also inform the search for life elsewhere in the Universe. While he relies heavily on computer modelling and satellite data analysis, Poulter also stresses the continued importance of human interpretation, arguing that the human eye still plays a critical role in recognising complex patterns across space and time.

The Johannes Geiss Fellowship (JGF) is established to attract to ISSI – for limited duration visits – international scientists of stature, who can make demonstrable contributions to the ISSI mission and increase ISSI's stature by their presence and by doing so will honour Johannes Geiss for his founding of ISSI and his contributions to ISSI, and for his many contributions to a broad range of space science disciplines.

A particular focus of his work is methane, a greenhouse gas responsible for roughly 30% of observed warming to date. Poulter describes methane as both intellectually challenging and politically significant: its complex sources and sinks make it difficult to model, yet reducing methane emissions offers one of the most effective short-term levers for slowing climate change.

Throughout the ISSIcast interview, Poulter returns to a clear message of cautious optimism. He challenges the misconception that humans lack the ability to change the course of climate change, pointing instead to the wealth of tools, data, and knowledge generated through satellite missions and modelling. He also underscores the responsibility of scientists to engage with the public and policymakers, helping translate scientific understanding into informed decisions that can support a safer and more stable climate.

Reflecting on his time in Bern, Poulter describes ISSI as a warm and welcoming environment that fosters open, interdisciplinary collaboration, complemented by the city's riverside walks, alpine landscapes, and Swiss culinary traditions. For him, the fellowship is as much about scientific reflection as it is about reconnecting with the broader purpose of Earth observation science in a changing world.

Fabio Crameri

Visiting Scientists

The ISSI Visiting Scientist programme enables short-duration visits to ISSI to conduct research based on data from space-based observatories or space missions. The programme is open to all scientists, regardless of career stage, nationality or institutional affiliation. In exceptional cases, applications from small groups of two to a maximum of three individuals wishing to meet at ISSI to pursue collaborative work in Space Science or Earth observation may be considered. Applications can be submitted four times a year (March 1, June 1, September 1, December 1). They are evaluated by the ISSI directorate with a short turn-around. The results of this research are to be published as books or in major scientific journals, with appropriate acknowledgment to ISSI.

The following Visiting Scientists have worked at ISSI in the course of the 30th year:

Ghassem Asrar, University of Maryland, USA, working periods: 7.-24.4.2025 and 10.-22.6.2025

Stuart Bale, University of California Berkeley, USA, working period: 23.6.-21.7.2025

Alina Bent, University of Warwick, UK, working period: 15.-19.9.2025

Sandra Chapman, University of Warwick, UK, working period: 15.-19.9.2025

Jianli Chen, University of Texas at Austin, USA, working period: 2.6.-31.7.2025

Angela Dapremont, Johns Hopkins University, USA, working period: 18.6.-9.7.2025

Jan Docekal, Silesian University Opava, Czechia, working period: 24.-28. 2.2025

Duncan Galloway, Monash University, Melbourne, Australia, working period: 7.-24.1.2025

Eric Gaidos, University of Hawaii, USA, working period: 13.-24.10.2025

Federico Gasperini, University of Colorado Boulder, USA, working period: 30.6.-11.7.2025

Thomas Henning, Max-Planck-Institut für Astronomie, Germany, working period: 1.-6.6.2025

Raluca Ilie, University of Illinois, USA, working periods: 7.-23.1.2025, 10.-26.2.2025 and 7.-25.4.2025

Jay Johnson, Andrews University, USA, working periods: 3.-14.6.2025 and 13.-17.10.2025

Connan Liptrott, University of Warwick, UK, working period: 15.-19.9.2025

Maria Madjarska, MPI for Solar System, Germany, working period: 16.-22.11.2025

Ben Poulter, Johannes Geiss Fellow, working periods: 22.2.-7.3.2025, 14.7.-8.8.2025, 24.9.-12.10.2025 and 2.-5.12.2025

Ivano Saccheo, University of Bristol, UK, working period: 10.-21.3.2025

Jan Schee, Silesian University Opava, Czechia, working period: 24.-28. 2.2025

Juri Skorov, Max Planck Institute for Solar System Research, Germany, working period: 24.7.-15.8.2025

Nicolas Watkins, University of Warwick, UK, working period: 15.-19.9.2025

Simon Wing, Johns Hopkins University, working periods: 3.-14.6.2025 and 13.-17.10.2025

Game Changers Online Seminars

Starting in the summer of 2020, the International Space Science Institute has organised the weekly on-line seminar series called "Game Changers". After six series of weekly talks on the different themes, the webinar series continues on a monthly basis.

ISSI has continued its series of webinar talks that have become known as the **Game Changers Online Seminars** with speakers from all over the world.
The webinars were recorded and are available at www.issibern.ch where upcoming talks are also advertised. Between roughly 100 and 200 participants have attended the live webinars, many as loyal participants throughout the series.

Star Clusters Near and Far: The little sparks that trace galaxy evolution through cosmic time
with Angela Adamo (Johns Hopkins University, USA) – 30 January 2025

How Waves and Turbulence Heat the Solar Corona and Accelerate the Solar Win
with Ben Chandran – 27 February 2025

Physics of Dust in the Inner Heliosphere
with Ingrid Mann (UiT Arctic University of Norway) – 27 March 2025

The Cosmic Origin of Gold (and more)
with Stephan Rosswog (Hamburg Observatory, Germany) – 26 June 2025

Opal 10-Year Anniversary
with Mike Wong (University of California, USA) – 25 September 2025

Earth Observations in the Era of Climate Overshoot: A Framework for Monitoring Novel Earth System Responses
with Ben Poulter (Spark Climate Solutions, USA) – 16 October 2025

The Local Distance Network to measure the Hubble Constant at ~1% precision Online Panel Discussion
with Stefano Casertano, Richard I. Anderson, Eleonora Di Valentino, Adam Riess and Licia Verde – 11 December 2025

Public Science Events

In 2025, ISSI continued to strengthen its commitment to public engagement by organising and supporting a series of outreach events that brought leading scientists and cutting-edge space research to a broad audience in Bern.

The Surprising Expansion History of the Universe

A highlight early in the year was the public lecture "The Surprising Expansion History of the Universe" delivered on March 25 by Nobel Laureate Adam Riess. The talk took place at the University of Bern and attracted a large audience of students, researchers, and members of the public eager to learn about one of modern cosmology's greatest discoveries: the accelerating expansion of the Universe. Riess, whose work with supernova observations led to the discovery of dark energy and the 2011 Nobel Prize in Physics, was visiting ISSI as co-convener of the workshop "What's under the H0od? Towards Consensus on the Local Value of the Hubble Constant". During his lecture he addressed fundamental questions about the expansion of the Universe and the ongoing efforts to understand the so-called "Hubble tension", captivating the audience with accessible explanations of complex cosmological ideas.

The Next 30 Years from the Discovery of the First Exoplanet

Another major outreach highlight took place on June 19 with the special event "The Next 30 Years from the Discovery of the First Exoplanet". The year 1995 marked both the founding of ISSI and the discovery of 51 Pegasi b, the first exoplanet detected orbiting a Sun-like star, a discovery that transformed our understanding of planetary systems. To celebrate this milestone and look ahead to the future of exoplanet science, ISSI hosted a public evening of talks and a panel discussion at the University of Bern. The event brought together leading figures in the field, including Michel Mayor, Didier Queloz, Sara Seager, Jonathan Lunine, Laura Kreidberg, Doug Lin, and Carole Mundell, with Thomas Zurbuchen moderating the discussion and Willy Benz serving as master of ceremonies. Together they explored how the field has evolved since its beginnings and discussed the prospects for discovering potentially habitable worlds and signs of life beyond the Solar System.

Astronomy on Tap

ISSI also expanded its outreach portfolio by supporting and co-organising the popular Astronomy on Tap events in Bern. These informal evenings,

Photo of the panel discussion on the special event "the next 30 years"

held in a relaxed bar setting, bring scientists and the public together through short talks, quizzes, and lively discussions. In November 2025 the first Astronomy on Tap × ISSI event filled the Stellwerk venue with nearly one hundred attendees. Speakers included Shadia Rifai Habbal (University of Hawai'i at Mānoa), Lucia Kleint and André Galli (both University of Bern), who presented engaging talks on solar eclipses, solar flares, and the structure of the heliosphere. The evening combined cutting-edge heliophysics with a welcoming atmosphere that encouraged conversation between researchers, students, and the wider public. By supporting this initiative, ISSI helped bring frontier space science "from the research bench to the bar table," reaching audiences beyond traditional academic venues.

Together, these events illustrate ISSI's ongoing commitment to connecting world-class space science with society. From Nobel-level discoveries in cosmology to discussions about the future of exoplanet exploration and informal conversations about our Sun and heliosphere, ISSI's public activities in 2025 offered multiple entry points for the public to engage with the excitement of modern space research.

Fabio Crameri

Financial Overview

The 30th financial year of ISSI resulted in a significant step toward the introduction of a full cost accounting approach. Under this framework, only costs attributable to scientific activities carried out within the year are recognised, while those relating to subsequent periods are not considered.

As a result of this transition, a temporary positive effect on the financial outcome has emerged, reflecting timing differences in cost recognition. This effect is expected to unwind gradually as the new accounting approach becomes fully established. The first measures of this transition, implemented in 2025, included balance sheet adjustments that impacted the total costs of scientific activities.

On the revenue side the contributions from ESA (Basic Activities) and from the Swiss Confederation (State Secretariat for Education, Research and Innovation SERI and Swiss Academy of Natural Sciences SCNAT) are gratefully acknowledged, as is the contribution from our Japanese partner, JAXA/ISAS.

In addition to the direct contributions listed here it is important to note that ISSI also receives indirect contributions that do not appear in the table below: One of the directors is employed directly by the University of Bern, and ISSI also benefits from valuable in-kind support provided by the University of Bern, including services and maintenance, as well as access to internet and high-performance computing facilities.

Sesil Ayri and Antonella Nota

Statement of Operations (in CHF) for the 30th Financial Year (1.1.2025-31.12.2025)

	Expenses	Revenues
ESA Contribution		1'594'001.20
Swiss Confederation		1'467'050.00
Swiss Academy of Sciences (SCNAT)		225'000.00
ISSI Partners: ISAS/JAXA		23'535.00
Salaries and related costs [1]	1'201'194.54	
Fixed costs	363'346.55	
Operating costs [2]	355'248.83	
Workshops, Working Groups, Teams, Visitors [3]	680'534.34	
Investment (depreciated)	63'106.22	
Other income or cost [4]	50'346.61	572'088.75
Result of the year	1'167'897.86	
Total	**3'881'674.95**	**3'881'674.95**

Remarks:

[1] **Salaries**: It should be noted that the majority of the ISSI staff members (including directors) are scientists actively conducting research as well as taking care of organisational, editorial, and administrative tasks.

[2] **Operating costs** include repair and maintenance, insurance, supplies, administration, and public relations.

[3] **Workshops, etc.** also include the balance from income and expenses of guest apartments.

[4] **Other income** includes extraordinary income, interest income, and exchange gain or loss.

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The list shows the status at the end of the 30th business year on 31 December 2025.

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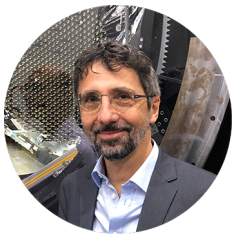

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The list shows the status at the end of the 30th business year on 31 December 2025.

The Universe on Our Wall: ISSI's Mural Brings Space Science to Life

The mural has become a popular photo spot for our visitors for group pictures

ISSI's common area gained a striking new centrepiece in 2025 with the creation of a large, wall-sized space science mural, hand-painted by Cosima-Lea Baier and Fabio Crameri. Stretching across one entire common-area wall, the mural features an impressive array of space wonders, including a three-dimensionally sculpted Earth and Moon that physically protrude from the surface, a swirling galaxy, Jupiter's stormy face, a black hole, an Earth observation satellite, and the James Webb Space Telescope, all set against a backdrop of countless stars. The work layers multiple materials: plaster, tinfoil, coloured pencil, marker, and airbrush, to achieve both texture and depth, mirroring the interdisciplinary nature of ISSI's scientific programme. Hidden Easter eggs, including a small rocket and a rumoured alien, give the piece a playful spirit that has made it an immediate conversation-starter for visiting scientists. The mural was documented in a making-of video and an artist interview, both published on the ISSI website. It quickly proved its worth as an outreach tool: when a local class of ten-year-olds visited ISSI, the pupils gathered around the mural and, gazing up at Earth, the Moon, Jupiter, comets, a galaxy, a black hole, and research satellites, fired off a stream of enthusiastic questions about space. Far from mere decoration, the mural has become a living gateway into ISSI's science, drawing in researchers, visitors, and young minds alike, and giving every coffee break in the common area a quietly cosmic dimension.

Fabio Crameri

Staff Activities

Listed are activities in which ISSI staff scientists participated in 2025. This includes presentations given, meetings attended, outreach, honours received, and chairmanships held.

Presentations

January 16, 2025 – F. Crameri: Accurate and accessible colour use for representing numerical models, CIG Seminar, online

January 23–24, 2025 – A. Nota: "25 years of Space Astronomy: the past and the future", INAF 25 Anniversary, Naples, Italy

January 27, 2025 – M. Sargent: Welcome to the SKACH Winter Meeting on behalf of ISSI-Uni Bern, welcome address to the SKACH consortium for the SKACH 2025 winter meeting, Bern, Switzerland

January 28, 2025 – M. Sargent: Constraining galaxy scaling relations with empirical distribution function modelling, contributed talk at the 2025 winter meeting of the SKACH consortium, Bern, Switzerland

March 7, 2025 – F. Crameri: Professional use of colour for accurate and accessible science graphics, Njord Seminar, Oslo, Norway

March 9, 2025 – F. Crameri: Presentation, The theory of accurate and accessible figure design, German Physical Society (DPG) Annual Meeting, Bonn, Germany

April 2–4, 2025 – M. Rast: ISSI's 'Scientific Opportunities', Virtual Alpine Observatory (VAO) Symposium Kaprun, Austria

April 7, 2025 – F. Crameri: The Invisible Power of Colour in Science, TEDx Unina, Naples, Italy

May 14, 2025 – F. Crameri: Professional use of colour for accurate and accessible scientific data visuals and graphics, Centre for Space and Habitability (CSH), Bern, Switzerland

May 19, 2025 – F. Crameri: Introducing The International Space Science Institute, Centre for Space and Habitability (CSH), Bern, Switzerland

May 26–31, 2025 – R. Marschall: From the solar system to high redshift galaxies, Invited Lecturer, INAF PhD School Francesco Lucchin - Asiago 2025: Asiago, Italy

June 15-20, 2025 – R. Marschall: Origins of Solar Systems, Invited Lecturer, and Invited discussion leader and poster presentation (The refractory-to-ice ratio in comet 67P: implications on the composition of the comet-forming region of the protoplanetary disk), Gordon Research Conference, South Hadley, Massachusetts, USA

June 23–24, 2025 – A. Nota: Panel Chair
JWST at the Gates of Cosmic Dawn - Baltimore, USA

September 7–12, 2025 – R. Marschall, 2 talks:
- ORIGO - an ESA M-class mission proposal to understand planetesimal formation and evolution.
- A modified formation scenario of the proto-solar disk constrained by comets
Europlanet Science Congress, Helsinki, Finland

September 1, 2025 – F. Crameri: From Plates to Palettes: A journey through Geodynamics and Visualisation, UFRJ Seminar Rio de Janeiro, online

September 3, 2025 – F. Crameri: Beyond Aesthetics: Accurate and accessible colour use, ScienceComm25, St.Gallen, Switzerland

October 3, 2025 – F. Crameri: Presentation, Professional use of colour for accurate and accessible science figures, Mind-Akademie, Mannheim, Germany

October 16–17, 2025 – A. Nota: "Building a foundation for Hubble science" Hubble Space Telescope 35th Anniversary Symposium. Invited to be a panel member on the topic: This symposium was postponed owing to US government shutdown.

October 17, 2025 – B. Welch: "Exploring the Smallest Scales of Galaxy Formation with JWST", Northwestern University, Chicago, USA

October 27–30, 2025 – Mlynczak, M. G., and J. Yue: NASA SABER/TIMED Measurements in the Stratosphere, presented at the Network for Detection of Atmospheric Composition Change (NDAAC), , Virginia Beach, Virgina, Invited.

December 4, 2025 – S. Xu: "Extrasolar Cosmochemistry & Polluted White Dwarfs", invited talk at ISSI BJ Forum on Planetary Habitability and Origin of Life, Beijing, China

December 11, 2025 – S. Xu: "Planetary Systems in Wide Binaries Probed by Polluted White Dwarfs", invited talk at International Conference on Exoplanets and Planet Formation, Shanghai, China

Staff Activities

ISSI was present at the European Planetary Science Congress – Division for Planetary Sciences Joint Meeting in Helsinki with a booth

Meetings Conferences

January 27–28, 2025 – M. Sargent: SKACH Consortium meeting, Bern Switzerland

April 7–12, 2025 – F. Crameri: EGU General Assembly, Vienna, Austria

April 28 - May 2, 2025 – T. Dudok de Wit, General Assembly of the European Geosciences Union, Vienna, Austria

September 7–12, 2025 – F. Crameri and R. Marschall: EPSC-DPS 2025 Conference, Helsinki, Finnland

May 5-9, 2025 – T. Dudok de Wit, Parker four conference, online

June 23-27, 2025 – M. Rast: 'ESA Living Planet Symposium' (LPS): "From Observation to Climate Action and Sustainability for Earth, Austria Centre Vienna, Austria

EPSC-DPS 2025 Conference

ISSI was represented at the European Planetary Science Congress – Division for Planetary Sciences (EPSC-DPS) Joint Meeting 2025 in Helsinki with a dedicated exhibition booth, making its presence felt throughout the conference week. The 3×2 metre stand – the only one in the hall with a blue carpet and a colourful backdrop – was strategically positioned directly in front of the coffee area, drawing a steady flow of scientists, long-standing ISSI friends, and many delegates encountering ISSI for the first time. Hosted throughout the week by Communication Scientist Fabio Crameri, the booth offered an array of giveaways including the iconic ISSI lanyards, stickers, pens, copies of SPATIUM magazine, books, and – perhaps most memorably – Swiss chocolate, which earned the stand something of a legendary reputation by the latter days of the conference. The week proved highly effective: existing connections were warmly renewed, a wealth of meaningful new contacts were established, and ISSI welcomed a significant number of new newsletter subscribers. ISSI extends its sincere thanks to the conference organisers and fellow exhibitors for contributing to such a productive and enjoyable experience.

Media Coverage

February 3, 2025 – A. Nota: Hubble and JWST Team Up to Solve a 13-Billion-Year-Old Planet Mystery by Lydia Amazouz, dailygalaxy.com

March 11, 2025 _ T. Dudok de Wit: "Die Erdatmosphäre schrumpft – darum steigt im All das Risiko von Zusammenstössen von Satelliten" by Sven Titz, Neue Zürcher Zeitung

April 15, 2025 – M. Marcos: "Climate crisis exacerbating ocean heatwaves" – report by Damian Carrington, The Guardian

June 10, 2025 – M. Marcos: See How Marine Heat Waves Are Spreading Across the Globe – report by Delger Erdenesanaa, The New York Times

Staff Publications

Listed are all papers written or co-authored by ISSI staff members that appeared in 2025.

Abdurro'uf (incl. B. Welch) et al. Spatially Resolved Physical Properties of Young Star Clusters and Star-forming Clumps in the Brightest z>6 Galaxy, the Strongly Lensed Cosmic Spear at z=6.2. arXiv (2025) doi:10.48550/arxiv.2512.08054.

Adamo, A. (incl. A. Nota) et al. The first billion years according to JWST. Nat. Astron. 9, 1134–1147 (2025).

Ajith, P. (incl. M. Falanga) et al. The Lunar Gravitational-wave Antenna: mission studies and science case. J. Cosmol. Astropart. Phys. 2025, 108 (2025).

Alfonso-Garzón, J. (incl. C. Malacaria) et al. Unveiling the origin of the optical and UV emission during the 2017 giant outburst of the Galactic ULX pulsar Swift J0243.6+6124 (Corrigendum). Astron. Astrophys. 697, C3 (2025).

Añel, J. A. (incl. M. Mlynczak) et al. The Need for Better Monitoring of Climate Change in the Middle and Upper Atmosphere. AGU Adv. 6, (2025).

Axelsson, M. (incl. C. Malacaria) et al. GRB 221009A: The B.O.A.T. Burst that Shines in Gamma Rays. Astrophys. J. Suppl. Ser. 277, 24 (2025).

Bizien, N. (incl. T. Dudok de Wit) et al. Tracing magnetic switchbacks to their source: An assessment of solar coronal jets as switchback precursors. Astron. Astrophys. 694, A181 (2025).

Bowen, T. A. (incl. T. Dudok de Wit) et al. Formation of magnetic switchbacks via expanding Alfvén waves. Astron. Astrophys. 700, A51 (2025).

Bowen, T. A. (incl. T. Dudok de Wit) et al. Nonlinear Interactions in Spherically Polarized Alfvénic Turbulence. Astrophys. J. 985, 49 (2025).

Burch, J. L. & Nakamura, R. Magnetic Reconnection in Space: An Introduction. Space Sci. Rev. 221, 19 (2025).

Choi, K.-E. (incl. T. Dudok de Wit) et al., Surface Waves at Switchback Boundaries in the Young Solar Wind from Parker Solar Probe Observations, Astrophys. J. 992 2 (2025).

Collaboration, H. (incl. A. Nota) et al. The Local Distance Network: A community consensus report on the measurement of the Hubble constant at ~1% precision. Astron. Astrophys. (2025) doi:10.1051/0004-6361/202557993.

Colomban, L. (incl. T. Dudok de Wit) et al. Polarization Properties of Whistler Waves From the First 17 Parker Solar Probe Encounters. Geophys. Res. Lett. 52, (2025).

Colomban, L. (incl. T. Dudok de Wit) et al. Surface Waves at Switchback Boundaries in the Young Solar Wind from Parker Solar Probe Observations. Astrophys. J. 992, 208 (2025).

Crameri, F. (2025), Surviving the Ranking Madness: A Geoscientist's Guide to Keeping Your Academic Soul, https://blogs.egu.eu/divisions/sm/2025/07/15/surviving-the-ranking-madness-a-geoscientists-guide/

Crameri, F., & Perez Diaz, L. (2025). The Evolving Role of Science Visuals in Geoscience: From Simple Illustrations to Storytelling Tools. Tektonika, 2(2), I-VI. https://doi.org/10.55575/tektonika2024.2.2.102

D'Ai, A. (incl. C. Malacaria) et al. Energy-resolved pulse profile changes in V 0332+53: Indications of wings in the cyclotron absorption line profile. Astron. Astrophys. 694, A316 (2025).

Falanga, M. et al. Dynamics of the Neapolitan Volcanoes Inferred from Tiltmeter and Seismic Data Analysis: A Review. Pure Appl. Geophys. 182, 1023–1046 (2025).

Florian, M. K. (incl. B. Welch) et al. JWST Catches a Strongly Gravitationally Lensed AGN In Transition from Type II to Type I. arXiv (2025) doi:10.48550/arxiv.2510.10376.

Fu, T. (incl. M. Falanga) et al. A Comprehensive Study of Type I (Thermonuclear) Bursts in the New Transient SRGA J144459.2–604207. Astrophys. J. 980, 161 (2025).

Grima, A.G. (incl. F. Crameri) et al. The Role of the Overriding Plate and Mantle Viscosity Structure on Deep Slab Morphology. Geochem., Geophys., Geosystems 26, (2025).

Hamlington, B.D., Fournier, S., Thompson, P.R., Marcos, M., Sea level rise in 2024. Nat Rev Earth Environ 6, 246–248 (2025)

Hebden, S. (incl. M. Rast) et al. Special Issue: International Space Science Institute (ISSI) Workshop on Tipping Elements in the Earth's Climate System. Surv. Geophys. 46, 259–264 (2025).

Heron, P. J. (incl. F. Crameri) et al. Art, music, and play as a teaching aid: applying creative uses of Universal Design for Learning in a prison science class. Front. Educ. 10, 1524007 (2025).

Staff Publications

Hohensinn, R. (incl. M. Rast) et al. Global water storage trends as observed from the GRACE/-FO G3P product. (2025) doi:10.5194/egusphere-egu25-10755.

Hutchison, T. A. (incl. B. Welch) et al. JWST & the Waz Arc I: Spatially Resolving the Physical Conditions within a Post-Starburst Galaxy at Redshift 5 with NIRSpec IFS. arXiv (2025) doi:10.48550/arxiv.2512.02000.

Hutchison, T. A. (incl. B. Welch) et al. THRILS -- The High-(Redshift+Ionization) Line Search: Program Description & Redshift Catalog. arXiv (2025) doi:10.48550/arxiv.2512.12509.

Kaushik, A. (incl. M. Falanga) et al. Probing the Accreting Millisecond X-Ray Pulsar SAX J1808.4–3658 Using the Evolution of Its Spectral and Aperiodic Timing Properties. Astrophys. J. 993, 140 (2025).

Krasnoselskikh, V. (incl. T. Dudok de Wit) et al. Plasma Instability in Front of Ejected Energetic Electrons and Type III Solar Radio Bursts. Astrophys. J. 990, 100 (2025).

Kretzschmar, M. (incl. T. Dudok de Wit) et al. The Solar Orbiter merged magnetic field. Astron. Astrophys. 699, A236 (2025).

Lacerda, P. (incl. R. Kokotanekova) et al. Secular brightness curves of 272 comets. Astron. Astrophys. 697, A210 (2025).

Li, Z. (incl. M. Falanga) et al. Timing and Spectral Studies of SRGA J144459.2–604207 with NICER, Einstein Probe, IXPE, NuSTAR, Insight-HXMT, and INTEGRAL During its 2024 Outburst. Astrophys. J. 990, 15 (2025).

Liu, Y.-H. (incl. R. Nakamura) et al. Ohm's Law, the Reconnection Rate, and Energy Conversion in Collisionless Magnetic Reconnection. Space Sci. Rev. 221, 16 (2025).

Marcos, M. et al. Constraining Extreme Storm Surges Along the European Coasts From a Large Ensemble of Climate Models. J. Geophys. Res.: Oceans 130, (2025).

Marcos, M. et al. Global warming drives a threefold increase in persistence and 1° C rise in intensity of marine heatwaves. Proc. Natl. Acad. Sci. 122, e2413505122 (2025).

Meena, B. (incl. A. Nota) et al. Detection of a Deeply Embedded Protocluster Candidate in NGC 602 with JWST. Astron. J. 170, 262 (2025).

Mlynczak, M. G. et al. Design considerations for the future Geospace System Observatory, Surveys in Geophysics, submitted (2025).

Nakamura, R. et al. Establishing a European Heliophysics Community (EHC). Ann. Geophys. 43, 855–879 (2025).

Nakamura, R. et al. Outstanding Questions and Future Research on Magnetic Reconnection. Space Sci. Rev. 221, 17 (2025).

Peng, Z. (incl. M. Falanga) et al. Quenching and Recovery of Persistent X-Ray Emission during a Superburst in 4U 1820–30. Astrophys. J. 982, 18 (2025).

Rivera-Thorsen, T. E. (incl. B. Welch) et al. The Sunburst Arc with JWST. IV. The importance of interaction, turbulence, and feedback for Lyman-continuum escape. arXiv (2025) doi:10.48550/arxiv.2510.11702.

Sargent, M.T. et al. The molecular gas content throughout the low-z merger sequence. Open J. Astrophys. 8, (2025).

Snodgrass, C. (incl. R. Kokotanekova) et al. First JWST spectrum of distant activity in long-period comet C/2024 E1 (Wierzchos). Mon. Not. R. Astron. Soc.: Lett. 541, L8–L13 (2025).

Steffen, R. and F. Crameri (2025), Seeing Geodesy clearly – suitable colours for effective and inclusive visualization, EGU-Geodesy Blog. (https://blogs.egu.eu/divisions/g/2025/09/26/seeing-geodesy-clearly/)

Toni, G. (incl. M. Sargent) et al. The COSMOS-Web deep galaxy group catalog up to z = 3.7. Astron. Astrophys. 697, A197 (2025).

Wu, J. (incl. M. Falanga) et al. CORBES: Radiation belt survey with international small satellite constellation. Adv. Space Res. 75, 6635–6652 (2025).

Yu, W. (incl. M. Falanga) et al. Emission and absorption lines in the photospheric radius expansion bursts of 4U 1820–30. Astron. Astrophys. 696, A139 (2025).

Visitor Publications

Listed are all papers written or co-authored by ISSI visitors, with acknowledgment to ISSI, that appeared for publication in refereed journals in 2025.

Abdalzaher, M. S., Ghamry, E., Yusof, K. A. & Shaaban, M. Toward Automatic Detection of Pi2 Magnetic Pulsation Using Machine Learning. IEEE Access 13, 109828–109839 (2025).

Acero, F. J., Carrasco, V. M. S., Gallego, M. C., Usoskin, I. G. & Vaquero, J. M. 14C-Based Sunspot Numbers for the Last Millennium Encompass the Full Range of Variability: Extreme Value Theory. Sol. Phys. 300, 50 (2025).

Ackermann, M., Malyshev, D. & Malyshev, D. V. Diffuse Continuum Emission and Large Extended Sources at MeV Energies. Space Sci. Rev. 221, 92 (2025).

Adamo, A. et al. The first billion years according to JWST. Nat. Astron. 1–14 (2025) doi:10.1038/s41550-025-02624-5.

Adhikari, S. et al. Dependence of electron pressure–strain interaction on guide magnetic field for ion coupled magnetic reconnection. Phys. Plasmas 32, 122304 (2025).

Adhikari, S. et al. Estimation of Effective Viscosity to Quantify Collisional Behavior in Collisionless Plasma. Astrophys. J. 992, 180 (2025).

Adhikari, S., Yang, Y. & Matthaeus, W. H. Helmholtz decomposition of pressure–strain interaction in kinetic plasma turbulence. Phys. Plasmas 32, 124502 (2025).

Affholder, A. et al. The Viability of Glycine Fermentation in Titan's Subsurface Ocean. Planet. Sci. J. 6, (2025).

Alberti, T., Benella, S., Stumpo, M., Sorriso-Valvo, L. & Carbone, V. Cross-scale turbulence in space plasmas: old concepts, recent findings, and future challenges. Plasma Phys. Control. Fusion 67, 023001 (2025).

Alinaghi, P., Janssens, M. & Jansson, F. Warming from cold pools: A pathway for mesoscale organization to alter Earth's radiation budget. Proc. Natl. Acad. Sci. 122, e2513699122 (2025).

Alvarez, G. J., Dmitruk, P., Rabatin, B., Collins, D. C. & Andrés, N. The Energy Cascade Rate in Supersonic Magnetohydrodynamic Turbulence. Astrophys. J. 991, 8 (2025).

Andrés, N. et al. Foreshock Ultralow Frequency Waves at Mars: Consequence on the Particle Acceleration Mechanisms at the Martian Bow Shock. Astrophys. J. 979, 77 (2025).

Añel, J. A. et al. The Need for Better Monitoring of Climate Change in the Middle and Upper Atmosphere. AGU Adv. 6, (2025).

Annenkov, V., Krafft, C., Volokitin, A. & Savoini, P. Statistical properties of beam-driven upper-hybrid wave turbulence in the solar wind. Astron. Astrophys. 699, L6 (2025).

Aragão, E. V. F. de et al. Dicyanoacetylene (NC4N) Formation in the CN + Cyanoacetylene (HC3N) Reaction: A Combined Crossed-Molecular Beams and Theoretical Study. ACS Earth Space Chem. 9, 2199–2214 (2025).

Astafyeva, E. et al. An Extraordinary Dayside Negative Ionospheric Storm of 11 May 2024 and Total Electron Content (TEC) Vortices. J. Geophys. Res.: Space Phys. 130, (2025).

Astafyeva, E. et al. Electrodynamic and Ionospheric Puzzles of the 10–11 May 2024 Geomagnetic Superstorm. J. Geophys. Res.: Space Phys. 130, (2025).

Attree, N. et al. Constraints on the ejecting-crust activity model on comet 67P/Churyumov–Gerasimenko. Mon. Not. R. Astron. Soc. 541, 771–783 (2025).

Bai, H. et al. Changes and drivers of long-term land evapotranspiration in the Yangtze River Basin: A water balance perspective. J. Hydrol. 653, 132763 (2025).

Bannister, M. et al. The Origins & Reservoirs of Exocomets. Space Sci. Rev. 221, 90 (2025).

Barabash, S., Holmström, M., Ramstad, R., Futaana, Y. & Voshchepynets, A. The Induced Magnetosphere of Mars and the Near-Mars Environment as Revealed by Mars Express. Space Sci. Rev. 221, 79 (2025).

Barbhuiya, M. H. et al. Identifying the Growth Phase of Magnetic Reconnection Using Pressure-Strain Interaction. J. Geophys. Res.: Space Phys. 130, (2025).

Barczynski, K. et al. First coordinated observations between Solar Orbiter and the Daniel K. Inouye Solar Telescope. Astron. Astrophys. 701, A77 (2025).

Baumeister, P. et al. Fundamentals of Interior Modelling and Challenges in the Interpretation of Observed Rocky Exoplanets. Space Sci. Rev. 221, 123 (2025).

Visitor Publications

Bayer, M. et al. A Pristine-UNIONS view on the Galaxy: Kinematics of the distant spur feature of the Sagittarius stream traced by blue horizontal branch stars. Astron. Astrophys. 701, A117 (2025).

Bekker, S. Z., Milligan, R. O. & Ryakhovsky, I. A. Response of Ionospheric Total Electron Content to the Impulsive and Late Phases of X-Class Solar Flares With Various Center-to-Limb Locations. J. Geophys. Res.: Space Phys. 130, (2025).

Benavitz, L. F., Reep, J. W., Tarr, L. A. & To, A. S. H. Spatiotemporal Low First Ionization Potential Abundance: A Catalyst for Coronal Condensation. Astrophys. J. 992, 4 (2025).

Bera, R. K. et al. The Role of Pickup Ions in the Interaction of the Solar Wind with the Local Interstellar Medium. II. Effects of Solar Cycle. Astrophys. J. 990, 5 (2025).

Berretti, M. et al. SoFT: Detecting and tracking magnetic structures in the solar photosphere. Astron. Astrophys. 693, A71 (2025).

Berretti, M. et al. Umbral oscillations in the photosphere. Astron. Astrophys. 697, A156 (2025).

Berthelemy, P. G., Wright, C. J., Hindley, N. P., Noble, P. E. & Hoffmann, L. A novel identification method for stratospheric gravity waves in nadir viewing satellite observations. Atmos. Chem. Phys. 25, 17595–17611 (2025).

Bhardwaj, A., Matsunaga, N., Huang, C. D., Riess, A. G. & Rejkuba, M. Absolute Calibration of Cluster Mira Variables to Provide a New Anchor for the Hubble Constant Determination. Astrophys. J. 990, 63 (2025).

Bhattacharjee, D., Kontar, E. P. & Luo, Y. Total Power and Low-energy Cutoff Time Evolution of Solar Flare Accelerated Electrons Using X-Ray Observations and Warm-target Model. Astrophys. J. 987, 211 (2025).

Bian, N. H. & Li, G. Gaussian Mixtures in Solar Wind Plasma Turbulence. Astrophys. J. 988, 173 (2025).

Bian, N. H. & Li, G. On the Singularity Structure of Alfvénic Turbulence. Astrophys. J. 992, 32 (2025).

Birn, J., Merkin, V. G., Sitnov, M. I. & Hesse, M. 3-D MHD Stability of Magnetotail Configurations With a Bz Hump. J. Geophys. Res.: Space Phys. 130, (2025).

Blaes, O., Jiang, Y.-F., Lasota, J.-P. & Lipunova, G. Non-Stationary Discs and Instabilities. Space Sci. Rev. 221, 120 (2025).

Blanc, M. et al. Understanding the Formation of Saturn's Regular Moons in the Context of Giant Planet Moons Formation Scenarios. Space Sci. Rev. 221, 35 (2025).

Bowen, T. A. et al. Formation of magnetic switchbacks via expanding Alfvén waves. Astron. Astrophys. 700, A51 (2025).

Breuval, L. et al. Converging on the Cepheid Metallicity Dependence: Implications of Nonstandard Gaia Parallax Recalibration on Distance Measures. Astrophys. J. 994, 111 (2025).

Bright, J. S. et al. The accretion–ejection connection in the black hole X-ray binary MAXI J1820+070. Mon. Not. R. Astron. Soc. 541, 1851–1865 (2025).

Brovkin, V. et al. Permafrost and Freshwater Systems in the Arctic as Tipping Elements of the Climate System. Surv. Geophys. 46, 303–326 (2025).

Buldgen, G. et al. The Future of Solar Modelling: Requirements for a New Generation of Solar Models. Sol. Phys. 300, 97 (2025).

Bulgin, C. E. et al. The Importance of Scale in the Definition of Uncertainties: How do we Best Communicate this to Data Users? Surv. Geophys. 1–24 (2025) doi:10.1007/s10712-025-09908-5.

Burch, J. L. & Nakamura, R. Magnetic Reconnection in Space: An Introduction. Space Sci. Rev. 221, 19 (2025).

Burch, J. L. & Nakamura, R. Magnetic Reconnection: Explosive Energy Conversion in Space Plasmas – Editorial. Space Sci. Rev. 221, 88 (2025).

Butler, J. et al. Intracluster light is a biased tracer of the dark matter distribution in clusters. Mon. Not. R. Astron. Soc. 539, 2279–2291 (2025).

Bzowski, M. et al. GLObal Solar Wind Structure (GLOWS). Space Sci. Rev. 221, 105 (2025).

Carlberg, R. G. et al. C-19 and Hot, Wide Star Streams. Astrophys. J. 988, (2025).

Casavecchia, B., Maio, U., Péroux, C. & Ciardi, B. Atomic and molecular gas as traced by [C II] emission. Astron. Astrophys. 693, A119 (2025).

Catanzaro, G. et al. Cepheid Metallicity in the Leavitt Law (C--MetaLL) survey. VII. High-resolution

Visitor Publications

IGRINS spectroscopy of 23 classical Cepheids: Validating NIR abundances. Astron. Astrophys. (2025) doi:10.1051/0004-6361/202558020.

Čemeljić, M., Kluźniak, W. & Kundu, S. Magnetic precession as a model for quasi-periodic oscillations in pulsating ultraluminous X-ray sources and in flat-top noise sources. Astron. Astrophys. 703, A7 (2025).

Čemeljić, M., Kluźniak, W., Mishra, R. & Wielgus, M. Pseudo-Newtonian Simulation of a Thin Accretion Disk Around a Reissner–Nordström Naked Singularity. Astrophys. J. 981, 69 (2025).

Chappuis, L. et al. CHEX-MATE: Multiprobe analysis of Abell 1689. Astron. Astrophys. 699, A141 (2025).

Chaurasiya, R., Bayanna, A. R. & Erdélyi, R. Propagation and energy dissipation of shock waves in the solar chromosphere. Mon. Not. R. Astron. Soc. 543, 3791–3801 (2025).

Chen, H. et al. Modeling the global shape and surface morphology of the Ryugu asteroid using an improved neural implicit method. Astron. Astrophys. 696, A212 (2025).

Chen, J. et al. Direct Measurement of the Longitudinal Magnetic Field in the Solar Photosphere with the Zeeman Effect. Sol. Phys. 300, 49 (2025).

Cheng, G. et al. Three-dimensional magnetic reconnection mediated with plasmoids and the resulting multithermal emissions in the cool atmosphere of the Sun. Astron. Astrophys. 701, A245 (2025).

Chierichini, S. et al. Coronal jet Identification with machine learning. Astron. Astrophys. 698, A50 (2025).

Claeyssens, A. et al. Tracing star formation across cosmic time at tens of parsec-scales in the lensing cluster field Abell 2744. Mon. Not. R. Astron. Soc. 537, 2535–2558 (2025).

Collaboration, E. et al. Euclid preparation. Astron. Astrophys. 698, A14 (2025).

Conger, K. et al. Virgo Filaments. IV. Using WISE to Measure the Modification of Star-forming Disks in the Extended Regions Around the Virgo Cluster. Astrophys. J. 978, 113 (2025).

Correa-Gazmuri, M. & Moya, P. S. Total internal reflection of electromagnetic waves in Kappa-distributed plasmas. Phys. Scr. 100, 115604 (2025).

Crida, A., Estrada, P. R., Nicholson, P. D. & Murray, C. D. The Age and Origin of Saturn's Rings. Space Sci. Rev. 221, 66 (2025).

D'Aì, A. et al. Energy-resolved pulse profile changes in V 0332+53: Indications of wings in the cyclotron absorption line profile. Astron. Astrophys. 694, A316 (2025).

D'Amicis, R. et al. Evolution of Alfvénic slow wind parcels coming from the same solar source: observations by Parker Solar Probe, Solar Orbiter, and Wind. Astron. Astrophys. (2025) doi:10.1051/0004-6361/202556711.

D'Amicis, R. et al. On Alfvénic turbulence of solar wind streams observed by Solar Orbiter during March 2022 perihelion and their source regions. Astron. Astrophys. 693, A243 (2025).

Dang, T. et al. Unveiling the Global Characteristics of Turbulence in the Venusian Space Environment. Geophys. Res. Lett. 52, (2025).

Das, S. et al. A theoretical framework for BL Her stars. Astron. Astrophys. 694, A255 (2025).

Das, S. et al. A theoretical framework for BL Her stars. Astron. Astrophys. 695, A38 (2025).

Das, S. K. et al. On the F-Region Ionospheric Plasma Density Distribution and Irregularities Response During the May-2024 Geomagnetic Storm Observed by LEO Satellites. Geophys. Res. Lett. 52, (2025).

Deshpande, K. et al. Coronal electron density: Insights from radio and in situ observations, and EUHFORIA modeling. Astron. Astrophys. 704, A95 (2025).

Dolliou, A., Klimchuk, J. A., Parenti, S. & Bocchialini, K. The nature of small-scale extreme ultraviolet solar brightenings investigated as impulsive heating of short loops in 1D hydrodynamics simulations. Astron. Astrophys. 699, A61 (2025).

Doorsselaere, T. V., Sieyra, M. V., Magyar, N., Goossens, M. & Banović, L. Uniturbulence and Alfvén wave solar model. Astron. Astrophys. 696, A166 (2025).

Drake, J. F. et al. Magnetic Reconnection in Solar Flares and the Near-Sun Solar Wind. Space Sci. Rev. 221, 27 (2025).

Duckenfield, T. J., Jess, D. B., Morton, R. J. & Jafarzadeh, S. Determining the Polarization of a Coronal Standing Kink Oscillation Using Spectral Imaging Techniques with CoMP. Astrophys. J. 982, 202 (2025).

Visitor Publications

Eastman, R., McCoy, I. L., Zuidema, P., Schulz, H. & Barrett, P. Increased Occurrence of Stratiform Clouds in the Caribbean Dry Season Since 1971 From Surface Observations. J. Geophys. Res.: Atmos. 130, (2025).

Edberg, N. J. T. et al. Statistical Analysis of Multiple Bow Shock Crossings at Mars. Geophys. Res. Lett. 52, (2025).

Effenberger, F. et al. Open Issues in Non-Gaussian Transport and Acceleration of Charged Energetic Particles in Space and Astrophysical Plasmas. Space Sci. Rev. 221, 75 (2025).

Elsden, T. et al. Theory and Modeling of Large Scale Plasmapause Surface Waves. J. Geophys. Res.: Space Phys. 130, (2025).

Eriksen, N. K. et al. Evolution and decay of a stable and a dynamic airglow patch. J. Atmos. Sol.-Terr. Phys. 275, 106593 (2025).

Espinoza-Troni, J., Arrò, G., Asenjo, F. A. & Moya, P. S. Electron-scale Magnetic Holes Generation Driven by Whistler-to-Bernstein Mode Conversion in Fully Kinetic Plasma Turbulence. Astrophys. J. 986, 228 (2025).

Fathy, A. et al. Insights into Conjugate Hemispheric Ionospheric Disturbances Associated with the Beirut Port Explosion on 4 August 2020 Using Multi Low-Earth-Orbit Satellites. Remote Sens. 17, 1908 (2025).

Fellenberg, S. D. von et al. First Mid-infrared Detection and Modeling of a Flare from Sgr A*. Astrophys. J. Lett. 979, L20 (2025).

Fellenberg, S. D. von et al. Mid-infrared Extinction toward the Galactic Center. Astrophys. J. 995, 215 (2025).

Fernández-Remolar, D. C. et al. The Role of Reducing and Acidic Hydrothermal Fluids in Forming Chloride Deposits in Terra Sirenum, Mars. J. Geophys. Res.: Planets 130, (2025).

Fitzmaurice, A., Drake, J. F. & Swisdak, M. Ion beam instabilities during solar flare energy release. Phys. Plasmas 32, 042114 (2025).

Formisano, M. et al. The role of self-heating and roughness in micro cold trap stability: implications for lunar poles. Mon. Not. R. Astron. Soc. 543, 4187–4197 (2025).

Fu, H. et al. The Distributions and Temporal Variations of FACs During Substorms and Quiet Periods. J. Geophys. Res.: Space Phys. 130, (2025).

Fu, W. D. et al. On the Dipolarization Front and Magnetopause: 1. Comparison and Implications. J. Geophys. Res.: Space Phys. 130, (2025).

Fu, W. D. et al. On the Dipolarization Front and Magnetopause: 2. Evidence of Interchange Instability at Magnetopause. J. Geophys. Res.: Space Phys. 130, (2025).

Fu, W. D. et al. On the Dipolarization Front and Magnetopause: 3. Evidence of Electron Kelvin–Helmholtz Instability at Dipolarization Front. J. Geophys. Res.: Space Phys. 130, (2025).

Galli, A. et al. 15 yr of Interstellar Neutral Hydrogen Observed with the Interstellar Boundary Explorer. Astrophys. J. Suppl. Ser. 278, 1 (2025).

Gao, Y. et al. Reconnection Nanojets in an Erupting Solar Filament with Unprecedented High Speeds. Astrophys. J. Lett. 985, L12 (2025).

Gauthier, A. et al. TIMED Doppler Interferometer measurements of neutral winds at the mesosphere and lower thermosphere and comparison to meteor radar winds. Ann. Geophys. 43, 427–440 (2025).

Gedalin, M. Self-organization of collisionless shocks: a 'phase transition' from a planar stationary profile to a rippled structure. J. Plasma Phys. 91, E6 (2025).

Gélis, I. de, Prigent, C., Jimenez, C. & Sandells, M. Forward modelling of passive microwave emissivities over snow-covered areas at continental scale. Remote Sens. Environ. 328, 114821 (2025).

Genestreti, K. J. et al. Structure of the Electron Diffusion Region During Magnetic Reconnection. Space Sci. Rev. 221, 59 (2025).

Georgiou, A. et al. Atomic-scale Insights into the Effects of Diffusion on the Binding of Adsorbed Sodium on the Surfaces of the Moon and Mercury. Planet. Sci. J. 6, 205 (2025).

Georgiou, A. et al. Effect of Solar Wind and Micrometeoroid Impact on the Lunar Water Cycle: A Molecular Dynamics Study. J. Geophys. Res.: Planets 130, (2025).

Gezer, I. et al. SED Modelling of Young Stellar Objects in the Orion Star Formation Complex. Astron. Astrophys. 696, A196 (2025).

Visitor Publications

Giuranna, M. et al. Vertical Structure of the Martian Atmosphere: The View from Mars Express. Space Sci. Rev. 221, 36 (2025).

Golubenko, K., Usoskin, I., Rozanov, E. & Bard, E. New SOCOL:14C-Ex model reveals that the Late-Glacial radiocarbon spike in 12350 BC was caused by the record-strong extreme solar storm. Earth Planet. Sci. Lett. 661, 119383 (2025).

Graaff, A. de et al. A remarkable ruby: Absorption in dense gas, rather than evolved stars, drives the extreme Balmer break of a little red dot at z = 3.5. Astron. Astrophys. 701, A168 (2025).

Graaff, A. de et al. RUBIES: A complete census of the bright and red distant Universe with JWST/NIRSpec. Astron. Astrophys. 697, A189 (2025).

Graham, D. B. et al. The Role of Kinetic Instabilities and Waves in Collisionless Magnetic Reconnection. Space Sci. Rev. 221, 20 (2025).

Grandin, M. et al. Citizen Science in Space and Atmospheric Sciences: Opportunities and Challenges. Surv. Geophys. 1–35 (2025) doi:10.1007/s10712-025-09888-6.

Grimmich, N. et al. Comparison of Kelvin–Helmholtz waves observed simultaneously at the dawn and dusk flanks of the Earth's magnetopause. Planet. Space Sci. 267, 106182 (2025).

Grimmich, N. et al. Investigation of the occurrence of significant deviations in the magnetopause location: solar-wind and foreshock effects. Ann. Geophys. 43, 151–173 (2025).

Groussin, O. et al. Thermal environment and erosion of comet 67P/Churyumov-Gerasimenko. Astron. Astrophys. 694, A21 (2025).

Gruber, A. et al. Making Sense of Uncertainties: Ask the Right Question. Surv. Geophys. 1–19 (2025) doi:10.1007/s10712-025-09889-5.

Gully, H. et al. Insights into environmental quenching at z ~ 1: an enhancement of faint, low-mass passive galaxies in clusters. Mon. Not. R. Astron. Soc. 539, 3058–3076 (2025).

Guo, J. et al. Three-dimensional Global Hybrid Simulation of Magnetosheath Jets at Mercury. Astrophys. J. Lett. 978, L9 (2025).

Gurev, D., Kronberg, E. A., Runov, A. & Shprits, Y. Cross-Calibration of Energetic Electron Flux Measurements From the Cluster and THEMIS Missions. J. Geophys. Res.: Space Phys. 130, (2025).

Gurgenashvili, E. et al. Multiple short-term cycles in star KIC 6876668 Kepler. Astron. Astrophys. (2025) doi:10.1051/0004-6361/202556508.

Haas, B. et al. Unraveling the Mystery of Earth's Space Radiation Environment Loss Processes: Meeting Report. Earth Space Sci. 12, (2025).

Hanlon, J. & Jones, G. H. An empirical radiation pressure correction for dust at small stellarcentric distances. Mon. Not. R. Astron. Soc.: Lett. 543, L14–L19 (2025).

Hansen, R. M. F. et al. Multi-frequency altimetry snow depth estimates over heterogeneous snow-covered Antarctic summer sea ice – Part 1: C/S-, Ku-, and Ka-band airborne observations. Cryosphere 19, 4167–4192 (2025).

Hansen, R. M. F. et al. Multi-frequency altimetry snow depth estimates over heterogeneous snow-covered Antarctic summer sea ice – Part 2: Comparing airborne estimates with near-coincident CryoSat-2 and ICESat-2 (CRYO2ICE). Cryosphere 19, 4193–4209 (2025).

Harra, L. et al. The Dynamics of the Extreme Ultraviolet Quiet Sun and Coronal Holes in the Solar Orbiter Era. Space Sci. Rev. 221, 50 (2025).

Harvey, V. L. et al. Signatures of Polar Vortex Weakening in the MLTI: A Review. Surv. Geophys. 1–41 (2025) doi:10.1007/s10712-025-09899-3.

Harzer, F., Garny, H., Davis, S. & Birner, T. Probing the Suitability of Meridional Stratospheric Ozone Gradients for Inferring Interannual Variability and Trends of the Subtropical Jet Stream. J. Clim. 38, 2571–2588 (2025).

Hayakawa, H. et al. The Solar and Geomagnetic Storms in 2024 May: A Flash Data Report. Astrophys. J. 979, 49 (2025).

He, D.-W. et al. A Statistical Analysis of the Returning Flux Tubes in the Jovian Magnetosphere Based on Juno Observations. Astrophys. J. 986, 115 (2025).

He, T.-L. et al. Challenges and Opportunities Offered by Geostationary Space Observations for Air Quality Research and Emission Monitoring. Bull. Am. Meteorol. Soc. 106, E939–E963 (2025).

Visitor Publications

Heinemann, S. G. et al. Evaluating Solar Wind Forecast Using Magnetic Maps That Include Helioseismic Far-Side Information. Sol. Phys. 300, 153 (2025).

Heinemann, S. G. et al. Quantifying Uncertainties in Solar Wind Forecasting due to Incomplete Solar Magnetic Field Information. Astrophys. J. 986, 166 (2025).

Heinzel, P., Beck, D., Gunár, S. & Anzer, U. Radiative Processes in Cool Coronal Condensations. Sol. Phys. 300, 166 (2025).

Herbst, K. & Papaioannou, A. Estimating solar-radiation environment extremes. Astron. Astrophys. 696, A63 (2025).

Herbst, K., Amazo-Gómez, E. M. & Papaioannou, A. Comparing the Sun to Sun-like stars. Astron. Astrophys. 697, A80 (2025).

Hezel, D. C., Palme, H., Zipfel, J., Morbidelli, A. & Mezger, K. Evolution of the Solar System: Constraints from Meteorites – Editorial. Space Sci. Rev. 221, 125 (2025).

Hillier, A., Oliver, R. & Martínez-Gómez, D. Understanding coronal rain dynamics through a point-mass model. Astron. Astrophys. 696, A231 (2025).

Hitchcock, P. & Ming, A. The Role of Ozone in the Secondary Circulation of the QBO: Linear Theory. J. Geophys. Res.: Atmos. 130, (2025).

Hoeijmakers, H. J., Jaworska, K. P. & Prinoth, B. Exocomets of β Pictoris. Astron. Astrophys. 700, A239 (2025).

Hong, Y. et al. Temporal and Spatial Variability of Multiscale Neutral Density Perturbations During Storm-Time: Insights From Multi-Satellite Observations. Space Weather 23, (2025).

Hou, C., Gannouni, B., Rouillard, A. P., He, J. & Réville, V. Fine-scale activity driven by magnetic reconnection within coronal microjets. Astron. Astrophys. 697, A67 (2025).

Howett, C. J. A., Miles, G. M. & Quick, L. C. Constraining the Mass and Energy of Enceladus' Dissipation Systems. Space Sci. Rev. 221, 56 (2025).

Hsieh, H. H. et al. The Volatile Composition and Activity Evolution of Main-belt Comet 358P/PANSTARRS. Planet. Sci. J. 6, 3 (2025).

Huang, J. et al. Significant Impact of Non-Tidal Oceanic and Atmospheric Mass Variations on Regional Ocean Mass Budgets: A Comparative Analysis Across 19 Representative Regions. J. Geophys. Res.: Oceans 130, (2025).

Iglesias, D. et al. An Overview of Exocomets. Space Sci. Rev. 221, 122 (2025).

Jadhav, A. P., Yamazaki, Y., Gurubaran, S., Sato, K. & Koshin, D. 2-Day Ionospheric Oscillations at Low Latitudes Due To an Ultra-Fast Kelvin Wave. Earth Space Sci. 12, (2025).

Jejčič, S., Schwartz, P., Heinzel, P. & Gunár, S. Theoretical relations between model parameters and Metis observables for eruptive prominences and coronal mass ejections. Astron. Astrophys. 696, A14 (2025).

Jiang, Q., Lei, J., Li, G. & Huang, F. Different Responses of O-Mode and X-Mode in Ionograms to Medium Scale Traveling Ionospheric Disturbances: Observations and Simulations. J. Geophys. Res.: Space Phys. 130, (2025).

JiJie, M. et al. Martian atmosphere sputtering escape generated by penetrating hydrogen energetic neutral atoms. Earth Planet. Phys. 9, 1147–1156 (2025).

Johnston, C. D. et al. Filament Mass Losses Forced by Magnetic Reconnection in the Solar Corona. Astrophys. J. 982, 131 (2025).

Kartavykh, Y. et al. A statistical study of energetic particle events associated with interplanetary shocks observed by Solar Orbiter in solar cycle 25. Astron. Astrophys. 699, A24 (2025).

Kaufmann, N., Guilera, O. M., Alibert, Y. & Sebastián, I. L. S. From streaming instability to the onset of pebble accretion. Astron. Astrophys. 696, A65 (2025).

Kaushik, A., Bhargava, Y., Bhattacharyya, S. & Falanga, M. Probing the Accreting Millisecond X-Ray Pulsar SAX J1808.4–3658 Using the Evolution of Its Spectral and Aperiodic Timing Properties. Astrophys. J. 993, 140 (2025).

Kayanikhoo, F., Kluźniak, W. & Čemeljić, M. ULX Collimation by Outflows in Moderately Magnetized Neutron Stars. Astrophys. J. 982, 95 (2025).

Kayanikhoo, F. et al. Energy Flow and Radiation Efficiency in Radiative GRMHD Simulations of Neutron Star Ultraluminous X-Ray Sources. Astrophys. J. 995, 10 (2025).

Visitor Publications

Kim, M. J. et al. Investigation of Thermospheric Horizontal and Vertical Neutral Winds via Tristatic Observations Over Alaska. J. Geophys. Res.: Space Phys. 130, (2025).

Kimmig, L. C. et al. Intra-cluster light as a dynamical clock for galaxy clusters: Insights from the MAGNETICUM, IllustrisTNG, Hydrangea, and Horizon-AGN simulations. Astron. Astrophys. 700, A95 (2025).

Klein, K. G. & Verscharen, D. The dielectric response of plasmas with arbitrary gyrotropic velocity distributions. Phys. Plasmas 32, 092104 (2025).

Knapmeyer-Endrun, B. et al. Porosity and hydrous alteration of the Martian crust from InSight seismic data. Phys. Earth Planet. Inter. 366, 107383 (2025).

Kontar, E. P., Emslie, A. G., Clarkson, D. L. & Pitňa, A. Ion-scale Turbulence and Energy Cascade Rate in the Solar Corona and Inner Heliosphere. Astrophys. J. Lett. 991, L57 (2025).

Kovács, G. B., Szabó, R. & Nuspl, J. A new framework of multidimensional pulsating stellar envelopes. Astron. Astrophys. 700, A268 (2025).

Kozlovsky, A. et al. Atmospheric Gravity Waves and Medium Scale Traveling Ionospheric Disturbances at Auroral Latitudes. Surv. Geophys. 1–17 (2025) doi:10.1007/s10712-025-09880-0.

Krafft, C. & Volokitin, A. S. Linear Mode Conversion Theory of Radio Emission from Turbulent Solar Wind Plasmas. Astrophys. J. Suppl. Ser. 281, 67 (2025).

Krämer, E. et al. Jets Downstream of Collisionless Shocks: Recent Discoveries and Challenges. Space Sci. Rev. 221, 4 (2025).

Krasnoselskikh, V. et al. Plasma Instability in Front of Ejected Energetic Electrons and Type III Solar Radio Bursts. Astrophys. J. 990, 100 (2025).

Krot, A. N. et al. Metasomatic Alteration of Type 3 Ordinary and Carbonaceous Chondrites. Space Sci. Rev. 221, 7 (2025).

Kruparova, O. et al. Radial Evolution of Interplanetary Shock Properties with Heliospheric Distance: Observations from Parker Solar Probe. Astrophys. J. Lett. 979, L10 (2025).

Kumar, A. et al. Impact of Weak and Strong Stratospheric Polar Vortices in the Northern and Southern Hemispheres on Solar-Migrating Semidiurnal Tides in UA-ICON. J. Geophys. Res.: Atmos. 130, (2025).

Kurbah, K. et al. Multiwavelength study of observed and predicted pulsation properties of first overtone Cepheids in the Magellanic Clouds. Mon. Not. R. Astron. Soc. 541, 2594–2618 (2025).

Lainey, V., Zannoni, M., Robert, V. & Guillot, T. Quantification of Tides in Giant Planets from Observations. Space Sci. Rev. 221, 93 (2025).

Lanabere, V. et al. Variability in Footpoint Mapping of Bursty Bulk Flows Using Tsyganenko Models: Impact on Swarm Conjunctions. J. Space Weather Space Clim. (2025) doi:10.1051/swsc/2025035.

Landy, J. C. et al. Anticipating CRISTAL: an exploration of multi-frequency satellite altimeter snow depth estimates over Arctic sea ice, 2018–2023. Cryosphere 20, 183–208 (2025).

Langsdale, M. et al. The Challenges and Limitations of Validating Satellite-Derived Datasets Using Independent Measurements: Lessons Learned from Essential Climate Variables. Surv. Geophys. 1–38 (2025) doi:10.1007/s10712-025-09898-4.

Larosa, A. et al. Velocity-space Turbulent Cascade in the Near-Sun Solar Wind: First Insights from the Parker Solar Probe Mission. Astrophys. J. Lett. 995, L69 (2025).

Larsen, N. & Mishev, A. Radiation Impact of the Halloween GLE Events During the October–November 2003 Period. Space Weather 23, (2025).

Laundal, K. M. et al. Next-Generation Data Assimilation Methods for Polar Ionospheric Electrodynamics. Surv. Geophys. 1–47 (2025) doi:10.1007/s10712-025-09918-3.

Läuter, M. & Kramer, T. Rotation dynamics and torque efficiency of cometary nuclei. Astron. Astrophys. 699, A75 (2025).

Li, G. et al. Magnetopause Location and Solar Wind Turbulence Level During FDs and Their Impacts on the Global Electric Circuit. Space Weather 23, (2025).

Li, W. et al. Solar energetic electron events with a spectral bump break. Astron. Astrophys. 699, A2 (2025).

Li, Y. et al. The Characteristics of Energetic Electron Precipitation Based on Low Altitude FY-3E Satellite Measurements. Geophys. Res. Lett. 52, (2025).

Lim, S. et al. The Spatial Distribution of Globular Cluster Systems in Early-type Galaxies: Estima-

Visitor Publications

tion Procedure and Catalog of Properties for Globular Cluster Systems Observed with Deep Imaging Surveys. Astrophys. J. Suppl. Ser. 276, 34 (2025).

Lin, M. & Poppe, A. R. Metallic Ions Near the Moon: Impact of Solar Activity and Lunar Position. J. Geophys. Res.: Space Phys. 130, (2025).

Lin, M., Ilie, R. & Glocer, A. Limits on the Efficacy of Wave-Particle Interaction on the Energization and Transport of Atomic and Molecular Heavy Ionospheric Ions. J. Geophys. Res.: Space Phys. 130, (2025).

Liou, Y., Nykyri, K., Ma, X. & Kavosi, S. Generation of FTE Signatures by the Kelvin–Helmholtz Instability. J. Geophys. Res.: Space Phys. 130, (2025).

Liu, S. et al. PyTransHelio: A Python tool for analyzing magnetic flux-weighted centroids of active regions and trans-equatorial loop footpoints in full-disk solar photospheric magnetograms. Astron. Tech. Instrum. (2025) doi:10.3724/ati2025068.

Liu, S., Ren, D. & Lei, J. Self-Consistent Optimization of Electron and Neutral Densities in a Physics-Based Model Toward Ionosphere-Thermosphere Forecast. Space Weather 23, (2025).

Liu, Z. et al. Dawn-Dusk Morphology of Auroral Arcs in Substorm Growth Phase. J. Geophys. Res.: Space Phys. 130, (2025).

Lodders, K., Bergemann, M. & Palme, H. Solar System Elemental Abundances from the Solar Photosphere and CI-Chondrites. Space Sci. Rev. 221, 23 (2025).

Lodders, K., Fegley, B., Mezger, K. & Ebel, D. Condensation and the Volatility Trend of the Earth. Space Sci. Rev. 221, 54 (2025).

Lomazzi, P. et al. A Parametric Study of Solar Wind Properties and Composition Using Fluid and Kinetic Solar Wind Models. Astrophys. J. 984, 198 (2025).

Longeard, N. et al. The Pristine Dwarf-Galaxy survey. Astron. Astrophys. 698, A63 (2025).

Loriani, S. et al. Monitoring the Multiple Stages of Climate Tipping Systems from Space: Do the GCOS Essential Climate Variables Meet the Needs? Surv. Geophys. 46, 327–374 (2025).

Lörinčík, J., Polito, V., Kerr, G. S., Hayes, L. A. & Russell, A. J. B. Probing Progression of Heating Through the Lower Flare Atmosphere via High-cadence IRIS Spectroscopy. Astrophys. J. 986, 73 (2025).

Lou, Y. et al. Distinct Global Distribution of Electrostatic Electron Cyclotron Harmonic Waves in Earth's Magnetosphere Revealed by Multi-Satellite Observations. Geophys. Res. Lett. 52, (2025).

Lu, M. et al. Comparison of meteor shower observed by two collocated meteor radars at low latitudes. Icarus 437, 116610 (2025).

Lübke, J. et al. Modelling cosmic-ray transport: magnetised versus unmagnetised motion in astrophysical magnetic turbulence. J. Plasma Phys. 91, E147 (2025).

Lukianova, R. et al., A. Solar Wind–Ionosphere–Troposphere Coupling Via the Polar Branch of the Global Electric Circuit. Surv. Geophys. 1–32 (2025) doi:10.1007/s10712-025-09914-7.

Ma, L., Tian, X., Yu, Y., Tang, L. & Cao, J. Statistical Relations Between Ionospheric Conductance and Precipitating Electrons Derived From Direct Conjugate Observations. Space Weather 23, (2025).

Maalal, N. D. & Zhang, M. Pitch-angle Focusing and Scattering of TeV Galactic Cosmic Rays Propagating in Local Interstellar Magnetic Fields. Astrophys. J. 992, 46 (2025).

Madarász, M. et al. A deep neural network approach to compact source removal. Astron. Astrophys. 696, A37 (2025).

Madurga-Favieres, V. et al. Pulse profile variations in the accreting X-ray pulsar Vela X-1. Astron. Astrophys. 704, A66 (2025).

Maia, J. S. et al. The Seismogenic Thickness of Venus. J. Geophys. Res.: Planets 130, (2025).

Maniadakis, D. K. et al. How the spin-phase variability of cyclotron lines shapes the pulsed fraction spectra: Insights from 4U 1538–52. Astron. Astrophys. 700, A70 (2025).

Marchetti, D. et al. Computational Science and Its Applications – ICCSA 2025 Workshops, Istanbul, Turkey, June 30 – July 3, 2025, Proceedings, Part XIII. Lect. Notes Comput. Sci. 309–326 (2025) doi:10.1007/978-3-031-97657-5_19.

Marchetti, D., Remote Sensing for Studying Pre-Earthquake Phenomena (Chapter 6), in: Remote Sensing for Geophysicists 125–140 doi:10.1201/9781003485278-12 (2025).

Visitor Publications

Martin, P. et al. Mars Express: From the Launch Pad to a 20-Year Success Record at Mars. Space Sci. Rev. 221, 48 (2025).

Martinović, M. M. et al. Impact of Two-population α-particle Distributions on Plasma Stability. Astrophys. J. Lett. 988, L25 (2025).

Mastroserio, G. et al. X-Ray and Optical Polarization Aligned with the Radio Jet Ejecta in GX 339–4. Astrophys. J. Lett. 978, L19 (2025).

Matteo, S. D. & Villante, U. Simultaneous Occurrence of Magnetospheric Fluctuations at Different Discrete Frequencies (f≈ 1 – 5 mHz): A Review. Space Sci. Rev. 221, 40 (2025).

Maute, A. et al. Challenges and Gaps in Understanding and Monitoring Low-Latitude F-region Plasma Irregularities. Surv. Geophys. 1–46 (2025) doi:10.1007/s10712-025-09917-4.

McCoy, I. L. Does It Matter to the Climate If Trade Cumulus Clouds Cluster? Geophys. Res. Lett. 52, (2025).

McCoy, I. L. et al. Increased dynamic efficiency in mesoscale organized trade wind cumulus clouds. Atmos. Chem. Phys. 25, 16233–16261 (2025).

McMurdo, M., Ballai, I., Verth, G. & Fedun, V. Driven Phase-mixed Alfvén Waves in a Partially Ionized Solar Plasma. Astrophys. J. 988, 50 (2025).

McQueen, Z. C. et al. Using SOFIA's EXES to Search for C6H2 and C4N2 in Titan's Atmosphere. Planet. Sci. J. 6, 287 (2025).

Meng, Y. et al. A criterion for magnetars producing giant flares. Mon. Not. R. Astron. Soc. 540, 319–330 (2025).

Merwe, F. H. van der & Engelbrecht, N. E. Revisiting the Winding Angle of the Heliospheric Magnetic Field: Investigating the Influence of Turbulence. Sol. Phys. 300, 80 (2025).

Micera, A., Verscharen, D., Coburn, J. T. & Innocenti, M. E. Quasi-parallel Antisunward-propagating Whistler Waves Associated with the Electron Deficit in the Near-Sun Solar Wind: Particle-in-cell Simulation. Astrophys. J. 979, 226 (2025).

Milby, Z., Kleer, K. de & Schmidt, C. Detection of New Auroral Emissions at Io and Implications for Its Interaction with the Plasma Torus. Planet. Sci. J. 6, 181 (2025).

Millán, L. et al. Ozone Trends in the Upper Troposphere-Lower Stratosphere Using Equivalent Latitude-Potential Temperature Coordinates. Geophys. Res. Lett. 52, (2025).

Moges, S. T. et al. Characteristics of Atmospheric Gravity Waves and Medium Scale Traveling Ionospheric Disturbances Derived From EISCAT Measurements. J. Geophys. Res.: Space Phys. 130, (2025).

Mokhtari, O. et al. The role of the hot porous layer in the gas flow in the inner coma. Astron. Astrophys. 693, A57 (2025).

Mondal, S., Banerjee, S. & Sorriso-Valvo, L. Emergence of Two Inertial Subranges in Solar Wind Turbulence: Dependence on Heliospheric Distance and Solar Activity. Astrophys. J. 982, 199 (2025).

Monelli, M. et al. Variable stars in Local Group galaxies. Astron. Astrophys. 700, A201 (2025).

Montelius, M. et al. The metal-poor tail of the APOGEE survey. Astron. Astrophys. 704, A44 (2025).

Moreno-Insertis, F., Hansteen, V. H. & Nóbrega-Siverio, D. Magnetic Flux Cancellation in the Solar Atmosphere through 3D Realistic Numerical Modeling. Astrophys. J. 995, 137 (2025).

Morra, G. et al. A benchmark for finite Prandtl number convection: comparison of Boltzmann and Navier–Stokes solutions. Geophys. J. Int. 242, ggaf221 (2025).

Mousavi, A., Roytershteyn, V., Fraternale, F. & Pogorelov, N. Fluctuations Driven by Multicomponent Pickup Ion Distributions in the Outer Heliosheath. Astrophys. J. 980, 95 (2025).

Müller, O. et al. Dwarf galaxies in the MATLAS survey: The satellite system of NGC 474 under scrutiny with MUSE. Astron. Astrophys. 693, A44 (2025).

Muñoz-Echeverría, M. et al. CHEX-MATE: Towards a consistent universal pressure profile and cluster mass reconstruction. Astron. Astrophys. 704, A302 (2025).

Murphy, B. P. et al. Recent Chemo-morphological coma evolution of comet 67P/Churyumov–Gerasimenko. Planet. Space Sci. 268, 106178 (2025).

Nadol, L. & Neukirch, T. An Efficient Method for Magnetic Field Extrapolation Based on a Family of Analytical Three-Dimensional Magnetohydrostatic Equilibria. Sol. Phys. 300, 63 (2025).

Visitor Publications

Nakamura, R. et al. Outstanding Questions and Future Research on Magnetic Reconnection. Space Sci. Rev. 221, 17 (2025).

Nakamura, T., Engrand, C., Zolensky, M., Hamilton, V. E. & Fraeman, A. A. Sample Return Missions: Rosetta Stones Returned from the First Small Bodies in the Solar System. Space Sci. Rev. 221, 44 (2025).

Namekata, K. et al. Do Young Suns Produce Frequent, Massive CMEs? Results from Five-year Dedicated Optical Observations of EK Draconis and V889 Hercules. Astrophys. J. 993, 80 (2025).

Narang, N. et al. Extreme-ultraviolet transient brightenings in the quiet-Sun corona. Astron. Astrophys. 699, A138 (2025).

Nishimura, Y., Lyons, L. R., Gabrielse, C., Donovan, E. F. & Angelopoulos, V. Transition Between Substorm Auroral Onset and Expansion Phase Activity. J. Geophys. Res.: Space Phys. 130, (2025).

Niu, J. Q., Wang, Z., Fu, H. S., Cao, J. B. & Fu, W. D. Observation and Reconstruction of Electron Vortex in Reconnection Outflow. J. Geophys. Res.: Space Phys. 130, (2025).

Noh, S. J. et al. Dual-band Ion-scale Waves in the Solar Wind: Statistical Properties and Comparison with Single-band Ion-scale Waves. Astrophys. J. Lett. 993, L8 (2025).

Noh, S. J. et al. Simultaneous Observation of Ion-scale Wave Packets with Opposite Polarizations and Their Implications on the Generation Region in the Inner Heliosphere. Astrophys. J. 985, 249 (2025).

Norgren, C. et al. Electron and Ion Dynamics in Reconnection Diffusion Regions. Space Sci. Rev. 221, 73 (2025).

Normier, A. et al. A call to address humanity's cosmic footprint. Nat. Astron. 9, 934–935 (2025).

Notsu, Y. et al. A Seven-day Multiwavelength Flare Campaign on AU Mic. III. Quiescent and Flaring Properties of the X-Ray Spectra and Chromospheric Lines. Astrophys. J. 993, 212 (2025).

O'Donoghue, J. et al. Sub-Auroral Heating at Jupiter Following a Solar Wind Compression. Geophys. Res. Lett. 52, (2025).

O'Hare, A. N., Bekker, S., Greatorex, H. J. & Milligan, R. O. Investigating a Characteristic Time Lag in the Ionospheric F-Region's Response to Solar Flares. Atmosphere 16, 937 (2025).

Oberheide, J. et al. Impact of Terrestrial Weather on the Space Weather of the Ionosphere-Thermosphere: Initial Results from a NASA Living with a Star Focused Science Topic. Surv. Geophys. 1–48 (2025) doi:10.1007/s10712-025-09895-7.

Ofman, L. et al. Modeling Hot, Anisotropic Ion Beams in the Solar Wind Motivated by the Parker Solar Probe Observations near Perihelia. Astrophys. J. 984, 174 (2025).

Okui, H. et al. A Convolutional Neural Network for the Detection of Gravity Waves in Satellite Observations and Numerical Simulations. Geophys. Res. Lett. 52, (2025).

Orosei, R. et al. Water Ice in the Subsurface and Polar Caps of Mars. Space Sci. Rev. 221, 126 (2025).

Ouar, I. D. et al. Ionospheric, Thermospheric, Electrodynamic and Magnetic Response to the Annular Solar Eclipse of 14 October 2023: A Multi-Instrumental Study. J. Geophys. Res.: Space Phys. 130, (2025).

Pallister, R., Jeffrey, N. L. S. & Stores, M. Exploring the Origin of Solar Energetic Electrons. II. Investigating Turbulent Coronal Acceleration. Astrophys. J. 983, 58 (2025).

Panetier, E., García, R. A., Breton, S. N., Jiménez, A. & Foglizzo, T. Revisiting the hypothesis of purely stochastic excitation of global p modes in the Sun. Astron. Astrophys. 700, A236 (2025).

Papaioannou, A. et al. Predicting Solar Energetic Particles: Solar Storm Watch - Preparing for Space Odyssey. Space Sci. Rev. 221, 82 (2025).

Papaioannou, A. et al. The High-Energy Protons of the Ground Level Enhancement (GLE74) Event on 11 May 2024. Sol. Phys. 300, 73 (2025).

Park, B., Pitňa, A., Šafránková, J. & Němeček, Z. Modification of the Power Spectral Density of Magnetic Field Fluctuations by Quasi-perpendicular Interplanetary Shocks. Astrophys. J. Lett. 986, L30 (2025).

Partamies, N. et al. First observations of continuum emission in dayside aurora. Ann. Geophys. 43, 349–367 (2025).

Patrick, L. R. et al. Binarity at LOw Metallicity (BLOeM). Astron. Astrophys. 698, A39 (2025).

Pätzold, M. et al. Investigations of the Moon Phobos by Mars Express and Implications Towards Its Origin.

Visitor Publications

Space Sci. Rev. 221, 41 (2025).

Pauli, D. et al. New empirical mass-loss recipe for UV radiation line-driven winds of hot stars across various metallicities. Astron. Astrophys. 697, A114 (2025).

Pedatella, N.M et al. Impact of Increasing Greenhouse Gases on the Ionosphere and Thermosphere Response to a May 2024-Like Geomagnetic Superstorm. Geophys. Res. Lett. 52, (2025).

Perrone, D. et al. Switchbacks and their role in the turbulent cascade: Solar Orbiter observations. Astron. Astrophys. 696, A192 (2025).

Pogorelov, N. V., Fraternale, F., Zank, G. P. & Zhang, M. The Global Structure of the Heliosphere. Astrophys. J. 992, 118 (2025).

Polanco-Rodríguez, F.J. et al., Polarization Ratios of Turbulent Langmuir/ Z -mode Waves Generated by Electron Beams in Magnetized Solar Wind Plasmas. Astrophys. J. Lett. 989, L38 (2025).

Poulain, M. et al. Dwarf galaxies in the MATLAS survey: Hubble Space Telescope observations of nuclear star clusters. Astron. Astrophys. 704, A113 (2025).

Poulain, M. et al. Evidence of star cluster migration and merger in dwarf galaxies. Nature 640, 902–906 (2025).

Povey, A. C., Bulgin, C. E. & Gruber, A. A Practical Introduction to Utilising Uncertainty Information in the Analysis of Essential Climate Variables. Surv. Geophys. 1–31, doi:10.1007/s10712-025-09906-7 (2025).

Przyłuski, R. et al. Disruption of Planetary System Architectures by Stellar Flybys. Universe 11, 240 (2025).

Pulupa, M. et al. Highly Polarized Type III Storm Observed with Parker Solar Probe. Astrophys. J. Lett. 987, L34 (2025).

Qiu, L. & Liu, H. Modeling of Three-Dimensional Structure and Dynamics of the Large-Scale Sporadic E Layers Over East Asia. J. Geophys. Res.: Space Phys. 130, (2025).

Quijada, M. A., Moya, P. S. & Navarro, R. E. Proton-acoustic wave effects on the relaxation of proton transverse heating in magnetized plasmas. Phys. Scr. 100, 105606 (2025).

Raptis, S. et al. Multimission Observations of Relativistic Electrons and High-speed Jets Linked to Shock-generated Transients. Astrophys. J. Lett. 981, L10 (2025).

Rawat, A., Gupta, G., Doorsselaere, T. V., Prasad, S. K. & Erdélyi, R. Understanding the Magnetic Field and Plasma-β along Umbral Fan Loops Traced Using 3 Minute Slow Waves. Astrophys. J. Lett. 988, L26 (2025).

Reda, R. et al. Modeling Decadal and Centennial Solar UV Irradiance Changes. Sol. Phys. 300, 173 (2025).

Reeves, G. D. et al. Multi-Platform Observations of the Radial Penetration of Substorm Injected Electrons and Subsequent Slot-Filling Event. J. Geophys. Res.: Space Phys. 130, (2025).

Remya, B. et al. (Un)Explained EMIC Waves: Understanding Quiet Time EMIC Wave Drivers. J. Geophys. Res.: Space Phys. 130, (2025).

Richard, L. et al. Non-Maxwellianity of ion velocity distributions in the Earth's magnetosheath. Phys. Rev. E 112, L053201 (2025).

Ricketts, A., Clouter-Gergen, B. A., Georgiou, A., Berhanu, D. & Morrissey, L. S. Surface Binding Energies for Amorphous Plagioclase Feldspar Calculated Using Molecular Dynamics. Planet. Sci. J. 6, 244 (2025).

Roberts, K. et al. Spatiotemporal Variations of Temperature in Jupiter's Upper Atmosphere. Planet. Sci. J. 6, 92 (2025).

Roquette, J. et al. The NEMESIS catalogue of young stellar objects for the Orion star formation complex. Astron. Astrophys. 702, A63 (2025).

Roth, L. et al. Mass Supply from Io to Jupiter's Magnetosphere. Space Sci. Rev. 221, 13 (2025).

Roychowdhury, T. et al. Photometric Constraints on Intermediate-mass Black Holes in the Galactic Centre. Publ. Astron. Soc. Pac. 137, 114102 (2025).

Roytershteyn, V. et al. Magnitude of Short-wavelength Electric Field Fluctuations in Simulations of Collisionless Plasma Shocks. Astrophys. J. 992, 104 (2025).

Rubino, S. et al. Space weathering on Vesta: Ion bombardment induced changes on HEDs in visible and infrared reflectance. Icarus 442, 116755 (2025).

Visitor Publications

Runov, A., Angelopoulos, V., Artemyev, A. V., Shi, X. & Gabrielse, C. Prolonged Intervals of Relativistic Electron Storm-Time Flux Enhancements in the Magnetotail at Lunar Distance. Geophys. Res. Lett. 52, (2025).

Saha, C., Mukhopadhyay, S. & Nandy, D. On the Origin of Long-term Modulation in the Sun's Magnetic Activity Cycle. Astrophys. J. Lett. 984, L5 (2025).

Samra, J., Zanna, G. D., Flores, C. E., Madsen, C. & DeLuca, E. New Near-infrared Coronal Lines Observed during the 2019 Total Solar Eclipse. Astrophys. J. 992, 145 (2025).

Santos, A. R. G. et al. Magnetic braking and dynamo evolution of β Hydri. Astron. Astrophys. 698, L23 (2025).

Santos, A. R. G. et al. Signature of spin-down stalling in stellar magnetic activity. Astron. Astrophys. 697, A177 (2025).

Sarah, C. et al. Earth observations for climate adaptation: tracking progress towards the Global Goal on Adaptation through satellite-derived indicators. npj Climate and Atmospheric Science 8, 359 (2025).

Sato, K. et al. Causes of the Abnormally Strong Easterly Phase of the Mesopause Semiannual Oscillation During the March Equinox of 2023 Revealed by a New Reanalysis Data Covering the Entire Middle Atmosphere. Geophys. Res. Lett. 52, (2025).

Saxena, H. et al. CHEX-MATE: The impact of triaxiality and orientation on Planck SZ cluster selection and weak lensing mass measurements. Astron. Astrophys. 700, A128 (2025).

Schechter, P. L. & Schnittman, J. D. Basic Elements of Strong Gravitational Lensing. Space Sci. Rev. 221, 49 (2025).

Schönbächler, M. et al. Initial Conditions of Planet Formation: Time Constraints from Small Bodies and the Lifetime of Reservoirs in the Solar Protoplanetary Disk. Space Sci. Rev. 221, 97 (2025).

Schröder, D.L. et al. H. Heat-flux Instabilities of Regularized Kappa Distributed Strahl Electrons Resolved with ALPS. Astrophys. J. 987, 110 (2025).

Setton, D. J. et al. Little Red Dots at an Inflection Point: Ubiquitous V-shaped Turnover Consistently Occurs at the Balmer Limit. Astrophys. J. 995, 118 (2025).

Sharma, R. et al. Potential Subsurface Lava Tube Skylight on the Western Flank of Elysium Mons, Mars. Astron. J. 169, 245 (2025).

Sharma, R. et al. Water-driven Accessible Potential Karstic Caves in Hebrus Valles, Mars: Implications for Subsurface Habitability. Astrophys. J. Lett. 993, L36 (2025).

Shay, M. et al. Simulation Models for Exploring Magnetic Reconnection. Space Sci. Rev. 221, 81 (2025).

Shen, C. et al. Modeling of Ionization and Recombination Processes in Plasma with Arbitrary Non-Maxwellian Electron Distribution. Astrophys. J. 988, 151 (2025).

Shen, F. et al. Wave-current interaction on turbulence mixing and sediment resuspension in muddy tidal flats. Estuar., Coast. Shelf Sci. 314, 109141 (2025).

Shi, G. et al. New insights into the polar ozone and water vapor, radiative effects, and their connection to the tides in the mesosphere–lower thermosphere during major sudden stratospheric warming events. Atmos. Chem. Phys. 25, 9403–9430 (2025).

Shi, X. et al. Statistical Characterization of Joule Heating Associated With Ionospheric ULF Perturbations Using SuperDARN Data. J. Geophys. Res.: Space Phys. 130, (2025).

Shprits, Y. Y., Haas, B. & Wang, D. Low-density plasma as a key catalyst for electron acceleration in the Van Allen radiation belts. Commun. Phys. 8, 314 (2025).

Sicignano, T. et al. The VMC Survey. Astron. Astrophys. 699, A370 (2025).

Silva, S. S. A. et al. Global Compressive Oscillations in the Outer Solar Corona Driven by an Extreme Coronal Mass Ejection. Astrophys. J. Lett. 994, L27 (2025).

Silwal, A. et al. Evolution of Solar Wind Turbulence during Radial Alignment of Parker Solar Probe and Solar Orbiter in 2022 December. Astrophys. J. Suppl. Ser. 278, 40 (2025).

Sioulas, N. et al. Higher-order Analysis of Three-dimensional Anisotropy in Imbalanced Alfvénic Turbulence. Astrophys. J. 993, 142 (2025).

Skirvin, S. J., Fedun, V., Verth, G. & Ballai, I. 3D Magnetohydrodynamic Wave Propagation and Energy Transport in a Simulated Solar Vortex. Astrophys. J. 988, 18 (2025).

Smethurst, R. J. et al. Galaxy Zoo JWST: up to 75 per

cent of discs are featureless at 3 < z < 7. Mon. Not. R. Astron. Soc. 539, 1359–1371 (2025).

Smirnov, A. et al. Bridging the Gap Between the Earth's Ionosphere and Plasmasphere. Geophys. Res. Lett. 52, (2025).

Snodgrass, C. et al. First JWST spectrum of distant activity in long-period comet C/2024 E1 (Wierzchos). Mon. Not. R. Astron. Soc.: Lett. 541, L8–L13 (2025).

Snow, B., Osborne, C. & Hillier, A. S. Observational signatures of mixing-induced cooling in the Kelvin–Helmholtz instability. Mon. Not. R. Astron. Soc. 537, 1904–1911 (2025).

Sola, E. et al. Low surface brightness structures from annotated deep CFHT images: effects of the host galaxy's properties and environment. Mon. Not. R. Astron. Soc. 541, 3015–3042 (2025).

Somma, G. D. et al. Spatial Age Distribution of Classical Cepheids in Spiral Galaxies: The Cases of M31 and M33. Astrophys. J. Lett. 984, L60 (2025).

Sossi, P. A. et al. Physicochemical Controls on the Compositions of the Earth and Planets. Space Sci. Rev. 221, 118 (2025).

Srivastava, S., Chatterjee, P., Dey, S. & Erdélyi, R. The Relation between Solar Spicules and Magnetohydrodynamic Shocks. Astrophys. J. 989, 39 (2025).

Stallard, T. S. et al. Dominant Trends in Jupiter's H3+ Northern Aurora: II. Magnetospheric Mapping. J. Geophys. Res.: Space Phys. 130, (2025).

Stephan, C. C. et al. Perspectives and Challenges in High-Resolution Whole-Atmosphere Modeling. Surv. Geophys. 1–32, (2025).

Stierhof, J. J. R. et al. Don't torque like that. Astron. Astrophys. 698, A308 (2025).

Stoll, K. et al. Can ECH Wave Scattering Explain the Unaccounted Electron Loss During the 17 March 2013 Geomagnetic Storm? J. Geophys. Res.: Space Phys. 130, (2025).

Stricklan, A., Waters, T. & Klimchuk, J. On the Stability Analysis of Astrophysical Cooling Functions. Astrophys. J. 992, 101 (2025).

Stumpo, M. et al. In-depth Analysis of the 2022 March 28 3He-rich Solar Energetic Particle Event. Astrophys. J. 987, 80 (2025).

Tang, X. et al. Migration in the Khonsu Region of Comet 67P/Churyumov–Gerasimenko. Astrophys. J. 979, 91 (2025).

Tissot, F. L. H. et al. Infall and Disk Processes – the Message from Meteorites. Space Sci. Rev. 221, 85 (2025).

Titov, D. et al. Mars Science and Exploration After Mars Express. Space Sci. Rev. 222, 3 (2025).

Tobie, G. et al. Tidal Deformation and Dissipation Processes in Icy Worlds. Space Sci. Rev. 221, 6 (2025).

Toni, G. et al. The COSMOS-Web deep galaxy group catalog up to z = 3.7. Astron. Astrophys. 697, A197 (2025).

Tsiapalis, A., Zsámberger, N. K., Asztalos, B. & Erdélyi, R. Nonparallel Wave Propagation in an Asymmetric Magnetic Slab. Astrophys. J. 988, 38 (2025).

Turchi, A. et al. Survey of Surveys. Astron. Astrophys. 700, A195 (2025).

Urbano, M. et al. Euclid: Early Release Observations of diffuse stellar structures and globular clusters as probes of the mass assembly of galaxies in the Dorado group. Astron. Astrophys. 700, A104 (2025).

Verkercke, S. et al. A Thermal Origin to the Asymmetry of the Permanent Dust Cloud at the Moon. J. Geophys. Res.: Planets 130, (2025).

Verkercke, S. et al. On the Origins of Mercury's Sodium Exospheric Cold Poles Enhancement: A Multiscale Exosphere Global Model. J. Geophys. Res.: Planets 130, (2025).

Wambsganss, J. et al. Strong Gravitational Lensing – Editorial. Space Sci. Rev. 221, 77 (2025).

Wang, B. et al. Field-Aligned Currents Induced by Magnetopause Motions Under Pressure Perturbations. Geophys. Res. Lett. 52, (2025).

Wang, B. et al. RUBIES: JWST/NIRSpec Confirmation of an Infrared-luminous, Broad-line Little Red Dot with an Ionized Outflow. Astrophys. J. 984, 121 (2025).

Wang, J. et al. Direct Kelvin-Helmholtz Instability Detection at the Ionospheric E Region Electron Density. Geophys. Res. Lett. 52, (2025).

Wang, X. et al. Dynamics of Ultra-Relativistic Electrons on 19 December 2015: Combinations of Adiabatic and Non-Adiabatic Effects. J. Geophys. Res.:

Visitor Publications

Space Phys. 130, (2025).

Wang, Y. et al. Numerical Simulation of Oscillatory Magnetic Reconnection Modulated by Solar Convective Motions. Astrophys. J. 987, 148 (2025).

Wang, Z.-F. et al. Observation-based Iterative Map for Solar Cycles. I. Nature of Solar Cycle Variability. Astrophys. J. 984, 183 (2025).

Warmuth, A. et al. CoSEE-Cat: A Comprehensive Solar Energetic Electron event Catalogue obtained from combined in situ and remote-sensing observations from Solar Orbiter. Astron. Astrophys. 701, A20 (2025).

Wei, Z. et al. Loss Cone Offset Method for Evaluating the Effect of Magnetic Field Line Curvature Scattering (FLCS). J. Geophys. Res.: Space Phys. 130, (2025).

Weibel, A. et al. RUBIES Reveals a Massive Quiescent Galaxy at z = 7.3. Astrophys. J. 983, 11 (2025).

Weng, S. et al. ALMACAL – XIV. X-Shooter spectroscopy, infrared properties, and radio SEDs of calibrators. Mon. Not. R. Astron. Soc. 539, 1977–2020 (2025).

Wijsen, N. et al. Freely propagating flanks of wide coronal-mass-ejection-driven shocks: Modelling and observational insights. Astron. Astrophys. 699, A51 (2025).

Wilde, M. D. et al. Synthesizing Sun-as-a-star flare spectra from high-resolution solar observations. Astron. Astrophys. 700, A275 (2025).

Willatt, R. et al. Ku- and Ka-Band Polarimetric Radar Waveforms and Snow Depth Estimation Over Multi-Year Antarctic Sea Ice in the Weddell Sea. Geophys. Res. Lett. 52, (2025).

Williams, C. C. et al. The PANORAMIC Survey: Pure Parallel Wide Area Legacy Imaging with JWST/NIRCam. Astrophys. J. 979, 140 (2025).

Woolliams, E. et al. A Metrological Framework for Addressing Uncertainty in Satellite and In Situ Earth Environmental Observations. Surv. Geophys. 1–39 (2025) doi:10.1007/s10712-025-09916-5.

Wu, H. et al. A new scenario with two subranges in the inertial regime of solar wind turbulence. Astron. Astrophys. 697, A187 (2025).

Xie, Q., Liu, J., Nelson, C. J., Erdélyi, R. & Wang, Y. Photospheric Swirls in a Quiet-Sun Region. Astrophys. J. 979, 27 (2025).

Xu, Y. D., Li, G. & Yao, S. Electron Acceleration at Shock Ripples: Role of Pitch-angle Diffusion. Astrophys. J. 988, 67 (2025).

Yamazaki, Y. et al., Atmospheric Semidiurnal Solar Tide Response to Sudden Stratospheric Warmings in the JAGUAR-DAS Whole Neutral Atmosphere Reanalysis (JAWARA) During 2004–2023. J. Geophys. Res.: Space Phys. 130, (2025).

Yan, Y. et al. Storm-Time Ring Current Plasma Pressure Prediction Based on the Multi-Output Convolutional Neural Network Model. Space Weather 23, (2025).

Yang, S. et al. Relative Alpha in the Magnetohydrodynamics with Open Magnetic Field Boundary and Its Application to the Solar Eruption. Astrophys. J. 980, 206 (2025).

Yeates, A. R., Bertello, L., Pevtsov, A. A. & Pevtsov, A. A. Latitude Quenching Nonlinearity in the Solar Dynamo. Astrophys. J. 978, 147 (2025).

Younas, W. et al. Spatio-Temporal Evolution of Mid-Latitude GPS Scintillation and Position Errors During the May 2024 Solar Storm. J. Geophys. Res.: Space Phys. 130, (2025).

Zanna, G. D. & Dayananda, S. H. Reduced atomic models for large-scale computations: Fe xiii near-infrared lines. Mon. Not. R. Astron. Soc. 537, 3781–3791 (2025).

Zanna, G. D. The middle corona – resonant photoexcitation in EUV lines. Mon. Not. R. Astron. Soc. 543, 390–406 (2025).

Zaqarashvili, T.V. et al. Magnetohydrodynamic shallow water equations with the alpha effect: Rossby-dynamo waves in solar–stellar tachoclines. Astron. Astrophys. 703, A190 (2025).

Zhang, C. et al. A Remote Brightening from Interactions between an Extreme-ultraviolet Jet and a Magnetic Null. Astrophys. J. Lett. 995, L11 (2025).

Zhang, C. et al. Multiple Episodes of Remote Brightenings Driven by a Coronal Extreme-ultraviolet Jet on the Sun. Astrophys. J. 979, 180 (2025).

Zhang, J. et al. Tidal Amplification in the Lower Thermosphere During the 2003 October–November Solar Storms. J. Geophys. Res.: Space Phys. 130, (2025).

Zhao, B. et al. Simultaneous Observation of Duskside

and Dawnside Subauroral Polarization Streams During an Intense Magnetic Storm. Geophys. Res. Lett. 52, (2025).

Zhao, S., Shi, X. & Lei, H. ThermoONet: Deep learning-based small-body thermophysical network. Astron. Astrophys. 698, A184 (2025).

Zhu, Y. et al. Active region upflows in various coronal structures and their coupling to the lower atmosphere. Astron. Astrophys. 701, A205 (2025).

Zoennchen, J. H. & Cucho-Padin, G. The response of exospheric neutral hydrogen to weak geomagnetic disturbances between June 12 and 29, 2008. Front. Astron. Space Sci. 12, 1536249 (2025).

Zuo, X. et al. Sequential Ejections of Plasma Blobs Due to Unbraiding of Tangled Loops in the Solar Atmosphere. Astrophys. J. 985, 17 (2025).

Zwick, L. et al. Bridging the micro-Hz gravitational wave gap via Doppler tracking with the Uranus Orbiter and Probe mission: Massive black hole binaries, early Universe signals, and ultralight dark matter. Phys. Rev. D 112, 083029 (2025).

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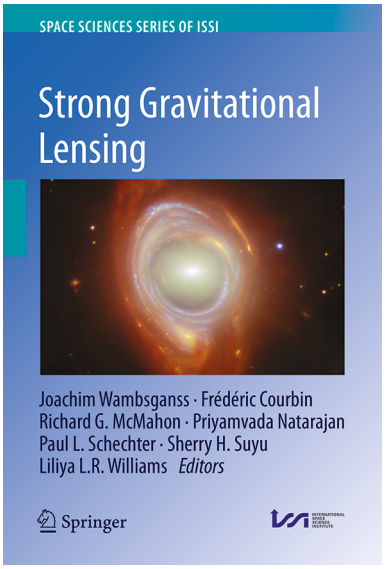

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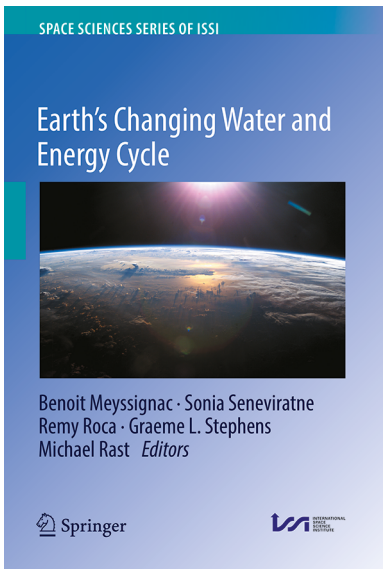

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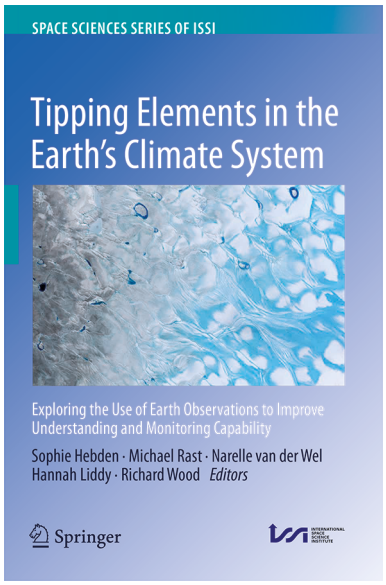

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