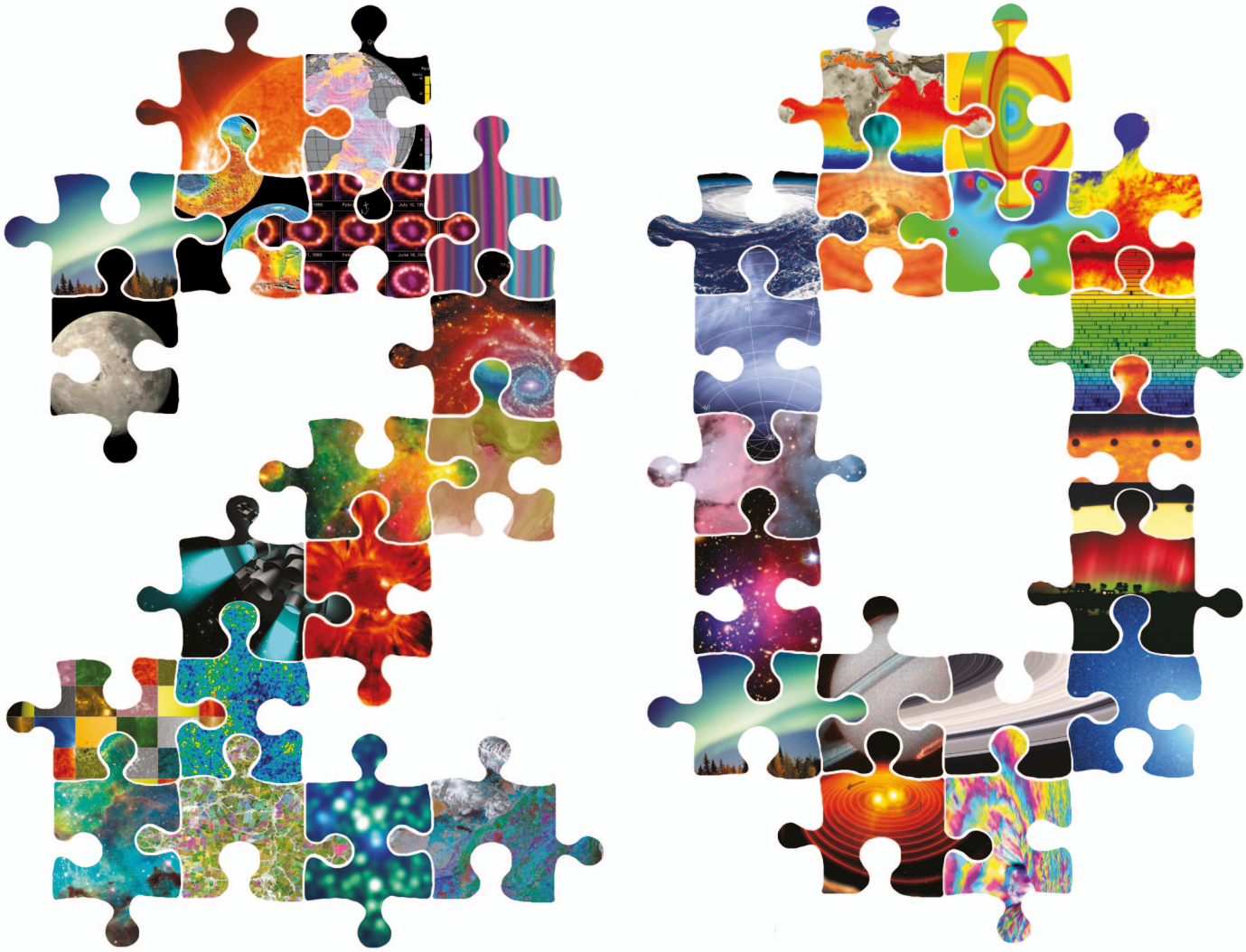
INTERNATIONAL
SPACE
SCIENCE
INSTITUTE



2014
2015 Annual Report

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The International Space Science Institute (ISSI) is an Institute of Advanced Studies where scientists from all over the world meet in a multi- and interdisciplinary setting to reach out for new scientific horizons. The main function is to contribute to the achievement of a deeper understanding of the results from different space missions, ground based observations and laboratory experiments, and adding value to those results through multidisciplinary research. The program of ISSI covers a widespread spectrum of disciplines from the physics of the solar system and planetary sciences to astrophysics and cosmology, and from Earth sciences to astrobiology.

From the Board of Trustees

One year ago the undersigned was appointed by the President as secretary of the Board, succeeding Kathrin Altwegg who had served in that capacity for six years. In the name of the entire Board I thank her for her commitment and wish her best of luck for the Rosetta mission, which understandably takes her full attention and capacity at this time. Little did I anticipate that less than one year later I would have to write these notes.

Shortly before the last meeting of the Board of Trustees Urs Würgler, who had been elected as the new President two years ago, had to be hospitalized and could not chair the meeting. In the meantime his health has even forced him to step down from his presidency. Currently the Board is led by its Vice-President, Rosine Lallement, and will congregate in October to elect a new President. The Board and the Institute have full understanding that health is now the highest priority for our former President and thank him for two years of service, which were marked by an excellent collaboration between all partners, and wish him a good recovery.

The previous meeting, in November 2014, marked the end of Hans Balsiger's service to ISSI as a Board member. He was on board of ISSI since the very first day, as an elected Board and Science Committee member and later as Vice-President and representative of the University of Bern. His merits in the upbringing of the young start-up to a mature institute cannot be overestimated, and the President, Board, and Institute all thank him for his continuous and vigorous support over the past nearly two decades.

Following Hans Balsiger's retirement from the Board he was replaced internally by Willy Benz as the representative of the University of Bern and by Rosine Lallement as Vice-President. His vacant seat was filled together with the one of Risto Pellinen, who had retired from the Board back in 2013, by Johan Bleeker from the SRON in Utrecht and by Jean-Pierre Swings from the University of Liège. Other notable Board decisions in the past year include the renewal of the partnership agreement with the National Space Science Center of China regarding the continuation of ISSI-Beijing for three years.

In February we received notice of the passing of Hanspeter Schneiter, the first President of ISSI. As then CEO of the Space Unit of Oerlikon-Contraves (later Contraves Space and now part of RUAG) he managed to secure an endowment from his company for creating ISSI as a foundation. He then led the Board as its chairman for more than a decade until passing the torch in 2008. We will always remember Hanspeter Schneiter as one of the founding fathers of our institute and instrumental personality in its successful upbringing.

As already apparent from its cover this is the twentieth annual report of ISSI. On this occasion the report includes, apart from its regular matters, a special foldout section with testimonials from about twenty personalities that all have played an essential role in ISSI's history. These are adorned with interesting facts and figures and with a timeline of important events and achievements during that time. We believe that the momentum that ISSI has received from its 4486 visitors during the first two decades will carry the institute further into a bright future.

Rudolf von Steiger
Secretary of the Board of Trustees

This year ISSI has completed its first twenty years of existence. Unlike for a human baby it is difficult to say exactly when it was born. This may have been in January 1995 when the Foundation was instated, or in May when it started operating in a basement office at the Physikalisches Institut of the University of Bern, or in September when it moved to its current premises on Hallerstrasse, but probably the most memorable event was the inaugural dinner that concluded the first Workshop in November. Sir Herman Bondi gave the keynote address (reproduced on page 1 of Vol. 1 of the Space Sciences Series of ISSI), in which he told the story of a man who had purchased a parrot of supposedly particularly high intelligence. Yet when the bird had not spoken a single word of wisdom in two weeks and the man went to complain to the shop, all he was told was that "the parrot is a thinker, not a talker". Of course the morale of the story was that all science is moot without communication, and it is ISSI's role to facilitate the communication between scientists. It is not for us to assess whether or not the institute has fulfilled this mandate in the past two decades. That's why we have asked a number of personalities who were involved in the creation and early evolution of ISSI for brief statements about their recollections. These are compiled in a special centerfold in this annual report, together with a timeline of ISSI's history and a few key numbers. Together this special section should provide a concise synopsis of twenty years of ISSI.

Changing focus back to the past year, the ISSI program had an unprecedented six Workshops, three Working Group meetings, 74 International Team meetings, and one Forum, all described in more detail in the subsequent pages. Together they brought us 922 visitors, 35 % of which were coming for the first time, thus demonstrating ISSI's continual ability to reach new segments of the space science community every year. The publication record has also grown, this time by three volumes in the Space Sciences Series, and the impact factor of Space Science Reviews (from which the ISSI volumes are reprinted) has increased further from 5.9 to 6.3. Twenty years ago that number oscillated somewhere between 1 and 2, and it is probably not least due to ISSI that the journal is now firmly established among the top ten in astronomy and space science.

Like every year preparations for the future program were an important item on the ISSI agenda, but this year they were more intense than usual. There was the usual call for International Teams, this time responded with 83 proposals, 32 of which could be selected for implementation (2 joint with and 3 fully at ISSI-Beijing), and there were several convenors meetings for future Workshops. In addition a new three-year contract with the ESA Earth Science Directorate could be secured and negotiations with the High-Level Space Policy Advisory Committee of ESA (HISPAC) for a contract to hold one joint Workshop and Forum per year are progressing well. ISSI also participated in the Europlanet proposal to the H2020 call of the European Commission, which was successful and will run for four years. Moreover the partnership agreement with Russia could be reinstated and is now with the Space Research Institute of the Russian Academy, IKI. Then a new partnership agreement was established for three years with the National Space Science Center of China regarding the continuation of ISSI-BJ, after an external review covering the first two years. Finally an agreement of cooperation is currently negotiated with JAXA/ISAS in Japan, and similar agreements may follow with other partners. All these agreements are important not only for establishing and broadening the international basis of ISSI, but also for helping to counteract the dwindling exchange rate of the Euro relative to the Swiss Franc, which has resulted in a loss of about 8 % in the budget last year.

The ISSI staff has remained unchanged in the past year, but the premises have undergone a modest enlargement by four offices and a small meeting area on the fourth floor of the same building. This will give us a little more flexibility in welcoming visitors, not least the first Johannes Geiss fellow, George Gloeckler, who was selected in a competitive process from 27 candidates and whom we are looking forward to welcoming in the forthcoming year.

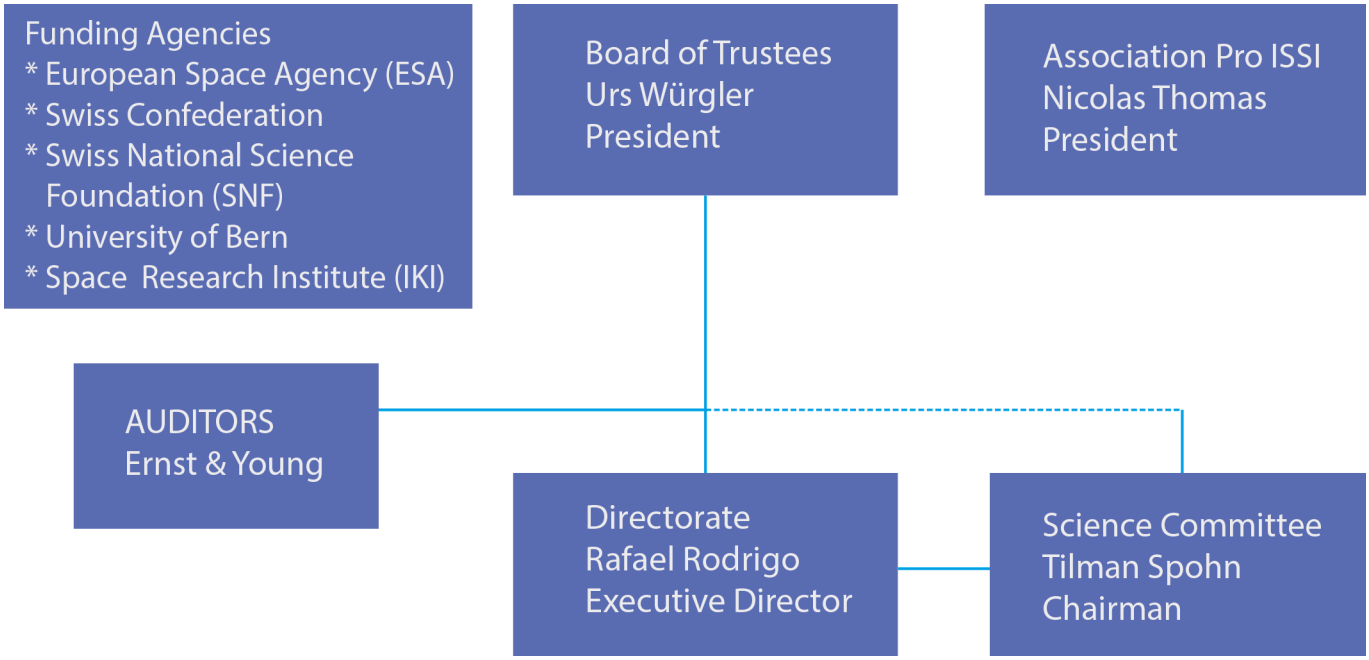

Rafael Rodrigo


Rudolf von Steiger


Anny Cazenave


John Zarnecki

About the International Space Science Institute



The International Space Science Institute (ISSI) is a nonprofit organization 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 RUAG. 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 National Science Foundation (SNF) provide the financial resources for ISSI's operation. The University of Bern contributes through a grant to a Director and in-kind facilities. The Space Research Institute (IKI) is supporting ISSI with an annual financial contribution. Details can be found on page 11. ISSI received tax-exempt status from the Canton of Bern in May 1995.

ISSI's **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 Founder, and of the funding Institutions. Furthermore the Board of Trustees may nominate up to five personalities representing the national and international science community, space industry and space politics for terms of three years. The Board of Trustees is presided over by Urs Würgler.

The **Science Committee**, chaired by Tilman Spohn, is made up of internationally known 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 Rafael Rodrigo (Executive Director), Rudolf von Steiger (University of Bern), Anny Cazenave (CNES Toulouse, France) and John Zarnecki (The Open University, Milton Keynes, UK).

The **Association Pro ISSI**, founded in spring 1994, counts 134 members. Pro ISSI promotes the idea of ISSI by organizing public lectures, where internationally known scientists introduce their results. Summaries of these talks are published in the journal SPATIUM. Member benefits include invitation to lectures and a free subscription to SPATIUM. The Board of the Association Pro ISSI is presided over by Nicolas Thomas.

row from left to right:
Rudolf von Steiger, Director, International Space Science Institute, Bern, Switzerland (Secretary of the Board)
Daniel Neuenschwander, Swiss Space Office, Bern, Switzerland
Rafael Rodrigo, Executive Director, International Space Science Institute, Bern, Switzerland
Nicolas Thomas, President of the Association Pro ISSI, Bern, Switzerland
Lennard A. Fisk, University of Michigan, Ann Arbor, USA
Rosine Lallement, Observatoire de Paris-Meudon, France (Vice Chairman)
Alvaro Giménez, ESA, Paris, France
Willy Benz, University of Bern, Switzerland
André Maeder, Observatoire de Genève, Sauverny, Switzerland

missing from the picture:
Urs Würgler, Bern, Switzerland (Chairman)
Daniel Fürst, RUAG, Zurich, Switzerland
Wu Ji, National Space Science Center (CAS) and International Space Science Institute Beijing, China
Sergio Volonté, Former Head of the Planning and Coordination Office in the Science and Robotic Exploration Directorate, ESA, Paris, France (retired)
Lev M. Zelenyi, IKI, Russian Academy of Sciences, Moscow, Russia

The Science Committee

from left to right:
Tilman Spohn, German Aerospace Center (DLR), Berlin, Germany (Chairman)
Vladislav Izmodenov, IKI, Russian Academy of Sciences, Moscow, Russia (ex officio RAS)
Athéna Coustenis, Observatoire de Paris-Meudon, France
Andrei Bykov, Russian Academy of Sciences, St. Petersburg, Russia
Georges Meylan, Ecole Polytechnique Fédérale de Lausanne, Switzerland*
Michael Rast, ESA ESRIN, Frascati, Italy (ex officio ESA)
Richard Marsden, ESTEC ESA, Noordwijk, The Netherlands (ex officio ESA)
Lennart Bengtsson, University of Reading, United Kingdom
Hugh Hudson, Space Sciences Laboratory, University of California, USA*
Xiaolong Dong, International Space Science Institute Beijing, China (ex officio)

missing from the picture:
Masaki Fujimoto, Japan Aerospace Exploration Agency, Sagamihara, Japan
Joanna D. Haigh, Imperial College London, United Kingdom*
Luisa M. Lara, Instituto de Astrofisica de Andalucia, CSIC, Granada, Spain
Mark McCaughrean, ESTEC ESA, Noordwijk, The Netherlands (ex officio ESA)
Rumi Nakamura, Space Research Institute, Graz, Austria
Luigi Stella, INAF, Rome, Italy
Stéphane Udry, Observatoire de Genève, Sauverny, Switzerland
Lidia van Driel-Gesztelyi, MSSL, University College London, Dorking, United Kingdom
Marco Velli, NASA Jet Propulsion Laboratory, Pasadena, USA

* Membership ended on 30 June 2015

from left to the right:
Andrea Fischer, Editorial Assistant
Veerle Sterken, Post Doctoral Scientist
Andrei Bykov, Discipline Scientist
Anny Cazenave, Director
Saliba F. Saliba, Computer Engineer and System Administrator
Rafael Rodrigo, Executive Director
Johannes Geiss, Honorary Director
Rudolf von Steiger, Director
Roger-Maurice Bonnet, Senior Discipline Scientist
Nicolas Champollion, Post Doctoral Scientist
Maurizio Falanga, Science Program Manager
Silvia Wenger, Assistant to the Executive Director
Vittorio De Falco, PHD Student
Michel Blanc, Discipline Scientist
Jennifer Fankhauser, Secretary
Irmela Schweizer, Librarian
Greta Kurpicz, Part-Time Secretary

missing from the picture:
John Zarnecki, Director

All lists show the status at the end of the twentieth business year on 30 June 2015.

Facilities

Picture showing ISSI's Meeting Point and Reception.

Since February 2015, ISSI has been renting half of the 4th floor with additional 93m^2.This gives ISSI four more working offices and a small conference room. To facilitate the expansion of the 4th floor, ISSI had to buy the following items:
- A new color printer
- A new info screen TV with Apple TV.

The info screen TVs on both the 1st and 4th floor are synchronized by one computer. This allows the same information to be displayed on both info screen TVs at the same time.
Furthermore the ISSI Ethernet network had to be extended to the 4th floor. Hence extra Ethernet cables had to be bought and installed from the 1st to the 4th floor.

The ISSI facilities now offer an area of 800 m^2 on three floors, consisting of office space for staff members, two conference rooms, two seminar rooms (up to 40 participants each), two smaller rooms for the visiting teams (one room for up to 14 and the other room for up to 10 participants), and five offices for visiting scientists. All rooms are equipped with high speed network connections including wireless, some of them have printers and projectors for large screen presentation. There is also a big coffee and reading area as a favorite meeting point for the visitors.

The 20th business year also saw a major change on the carpets' side. ISSI replaced all the carpets in the offices, seminar room and conference room on the 1st floor.

Among other items bought during the 20th business year are: new computers (3 Macs, 1 Windows), 1 printer, info screen TV, other computer accessories, etc.

ISSI's workgroup domain network is a part of the University's local area network, so that its resources (e.g., Linux cluster server, grid server, license server and special peripherals) are available as well. With the locally installed computer peripherals, the Institute's staff and guest scientists are able to perform most computing tasks and access the Internet. The network consists of the following:

- Two servers – Linux (Ubuntu 14.04.2 server) and Mac (10.6 server)
- Five Windows workstations one of which runs Windows 8.1
- Seven Mac workstations running Mac OS 10.6 - 10.10
- 14 laptops (five Windows and nine Macs)
- Seven printers, two of which are color
- Six projectors (four fixed on the ceiling and two mobile ones)
- Two wireless access points
- One digital video camera, one still camera and one scanner

ISSI's software packages are regularly updated. These software packages provide access to the large scientific packages (such as IDL, Matlab, Grapher, ArcView GIS, ISIS, and Maple) either locally or by connecting to the University's license server. This provides a heterogeneous workstation environment in the Institute.

Several conference rooms and guest offices are available for our visitors, teams and workshops. These are all equipped with high speed network connections (partly wireless), some of them also have printers and projectors for large screen presentation.

Please feel free to visit our up to date website www.issibern.ch for more information.

The 20th financial year of ISSI ended with a deficit of about 38 kCHF, as opposed to a budgeted deficit of 186 kCHF. This better result is all the more surprising as there has been a hefty loss of more than 250 kCHF due to the lower exchange rate of the Euro to the Swiss Franc. It is due to two unforeseen effects that helped to reduce the deficit: First, unexpected incomes were received from IKI, replacing the one from the Russian Academy that had ended due to their reorganization, and a late payment from the Europlanet network under the FP7 program of the European commission. Second, the expenditures for Workshops, Working Groups, Teams and Visitors were lower than budgeted. This was not because of fewer activities in the current year, though, but due to reversed accruals made for Teams in 2011-13 that had not been fully used. All other expense items were close to or somewhat below budget. The mentioned deficit is covered by positive results from previous years.

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 the University through in-kind contributions such as Internet connectivity etc.

Statement of Operations (in CHF) for the 20th Financial Year (1.7.2014-30.6.2015)

	Expenses	Revenues	
ESA Science Directorate		1'350'713.00	
ESA Earth Observation Programme		317'337.00	
ESA HISPAC		0.00	
Swiss Confederation		920'000.00	
EuroPlaNet		52'179.25	
Russian Academy of Sciences / IKI		75'000.00	
Other income [3]	88'811.45		
Salaries and related costs [1]	1'305'154.13		
Fixed costs	263'652.90		
Operating costs [2]	202'755.30		
Investment (depreciated)	25'630.89		
Workshops, Working Groups, Teams, Visiting Scientists (ISSI funded) [4]	867'318.53		
Result of the Year		38'093.95	
Subtotal	**2'753'323.20**	**2'753'323.20**	*Audited by Ernst & Young, Bern*
Swiss National Science Foundation (SNF) [5]		194'399.50	
Workshops, Working Groups, Teams, Visiting Scientists (SNF funded)	194'399.50		
Total	**2'947'722.70**	**2'947'722.70**	*Audited by SNF*

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 organizational, editorial, and administrative tasks.

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

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

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

[5] **SNF:** Grant from Swiss National Science Foundation to R. von Steiger and related expenses.

The Association Pro ISSI

Stephan Ulamec and Nicolas Thomas, President of the Association Pro ISSI. Stephan Ulamec talked about "the event" of the year 2014: the landing of Philae on Comet 67P/Churyumov–Gerasimenko.

The Pro ISSI Association was founded in 1994 under Swiss law with the goals to create a Space Science Institute in Switzerland, and to communicate the fascinating results of space sciences to the Swiss public. With the creation of the Foundation International Space Science Institute (ISSI) in 1995 the first objective had been reached. Pro ISSI focuses now on providing a bridge between leading space scientists and its members, representing universities, industry, politics and public administration. The Association offers public lectures on new insights in space science, and publishes 2-3 SPATIUM issues per year. The Pro ISSI Association, which counts presently 134 members, meets once per year for its general assembly. The Board of Pro ISSI consists of Nicolas Thomas (President), Adrian Jäggi (Vice President), Hansjörg Schlaepfer (Editor Spatium), Frank Rutschmann (Treasurer) and Silvia Wenger (Secretary).

Public Lectures

Pro ISSI organized three public lectures in the period of this report:

The General Assembly was held on 22nd October 2014 and was followed by a lecture by Stefan Jordan, Astronomisches Recheninstitut am Zentrum für Astronomie der Universität Heidelberg, Germany on "GAIA: Die Vermessung der Milchstrasse" which addressed ESA's mapping of the Milky Way using the astrometric measurements of the GAIA spacecraft. He provided a fascinating glimpse into the precision obtained with the mission.

On 25th March 2015, Frank Postberg, Institut für Raumfahrtsysteme, University Stuttgart, Germany spoke about "Ein Salzwasserozean im äusseren Sonnensystem: Die Raumsonde Cassini erforscht den spektakulären Saturnmond Enceladus". He presented the latest studies about the activity observed on Enceladus and whether this provided evidence for sub-surface liquid water. The talk included work published only a few days earlier in Nature magazine.

On 27th May 2015, Stephan Ulamec from the Deutsches Zentrum für Luft- und Raumfahrt (DLR), Köln, Germany, took as his title, "Philae, Landung auf dem Kometen Churyumov-Gerasimenko" where he discussed the Rosetta mission and specifically the lander, Philae. At the time of his presentation, it was not known whether Philae would wake-up again. Only 2 weeks later, the Rosetta orbiter picked up a signal and attempts to obtain additional scientific data (as outlined by Ulamec in his talk) began.

SPATIUM

The Association's magazine SPATIUM elaborates on selected lectures offered by Pro ISSI. It appears twice to three times per year. During the reporting period, issue no. 34 was published in October 2014. Based on a lecture given by Lennart Bengtsson, it addresses the evolution of meteorology from the very beginning to the status reached in our days. It is entitled How Earth Observation and Super-Computers Have Made Global Weather Prediction Possible.

Later, in May 2015, issue no. 35 appeared. It addresses the subject of Volcanism in the Solar System summarizing a presentation given by Ralf Jaumann of the German Aerospace Centre DLR, Berlin.

These publications together with all previous issues of SPATIUM can be found on Pro ISSI's homepage www.issibern.ch/publications/spatium.html.

The Program and the Tools

ISSI's mode of operation is generally fivefold: multi- and interdisciplinary Workshops, Working Groups, International Teams, Forum, and Visiting Scientists. In the 20th business year a total of 922 international scientists participated in the scientific activities of ISSI:

Workshops consist of up to 50 invited scientists exchanging their views on a scientific theme, typically during a week's duration. 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. In the 20th year five Workshops were organized, one joint Workshop together with ISSI-BJ and one hosted Workshop, summaries of which can be found on the following pages.

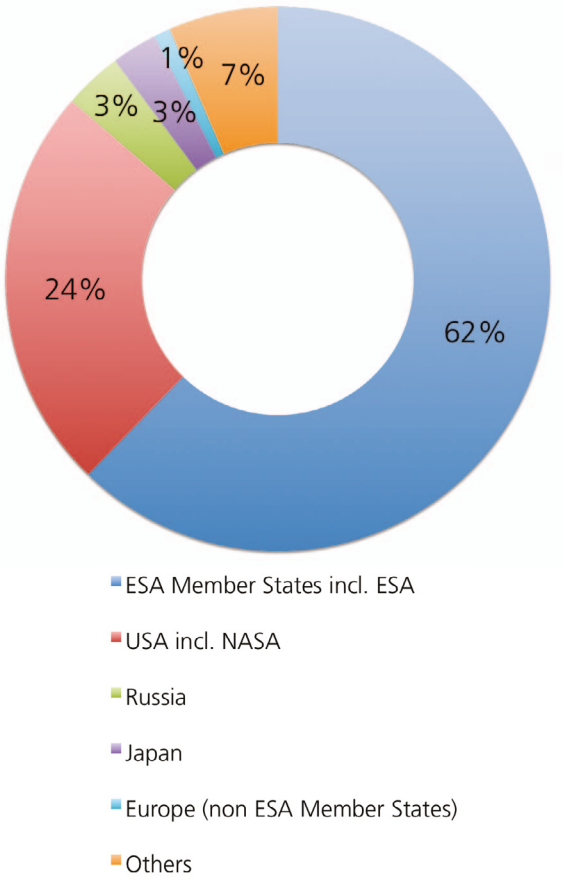
Working Groups have a smaller number of members and meet repeatedly as necessary to achieve the assigned objective. The results of the Working Groups activities are in general published as titles of ISSI Scientific Report Series. In the course of the 20th business year three Working Groups were active.

International Teams consist of about 15 external scientists, addressing a specific scientific topic in a self-organized fashion. The results of these activities are customarily reported in scientific journals. In total 74 Team meetings took place in the 20th business year. Details can be found from page 20 on.

A Forum is an informal and free-ranging debate consisting of some 25 high-level participants on open questions of a scientific nature or on science policy matters for about two days. A Forum does not necessarily lead to formal recommendations or decisions. In the 20th business year one Forum was held.

Visiting Scientists spend variable periods of scientific activity at ISSI. 10 individual visitors used the ISSI facilities during the year.

The Young Scientists Program is designed to bring PhD students and young post docs in contact with the community at work. These young scientists are invited by ISSI to complement the membership of Workshops, Working Groups, International Teams and Forums. 136 young scientists participated in the ISSI activities in the course of the 20th year.



Pie chart showing the ISSI visitors countries of origin. A total of 922 scientists worked at ISSI during the 20th business year, 319 of them were here for the first time.

How to use ISSI tools

As a general rule participation in ISSI's activities is by invitation only. 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 January. These proposals are evaluated by the ISSI Science Committee and approved by the Directorate.

Workshops, Working Groups, and Forum: There is no annual call. The scientific community may suggest at any time Workshops, Working Groups, and Forums by submitting an idea on a maximum of one page. The ISSI Science Committee will evaluate these suggestions and the ISSI Directorate will take a final decision.

Forum

Continuity of Microwave Observations in L-band for Operational and Climate Applications

30 September - 1 October 2014

The SMOS mission makes global observations of soil moisture over Earth's landmasses and salinity over the oceans. Variations in soil moisture and ocean salinity are a consequence of the continuous exchange of water between the oceans, the atmosphere and the land – Earth's water cycle. (Image Credit: ESA/AOES Medialab)

Systematic L-band observations from space became available for the first time with the launch of ESA's Soil Moisture and Ocean Salinity (SMOS) mission in 2009, followed by NASA's Aquarius and Soil Moisture Active Passive (SMAP) missions launched in 2011 and 2015, respectively. This was a significant step towards providing global observations of soil moisture and ocean salinity, two key variables in the Earth's water cycle. This new type of measurement is largely unaffected by atmospheric parameters and presents an "all-weather" tool for the monitoring of the Earth's surface. Although primarily designed for retrievals of soil moisture and ocean salinity, other parameters, e.g. sea ice thickness, high wind speeds over the ocean, and freeze / thaw state of the soil have been derived. Over the past 5 years the scientific and operational communities have made extended use of these new observations across a variety of applications (climatology, hydrology, oceanography, weather prediction, ...) rendering these observations indispensable.

Forums are informal and free-ranging debates among some twenty-five high-level participants on open questions of a scientific nature or on science policy matters. Forums do not necessarily lead to formal recommendations or decisions.

The Forum on Continuity of Microwave Observations in L-band for Operational and Climate Applications took place with participants from all around Europe, the United States and China. All thematic fields using L-band observations were covered by experts: soil moisture, ocean salinity, sea ice, sea surface temperature, ocean acidification, wind speed over ocean, hydrological cycle, observation of the vegetation and observation of the cryosphere.

The Forum focused on the following objectives:

(1) review the results and achievements from SMOS and Aquarius (and the expected results from SMAP) and their (potential) impact on operational applications

(2) review and discuss the user requirements within the context of scientific challenges and international guidelines, e.g. as defined through the World Meteorological Organization

(3) define next generation L-band mission requirements and concepts responding to evolving user requirements.

Based on these discussions, key application areas were defined and drove the requirements for future missions. The initiative aimed at advancing the discussion between agencies as to future mission concepts beyond SMOS-Aquarius-SMAP. The Forum discussion summary, SMOS-Aquarius result overview and L-band mission requirements will be provided in a coming community paper on Passive microwave L-band observations from space: Achievements and perspectives.

IPCC AR5: Lessons learnt for Climate Change Research and WCRP

8-10 September 2014

ISSI hosted in Bern a joint Workshop organized by the World Climate Research Program (WCRP) and the Intergovernmental Panel on Climate Change (IPCC) with 78 participants, coming from almost all around the world and covering most climate research fields. The Workshop was aimed at informal exchanges and brainstorming between scientists involved in climate change research coordination and IPCC authors. The main purpose was to take stock of key scientific issues identified through the IPCC assessment in WCRP's research plans. This would in turn help IPCC in its own reflection on future activities.

Up to 80 Participants were involved in the WCRP / IPCC Workshop hosted by ISSI.

IPCC AR5 has indeed identified a number of emerging themes and outstanding issues in climate change research, some of them outlined as key uncertainties by Working Group I (WG I) and "research and data gaps" by Working Group II (WG II). IPCC authors participating in the Workshop have provided their views on debates held at IPCC on those issues. Additional input from the Working Group III (WG III) report was also considered, as well as new scientific material available since the AR5 cut-off dates. Contributions and discussions focused on issues which are considered as essential for the progress of climate change research and on actions which may facilitate the evaluation of risks and impacts, and the development of adaptation strategies. The agenda was built around scientific themes and types of research activities which are needed for responding to outstanding questions. Outcomes were expected to benefit the planning of major WCRP projects, particularly the "Grand Science Challenges", defined as major areas where efforts in research, modeling, analysis and observations are needed. Among the aspects of WCRP research which should particularly benefit from the workshop were the planning of climate model evaluation activities and the development of regional climate projections. The workshop also fed in the progress report being prepared by the Global Climate Observing System (GCOS). From the IPCC viewpoint, it was expected that the workshop would provide constructive comments and recommendations for the preparation of future assessments. Finally, a community article is in preparation encompassing a review of WCRP Grand Challenges and research priorities in a broad IPCC perspective, making use of discussions and recommendations from this workshop, including input from the climate research survey performed before the workshop.

Workshop Report, IPCC AR5: Lessons Learnt for Climate Change Research and WCRP, prepared by Gilles Sommeria and Nicolas Champollion, WCRP Report No. 5, 29 January 2015.

Workshops

Every year the Arctic Ocean experiences the formation and then melting of vast amounts of ice that floats on the sea surface. This sea ice plays a central role in polar climate and the global ocean circulation pattern. (Image Credit: ESA Image Gallery)

Workshops are selected by the Directorate in consultation with the Science Committee. Proposals or suggestions for Workshops may originate from the external community. The program and speakers are defined by a group of experts serving as conveners. The Workshops can be attended by up to 50 invited scientists. Workshops always lead to a volume of the Space Sciences Series of ISSI (SSSI) published by Springer and in parallel as issues of Space Science Reviews or Surveys in Geophysics.

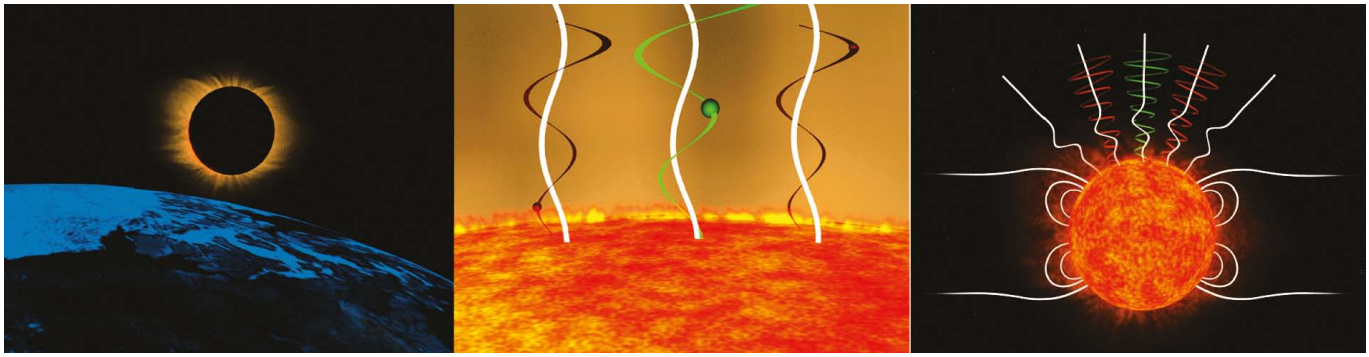
Remote Sensing and Water Resources

6-10 October 2014

The objective of this Workshop was to bring together scientists interested in land hydrology, water resources and the global water cycle either from space-based and/or in situ observations, and hydrological modeling. For about 15 years, remote sensing techniques have demonstrated their capability to monitor components of the water balance of large river basins on time scales ranging from months to decades: satellite altimetry routinely monitors water level changes of large rivers, lakes and floodplains. If combined with satellite imagery, it provides surface water volume variations. Passive and active microwave sensors offer important information on soil moisture (e.g., the SMOS mission) as well as wetlands and snowpack. The GRACE space gravity mission offers for the first time, the possibility of directly measuring spatio-temporal variations of the total vertically integrated terrestrial water storage. When combined with other space observations (e.g., from satellite altimetry and SMOS) or model estimates of surface waters and soil moisture, space gravity data can measure groundwater storage variations. Two main issues have been addressed during the Workshop: (1) use in combination of space observations for monitoring water storage changes in river basins worldwide, and (2) use the space data in hydrological modeling either through data assimilation or as external constraints. An important perspective for the latter topic is to account as far as possible for direct anthropogenic forcing on land hydrology (e.g., ground water depletion; dam building on rivers, crop irrigation, change in land use and agricultural practices, etc.) using a variety of remote sensing and other information. Such a new generation of hydrological models will be of great interest for water management objectives. They might also be used for projecting future water resources under different climate and anthropogenic forcing scenarios. The presentations were structured into 6 sessions:

1. The global water cycle: observations and modeling
2. Satellite altimetry and surface waters
3. Soil moisture from remote sensing
4. Total water storage from GRACE space gravimetry
5. Water resources: present and future
6. Water management

A total of 28 presentations were delivered. Currently, the Workshop articles have been submitted for publication in Surveys in Geophysics and the ISSI Space Science Series book is expected to be published in early 2016.



The outermost solar atmosphere, or corona, is normally visible only during a solar eclipse. Observations of particles „surfing" on waves in the corona have shed light on an ongoing mystery of why the solar wind flows as fast as it does. Charged particles in the solar wind spiral around lines of magnetic force, and these lines oscillate back and forth to create outward-propagating waves. When the particles' spiraling frequencies match the wave frequencies, the particles can absorb the waves' energy; this spins up the particles into larger orbits, gives them an added outward boost, and damps out the waves. (Image Credit: NASA/Dana Berry, Allied Signal Max Q digital animation group)

Solar Magnetic Fields

12-16 January 2015

This was the second in a series of two Workshops on the solar activity cycle; the first one on „The Solar Activity Cycle: Physical Causes and Consequences" had taken place in the previous year and recently resulted in an ISSI volume (see p. 70). This second Workshop focused on the driver of solar activity, the solar magnetic field. Both the observational and measurement techniques of magnetic fields and the complex processes that control the variability of solar magnetic phenomena were addressed. The objective was to review the current status of the field and to identify the links between the observational capabilities and the elaboration of accurate and predictive models of solar variability on all temporal and spatial scales.

The topics covered in the Workshop were:

- History of solar magnetic observations from Hale to the present
- Basic physics of solar magnetic field measurements
- Photospheric, chromospheric and coronal magnetic field measurements - techniques, interpretation, capabilities and limitations
- Coronal magnetic field models - Potential Field Source Surface models and beyond and the extension to the heliosphere
- Heliospheric magnetic field measurements
- Magnetoconvection as a mechanism for creating fine scale structure, sunspots, turbulent fields (local dynamo)
- Flux emergence and decay, large-scale flows and magnetic field transport, (meridional circulation), diffusion, active regions evolution, polarity reversals
- Origin and variability of the solar magnetic field, status and perspectives of dynamo theories (global vs local dynamos)
- Requirements and perspectives for solar magnetic field measurements

The Workshop was convened by André Balogh (Imperial College London, UK), Ed Cliver (SP/AFRL National Solar Observatory, NSO/Sacramento Peak, USA), Gordon Petrie (National Solar Observatory, Sacramento Peak, USA), Sami Solanki (Max-Planck-Institut für Sonnensystemforschung, Germany), Michael Thompson (High Altitude Observatory, NCAR, USA), and Rudolf von Steiger (ISSI Bern, Switzerland). It brought together some 39 experts in the relevant fields during the week of 12-16 January, 2015. Following the Workshop, its output is now being edited to appear as a volume in the Space Science Series of ISSI by Springer, in parallel with the publication of the papers in Space Science Reviews. Some 17 high-quality topical review papers, submitted to the usual refereeing process, will be based on talks presented at the Workshop and will also reflect the discussions that were held among the participants during the Workshop, with emphasis on interdisciplinarity.

Workshops

Integrative Study of Sea Level Budget

2-6 February 2015

The Workshop's objective was to discuss recent results obtained for a number of Essential Climate Variables (ECVs, as defined by GCOS -Global Climate Observing System-, a body of the World Meteorological Organization), namely sea level, glaciers, ice sheets, sea ice, sea surface temperature (SST) and ocean color. A number of ECVs that can be observed from space are currently computed in the context of the Climate Change Initiative (CCI) programme of the European Space Agency (ESA). The goal of the CCI programme is to provide long, accurate records of ECVs that are measurable from space. So far 14 ECVs have been considered within the CCI, including sea level (global and regional), glaciers, ice sheets, SST and ocean color. Sea level is an integrative variable and a good indicator of climate change. In terms of global mean, it results from changes of several components: glacier melting, Greenland and Antarctica ice mass loss, ocean thermal expansion, and land water storage change. Monitoring these climate variables is crucial to understand processes at work under current global warming and for validating the climate models used for future projections. The ESA Climate Change Initiative has provided a first attempt to produce consistent and continuous space-based records for these important climate parameters. During the Workshop, it has been shown that these high-quality ECVs now allow better closing of the sea level budget. The Workshop also addressed the regional variability in sea level, SST and ocean color, and discussed the relative contributions of the natural/internal climate variability and anthropogenic forcing (detection/attribution) to the observed regional changes.

About 40 scientists attended the Workshop. The 32 presentations were structured into 7 sessions.

- Introduction on climate change, sea level rise, land ice melt and ocean warming
- The CCI programme and ECVs. Present status and prospect
- Global ocean thermal expansion and ocean mass change components
- Global mean sea level closure budget
- Regional variations in sea level
- Sea level closure budget at regional scale
- Sea level projections (21st century) and land ice contribution

An important part of the Workshop has been devoted to general discussions and prospects about future collaborations on this topic among the international community. An ISSI volume of the Space Science Series is currently in preparation with 24 articles expected.

Dust Devils on Mars and Earth

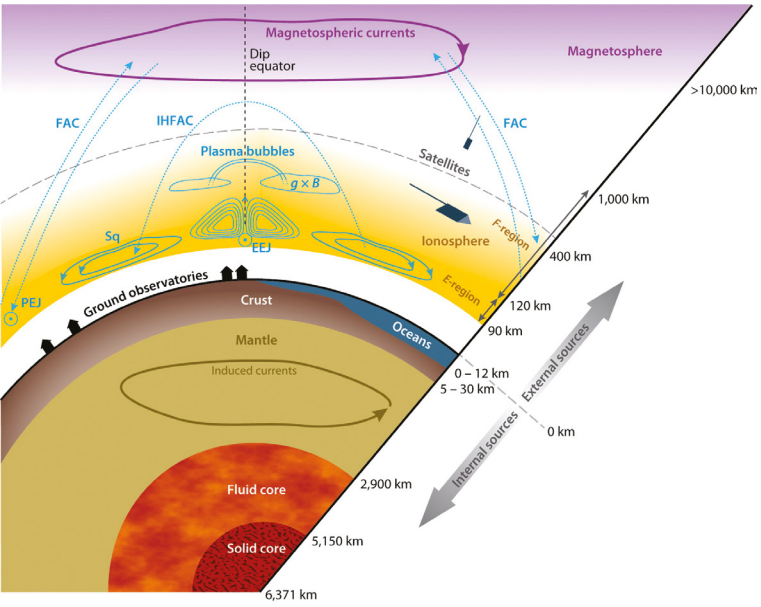
16-20 February 2015

Dust devils result from the entrainment of surface dust in a convective vortex, giving rise to an ascending plume of dust, and are observed on both the Earth and Mars. This Workshop brought together a community of some 35 worldwide scientists with experience of measurements, both in-situ and remote, modelers and experimentalists with a view to synthesizing current understandings in this subject. Recent years have seen a significant development in all these areas and further progress is promised by planned Mars missions in the coming years, especially the ESA/Roscosmos ExoMars Rover scheduled for launch in 2018 and NASA's 2020 mission.

The impact of the dust devil phenomenon on global climate is acknowledged though the details are still not clear. Dust and aerosols lifted into the atmosphere can influence the climate through reflection of incoming solar radiation as well as contributing to cloud condensation. On Earth, they also significantly contribute to reducing air quality in arid and semi-arid regions. Progress is needed in the area of both observations and underpinning theoretical understanding in order to further enumerate these significant impacts of dust devils and it is hoped that this Workshop will contribute to that further understanding.

The Workshop was divided into 4 sections, namely (i) Observations and Measurements; (ii) Laboratory Experiments; (iii) Electric Fields and (iv) Modeling. Participants came from a wide variety of disciplines and specialties and accordingly a comprehensive review of the current status of the field was achieved. The Workshop was convened by John Zarnecki, Dennis Reiss, Aymeric Spiga, Ralph Lorenz, Matthew Balme, Lynn Neakrasse and Angelo Pio Rossi.

Earth's Magnetic Field: Understanding Sources from the Earth's Interior and its Environment



Sketch of sources inside the Earth and above the Earth's surface contributing to the near-Earth magnetic field. Observations of the geomagnetic field always contain signals of multiple sources.

18-22 May 2015

This was the third Workshop on magnetic fields of planets and the Earth organized by ISSI. The Workshop conveners are Claudia Stolle (GFZ Potsdam, Germany), Nils Olsen (DTU, Demark), Arthur Richmond (NCAR/UCAR, Boulder, USA), and Hermann Opgenoorth (IRF Uppsala, Sweden). Rudolf von Steiger coordinated the Workshop from the ISSI side. The activity has been proposed together with a series of other working groups during an ISSI Forum on "Near Earth Electro-Magnetic Environment" on 3-5 April 2013.

This Workshop has especially aimed at describing the characteristics of the different sources for the geomagnetic field with the goal to isolate them properly and to discuss suitable approaches for source characterization. Main contributors to the geomagnetic field are internal sources due to fluid motion in the Earth's outer core and magnetized rocks in the lithosphere, and external sources due to electric currents in the ionosphere and magnetosphere. The participants have aimed at understanding how to define "magnetic quiet conditions" and which electric currents are then still contributing to the magnetic field? Such quantification is important in order to define a baseline for understanding what is different during geomagnetic storms. A proper description of such baseline behavior is also crucial for modelers of the internal geomagnetic sources to understand remaining signals from the external fields. One direct scientific outcome of the Workshop has been that the present definition of quiet conditions by the geomagnetic community does not sufficiently reflect our understanding of the background ionosphere.

For this purpose the Workshop invited 30 participants, including 3 young scientists.

For the different investigations, a very interesting series of talks on more specific topics has been presented covering the magnetosphere, ionospheric dynamos, at low-, mid-, and high latitudes. On each topic approaches spreading from data interpretations, empirical modeling, to theoretical simulations have been presented, followed by lively discussions.

The book on the "The Sources of the Earth's magnetic field" will be published in the Space Science Series of ISSI, as a tangible outcome of the lively presentations and discussions during the Workshop. It is planned to have 20 substantial, multi-authored reviews of the topics covered during the meeting.

International Teams

Listed are Teams that had a meeting at ISSI in the period of the 20th business year. A rationale is given only for the selected teams in 2014; for the others see the previous Annual Reports.

International Teams consist of about 4-15 external scientists, addressing a specific scientific topic in a self-organized fashion, under the responsibility of a Leader in a series of two to three one week meetings over a period of 18 to 24 months. The results of these activities are customarily reported in scientific journals. The selection of Teams results from an annual call for International Teams issued in January and from the subsequent review and prioritization done by the Science Committee.

Teams selected in 2011

Heating of the Magnetic Chromosphere: Confronting Models with Observations

Team leaders: Bart De Pontieu, LMSAL, USA, and Scott McIntosh, High Altitude Observatory, USA
Session: 5-8 January 2015

Aerosol Remote Sensing from Space

Team leader: Alexander Kokhanovsky, Bremen University, Germany
Session: 1-5 September 2014

Teams selected in 2012

Planetary Population Synthesis: Interpreting Present and Future Space Data

Team leaders: Yann Alibert, University of Bern, Switzerland, and Douglas Lin, University of California Santa Cruz, USA
Session: 8-12 June 2015

Rapid Dynamics in the Earth's Core: Assimilation of Satellite Observations into MHD models

Team leader: Christopher Finlay, Technical University of Denmark, Copenhagen, Denmark
Session: 25-27 March 2015

First Principles Physics for Charged Particle Transport in Strong Space and Astrophysical Magnetic Turbulence

Team leader: Federico Fraschetti, University of Arizona, USA
Session: 22-25 September 2014

The Evolution of the First Stars in Dwarf Galaxies

Team leader: Pascale Jablonka, École Polytechnique de Lausanne EPFL, Lausanne, Switzerland
Session: 2-4 September 2014

Modeling Cometary Environments in the Context of the Heritage of the Giotto Mission to Comet Halley and of Forthcoming New Observations at Comet 67P/Churyumov-Gerasimenko

Team leader: Monio Kartalev, Bulgarian Academy of Sciences, Sofia, Bulgaria
Session: 29 September - 3 October 2014

The Induced Magnetosphere of Mars: Physical Processes and Consequences

Team leaders: Mark Lester, University of Leicester, Leicester, United Kingdom, and Hermann Opgenoorth, Swedish Institute of Space Physics, Uppsala, Sweden
Session: 25-29 August 2014

MHD Oscillations in the Solar Corona and Earth's Magnetosphere: Towards Consolidated Understanding

Team leaders: Valery Nakariakov, University of Warwick, Coventry, United Kingdom, and Viacheslav Pilipenko, Space Research Institute, Russia
Session: 15-19 December 2014

Study of Gamma-ray Loud Binary Systems

Team leader: Andrii Neronov, University of Geneva, Switzerland
Session: 17-21 November 2014

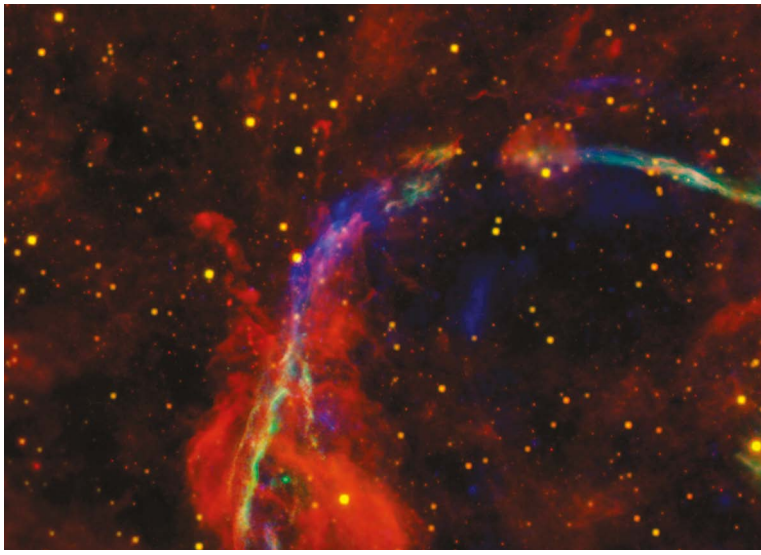
Vesta, the Key to the Origins of the Solar System

Team leader: Diego Turrini, Italian National Astrophysics Institute (INAF), Rome, Italy
Session: 7-9 July 2014

Towards a Full Integration of Earth Observation Products and Concepts in Land Surface Models
Team leader: Peter M. van Bodegom, VU University Amsterdam, The Netherlands
Session: 28-30 October 2014

Magnetosphere and Ionosphere as a Coupled System: Theory and Observations
Team leader: Andrew Wright, University of St. Andrews, United Kingdom
Session: 4-8 August 2014

Stratospheric Sulfur and its Role in Climate (SSiRC) Workshops
Team leader: Larry W. Thomason, NASA Langley Research Center, USA
Sessions: 22-26 September 2014 and 27 April - 1 May 2015



Most celestial events unfold over thousands of years or more, making it impossible to follow their evolution on human timescales. Supernovas are notable exceptions, the powerful stellar explosions that make stars as bright as an entire galaxy for several days. (Image Credit: ESA/ XMM-Newton & NASA/Chandra (X-ray); NASA/WISE/ Spitzer (Infrared))

Teams selected in 2013

Slow Solar Wind Sources and Acceleration Mechanisms in the Corona
Team leaders: Lucia Abbo, INAF-Osservatorio di Torino, Italy, and Leon Ofman, NASA Goddard Space Flight Center, Greenbelt, USA
Session: 16-20 March 2015

Partially Ionized Plasmas in Astrophysics (PIPA)
Team leader: José Luis Ballester, Universitat de les Illes Balears, Palma de Mallorca, Spain
Session: 8-12 June 2015

Mapping the Northern Plains of Mars: Origins, Evolution and Response to Climate Change
Team leader: Matthew Balme, The Open University, Milton Keynes, United Kingdom
Sessions: 24-26 September 2014 and 11-13 May 2015

Massive Star Clusters Across the Hubble Time
Team leader: Corinne Charbonnel, University of Geneva, Switzerland
Session: 15-19 June 2015

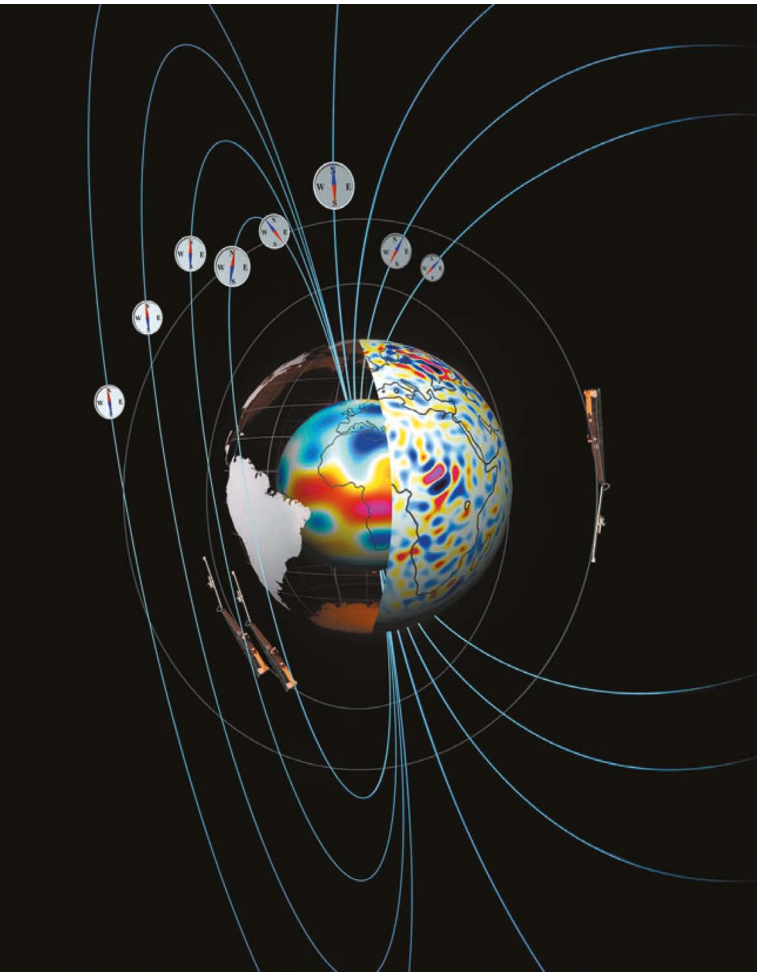
Early Universe: Research On Plasma Astrochemistry
Team leader: Carla M. Coppola, University of Bari, Bari, Italy
Session: 3-5 March 2015

Unveiling Multiple AGN Activity in Galaxy Mergers
Team leader: Alessandra De Rosa, INAF – Istituto di Astrofisica Spaziale, Rome, Italy
Session: 24-28 November 2014

Integrating Earth Observation Data the Description of Land Management Practices into Global Carbon Cycle Models
Team leader: Han Dolman, University of Amsterdam, the Netherlands
Session: 9-11 March 2015

Exploration of the inner Heliosphere - what we have learned from Helios and what we want to study with Solar Orbiter
Team leader: Wolfgang Droege, University of Würzburg, Germany
Session: 9-12 March 2015

International Teams



The image highlights the new crust (right) and core (center) magnetic field models from Swarm. These preliminary results are based only on the first year of data. (Image Credit: ESA/DTU Space/ATG medialab)

Non-Equilibrium Processes in the Solar Corona and their Connection to the Solar Wind

Team leaders: Elena Dzifcakova, Academy of Sciences of the Czech Republic, Ondrejov, Czech Republic, and Helen E. Mason, University of Cambridge, United Kingdom
Sessions: 13-16 October 2014 and 3-5 June 2015

Multidisciplinary Search for Preservation Windows of Biomolecules in Modern and Ancient Terrestrial Analogs as a Proxy for Ancient Deposits of Mars

Team leader: David C. Fernandez Remolar, Centro de Astrobiología (INTA-CSIC), Madrid, Spain
Sessions: 8-10 December 2014 and 8-12 June 2015

Effects of Interplanetary Disturbances on the Earth's Atmosphere and Climate

Team leader: Katya Georgieva, Bulgarian Academy of Sciences, Sofia, Bulgaria
Session: 19-23 January 2015

Energy Transformation in Solar and Stellar Flares

Team leader: Louise Harra, University College London, Surrey, United Kingdom
Session: 11-13 May 2015

The Science of Near-Sun Comets

Team leader: Geraint H. Jones, University College London, Surrey, United Kingdom
Session: 23-27 March 2015

Towards a Self Consistent Model of the Thermal Structure of the Venus Atmosphere

Team leader: Sanjay S. Limaye, University of Wisconsin, Madison, USA
Session: 9-11 February 2015

The Nature of Coronal Bright Fronts

Team leaders: David Long, University College London, Surrey, United Kingdom, and Shaun Bloomfield, Trinity College Dublin, Ireland
Session: 23-27 February 2015

Specification of Ionization Sources Affecting Atmospheric Processes

Team leader: Irina A. Mironova, St. Petersburg State University, Russia
Session: 4-8 May 2015

Probing Deep into the Neutron Star Crust with Transient Neutron-Star Low-Mass X-Ray Binaries

Team leader: Dany Pierre Page, Universidad Nacional Autónoma de México, Mexico
Session: 15-19 December 2014

Modes of Radial Plasma Motion in Planetary Systems

Team leaders: Christopher Paranicas, The Johns Hopkins University, Paranicas, USA; Caitriona Jackman, University of Southampton, United Kingdom, and Nick Sergis, Academy of Athens, Greece
Session: 21-25 July 2014

Ion and Electron Bulk Heating by Magnetic Reconnection

Team leader: Tai Phan, University of California Berkeley, USA
Sessions: 8-12 October 2014 and 1-5 June 2015

Heliosheath Processes and Structure of the Heliopause: Modeling Energetic Particles, Cosmic Rays, and Magnetic Fields

Team leaders: Nikolai V. Pogorelov, University of Alabama, Huntsville, USA, and Horst Fichtner, Ruhr-Universität Bochum, Germany
Session: 17-20 November 2014

Multi-instrument Space-Borne Observations and Validation of the Physical Model of the Lithosphere-Atmosphere-Ionosphere-Magnetosphere Coupling

Team leaders: Sergey Pulinets, Russian Academy of Sciences, Moscow, Russia, and Dimitar Ouzounov, Chapman University, USA
Sessions: 15-19 October 2014 and 22-26 June 2015

Kinetic Turbulence and Heating in the Solar Wind

Team leaders: Fouad Sahraoui, CNRS-Ecole Polytechnique, Palaiseau, France, and David Sundkvist, University of California Berkeley, USA
Session: 16-20 March 2015

Sulfur Dioxide Variability in the Venus Atmosphere

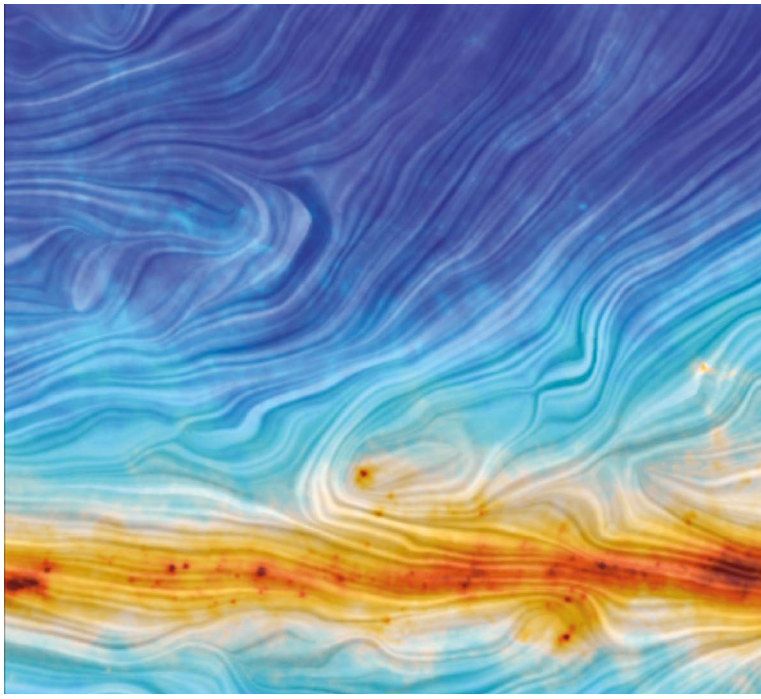
Team leaders: Anne Carine Vandaele, Belgian Institute for Space Aeronomy, Brussels, Belgium, and Oleg Korablev, Space Research Institute (IKI), Moscow, Russia
Session: 9-11 February 2015

Improved Understanding of Venus Clouds

Team leaders: Colin Wilson, University of Oxford, United Kingdom, and Emmanuel Marcq, LATMOS, Guyancourt, France
Session: 9-11 February 2015

Determination of the Global Conductance Pattern and its Influence on the Dynamics of Geospace

Team leader: Michael Wiltberger, National Center for Atmospheric Research, Boulder, USA
Session: 25-29 August 2014

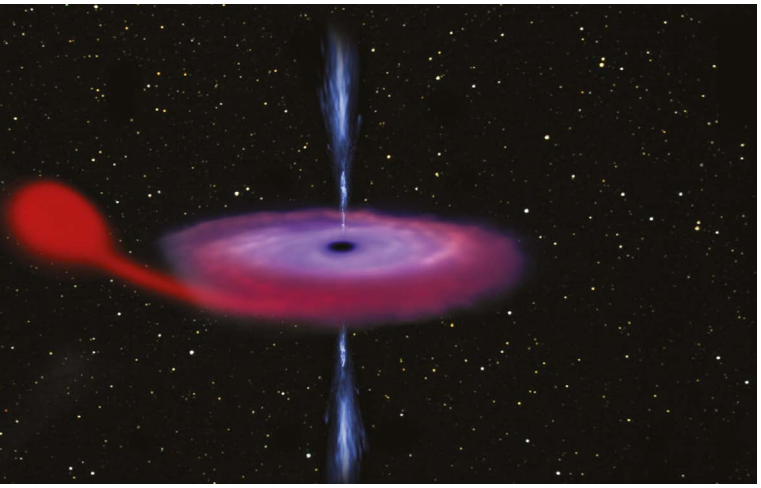


While the pastel tones and fine texture of this image may bring to mind brush strokes on an artist's canvas, they are in fact a visualization of data from ESA's Planck satellite. The image portrays the interaction between interstellar dust in the Milky Way and the structure of our Galaxy's magnetic field. (Image Credit: ESA/Planck Collaboration. Acknowledgment: M.-A. Miville-Deschênes, CNRS – Institut d'Astrophysique Spatiale, Université Paris-XI, Orsay, France)

Physics of the Injection of Particle Acceleration at Astrophysical, Heliospheric, and Laboratory Collisionless Shocks

Team leaders: Ryo Yamazaki, Aoyama Gakuin University, Sagamihara, Japan, and Shuichi Matsukiyo, Kyushu University, Kukuoka, Japan
Session: 1-5 June 2015

International Teams



Artist's impression of a black hole feasting on matter from its companion star in a binary system. Material flows from the star towards the black hole and gathers in a disc, where it is heated up, shining brightly at optical, ultraviolet and X-ray wavelengths before spiraling into the black hole. Part of the disc material does not end up on the black hole but is ejected the form of two powerful jets of particles. (Image Credit: ESA/ATG medialab)

Teams selected in 2014

SZ Clusters in the Planck Era

Team leaders: Nabila Aghanim and Marian Douspis, IAS, Université Paris Sud, France
Session: 27 April - 1 May 2015
Scientific Rationale: For the first time a team is deeply involved in two major Sunyaev-Zeldovich (SZ) surveys namely the Atacama Cosmology Telescope (ACT) and the Planck satellite. The scientists work together on a detailed investigation of the SZ signal in the direction of 30 massive clusters from redshift 0.1 to 0.87 common to both surveys. The team combines high resolution SZ data from ACT to lower resolution data from Planck in order to derive the first SZ-based reference model of the pressure distribution in clusters. The team members investigate the effects of the pressure profile, on cosmological analyses based either on SZ cluster counts and/or on SZ power spectrum.

The Extreme Physics of Eddington and Super Eddington Accretion onto Black Holes: A Comprehensive Study of the „Eddington Limit" Across Mass Scales

Team leaders: Diego Altamirano, University of Southampton, United Kingdom, and Omer Blaes, University of California Santa Barbara, USA
Session: 23-27 March 2015
Scientific Rationale: The team studies so called Eddington-limited accretion, an unique and extreme regime where so much accretion power is liberated that the outward radiation pressure force is comparable to the inward force of gravity. The team members span a wide range of expertise in order to critically review the understanding of the physics of Eddington-limited accretion onto black holes across a mass scale that spans 8 orders of magnitude, and the physical mechanisms that produce different types of outflows (like disk-winds and relativistic jets). The primary goals address the key questions related to (i) the physical conditions for Eddington and super-Eddington accretion, (ii) its observational manifestation across a wide range of black-hole mass, and (iii) the implications for accretion-disk geometry and outflows.

Implications for Coronal Heating and Magnetic Fields from Coronal Rain Observations and Modelling

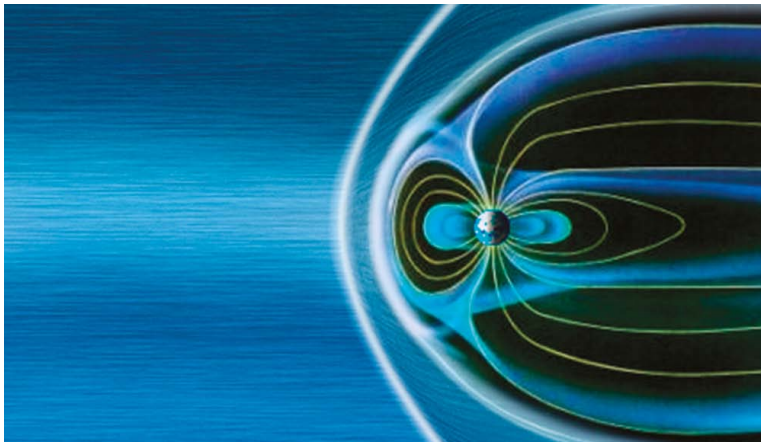
Team leader: Patrick Antolin, National Astronomical Observatory of Japan, Tokyo, Japan
Session: 23-27 February 2015
Scientific Rationale: The launched IRIS mission provides high spatial, temporal and spectral resolution coverage of the transition region and chromosphere, allowing for the first time proper visualization of the thermal instability process leading to the formation of condensations such as coronal rain. By combining high resolution multi- wavelength observations with IRIS and other instruments, with state-of-the-art numerical codes, the team aims at thoroughly investigating coronal rain in each of the aforementioned topics. Through a series of publications and a major review, awareness from the scientific community will be raised on the importance of this partially ionised, cool and dense plasma. A series of discussions help establish several unknown aspects of the coronal magnetic field and plasmas such as the fundamental length scales, the occurrence rate of thermal instability in the corona, the dynamics of accretion onto the solar surface, the interaction (through MHD waves) of coronal rain with the magnetic field, and the physical processes at the root of the rain morphology.

Analysis of Cluster Inner Magnetosphere Campaign Data, in Application the Dynamics of Waves and Wave-particle Interaction within the Outer Radiation Belt

Team leader: Michael Balikhin, University of Sheffield, United Kingdom
Session: 19-23 January 2015
Scientific Rationale: The team aims to advance the fundamental knowledge of the inner magnetospheric waves that are of key importance to the control of energetic electron fluxes within the Radiation Belts. This will be achieved with the analysis of data collected during the Cluster Inner Magnetosphere (IMC) complemented as needed by other Cluster data. The uniqueness of the Cluster-IMC data is due to the small spacecraft separations (occasionally down to 4-5 km), an important advantage when probing wave dynamics. Such measurements are beyond the capabilities of missions such as the Van Allen Probes and currently selected future missions. The Cluster Inner Magnetosphere Campaign data is used to identify the properties and linear/nonlinear processes that govern the evolution of waves for Chorus, Equatorial Magnetosonic, Electromagnetic Ion Cyclotron waves, and lightning whistlers and compare with the theoretical models. The study of these magnetospheric waves is important because of their role in acceleration and loss of energetic electrons in the outer radiation belt.

Field-Aligned Currents: Their Morphology, Evolution, Source Regions and Generators

Team leaders: Yulia Bogdanova, Rutherford Appleton Laboratory, STFC, United Kingdom, and Hermann Lühr, Deutsches GeoForschungsZentrum, Potsdam, Germany
Session: 16-18 March 2015
Scientific Rationale: The team combines the observations from different missions, including and most notably from ESA's multi-spacecraft mission Swarm, which provides the most accurate estimates of small and medium-scale FACs to date. The scientists combine observations from low-Earth orbiting satellites, SuperDARN, and ground-based magnetometers to investigate FACs, ionospheric electrodynamics, and thermospheric response; use observations from Cluster, THEMIS, and Van Allen Probes to investigate current sources in the magnetosphere; and employ MHD modeling and mapping techniques to relate magnetospheric, ionospheric, and thermospheric observations. The members compare as well different techniques for the current estimations and try a common calibration against the most reliable estimates.

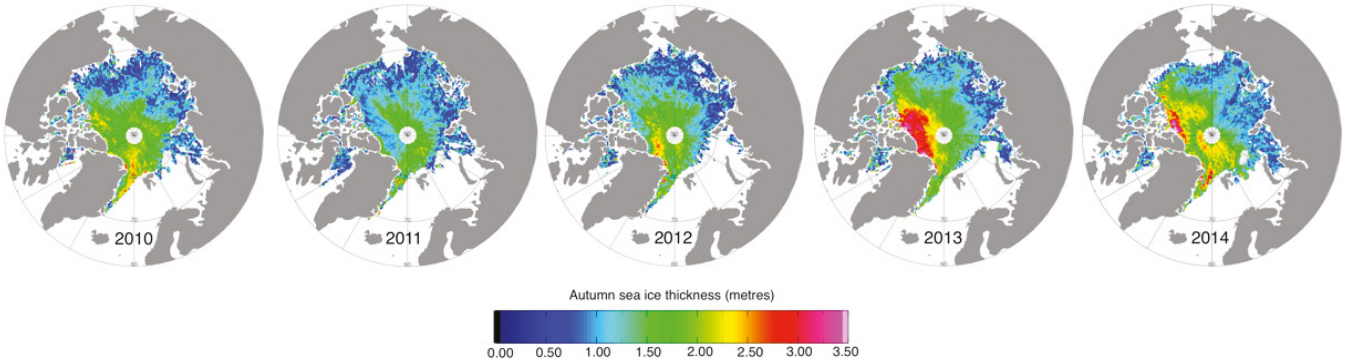


This artist's impression shows Earth's bow shock, a standing shockwave that forms when the solar wind meets our planet's magnetosphere. (Image Credit: ESA/ AOES Medialab)

Anisotropy and Intermittency in Solar Wind Turbulence (ISSI - ISSI-BJ Team)

Team leaders: Christopher Chen, Imperial College London, United Kingdom, and Jiansen He, Peking University, China
Session: 5-9 January 2015
Scientific Rationale: Plasma turbulence is ubiquitous throughout the heliosphere but in many respects remains poorly understood. As well as being of intrinsic interest, this turbulence is important for understanding plasma heating, such as in the solar corona, and determining the propagation, and therefore origin, of energetic particles. Two fundamental features of turbulence in the solar wind are anisotropy (different properties with respect to the magnetic field direction) and intermittency (burstiness of the fluctuations), but their origin, precise nature, and, in particular, the relationship between them is not well understood. The team combines observations, simulation and theory to make progress in understanding these features.

International Teams



Autumn Arctic sea-ice thickness as measured by CryoSat between 2010 and 2014. (Image Credit: UCL/CPOM/University of Leeds)

Solving the Exo-Cartographic Inverse Problem

Team leader: Nicolas Cowan, Amherst College, USA
Session: 19-23 January 2015
Scientific Rationale: The team takes a huge step forward by combining the major advances of the last decade in exo-cartography. The team members 1) construct a suite of full-physics simulated reflected lightcurves of exoplanets using the Virtual Planetary Laboratory's Earth model, and 2) attempt to infer the planetary properties in a blind fashion by analyzing these lightcurves with a variety of inverse methods including a Markov Chain Monte Carlo. They also set intermediate "data challenges" to better understand which assumptions are most critical to the retrieval exercise. The results of the collaboration will be published in one or more peer-reviewed papers, and the lightcurves and inverse models will be made publicly available to serve as a benchmark for future efforts.

Scenarios of Future Solar Activity for Climatemodelling

Team leader: Thierry Dudok de Wit, CNRS-University of Orléans, France
Session: 5-8 May 2015
Scientific Rationale: Model simulations of the 21st century climate undertaken by the IPCC suggest that the recently observed decline in solar activity may affect projected antropogenic warming scenarios. Although the solar impact is likely to be small, large uncertainties remain in projected levels of solar forcing because of the lack of realistic scenarios. The latest assessment report of the IPCC has highlighted a need for having better projections of future climate change up to 2100, including more realistic forecasts of solar activity on multi-decadal time scales. This multidisciplinary team precisely aims at answering this need for meaningful scenarios that are of direct use to climate modelers. The team brings together experts in solar activity reconstructions, in solar dynamo models, in climate modeling with the use of solar radiative and particle inputs (with a particular focus on the middle atmosphere), and in statistical analysis. The prime output is a data set with a series of realistic scenarios of the level of solar activity 500 years ahead, with a special emphasis on the 2100 horizon for the SPARC-CCMI (Chemistry-Climate Model Intercomparison) and CMIP6 (Coupled Model Intercomparison Project) climate model experiments. The team considers multi-decadal and centennial time-scales, not the actual solar cycle.

Small Scale Structure and Transport During Magnetopause Magnetic Reconnection: from Cluster to MMS (ISSI - ISSI-BJ Team)

Team leader: Malcolm Dunlop, Rutherford Appleton Laboratory, United Kingdom
Session: 11-14 November 2014
Scientific Rationale: The team project is designed to investigate small-scale structure and transport induced by magnetic reconnection (MR) in the Earth's magnetosphere; focusing on the dayside magnetopause. Magnetic reconnection is one of the most fundamental processes controlling the interaction of planetary magnetospheres with the solar wind. In particular, the dynamics of reconnection are strong-

ly influenced by small-scale processes occurring within the diffusion region, and in the (larger scale) sub-layers, which separate inflowing and out-flowing plasma (the separatrices, forming an X-line). The dayside magnetopause provides a special context for the operation of MR under asymmetric conditions driven by the solar wind. Over the last decade, data from the four-spacecraft Cluster mission have demonstrated the key importance of multi-spacecraft analysis in deciphering the structure, and thus the physics, of magnetic reconnection. The team includes experts in both, reconnection physics and four-spacecraft analysis to address two specific goals: 1. Examine Cluster observations of reconnection on the dayside magnetopause, and establish the likely signatures that will be observed by MMS, 2. Review and collate all the Cluster four-spacecraft techniques and determine how these techniques can be used by MMS with its much smaller tetrahedron.

Magnetosphere-Ionosphere-Thermosphere Coupling: Differences and Similarities between the Two Hemispheres

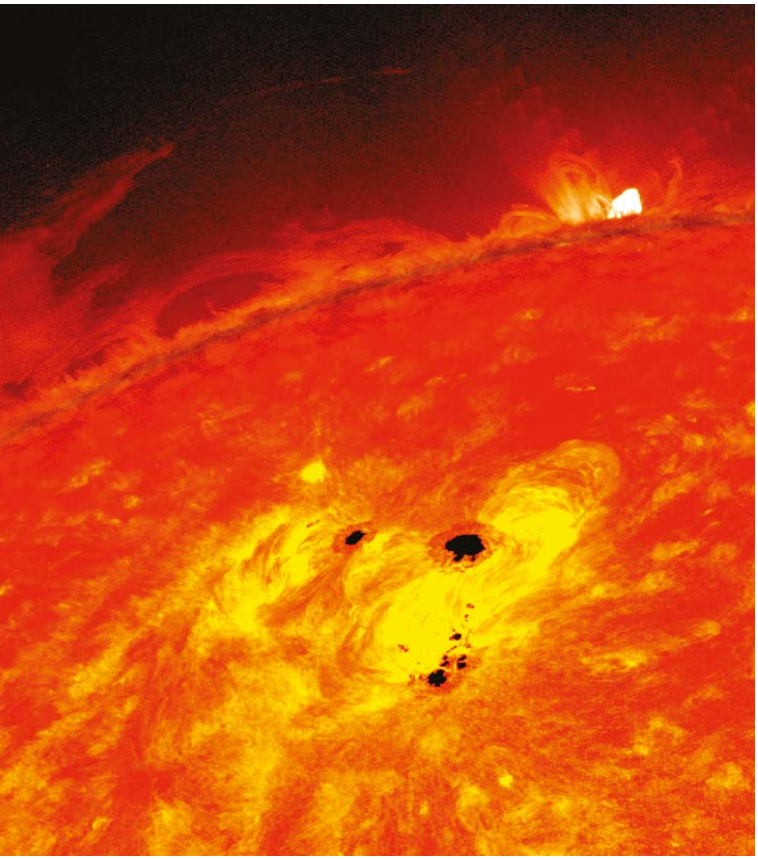
Team leaders: Matthias Foerster, GFZ German Research Centre for Geosciences, Potsdam, Germany, and Ingrid Cnossen, British Antarctic Survey, Cambridge, United Kingdom
Session: 1-5 December 2014
Scientific Rationale: The goal is to study various aspects of hemispheric asymmetries through a combination of numerical model simulations and analyses of observations obtained with different methods, covering different spatial and temporal ranges. The work takes account of the launch of the Swarm mission, which provides further observational material for this project.

Analysis of the Circumnuclear Gas and Dust Coma of Comet 67P, the Rosetta Target, on the Basis of 3D and 3D+t Model Fits to Data Collected from Part of the Orbiter Payload

Team leader: Marco Fulle , Osservatorio Astronomico di Trieste, INAF, Italy
Session: 28 September - 2 October 2015 (BY 21)
Scientific Rationale: After a number of flybys at short-period comets, the detailed properties of the gas and dust emission from a comet nucleus remain still obscure: we do not know whether the most abundant molecules and the dust are emitted as a uniform mixture, or with different (position dependent) relative abundances, nor whether the production is about uniform over the surface, or restricted to discrete areas. This ignorance follows from the lack of experimental data: e.g., complete nucleus shape and spin state of any comet nucleus has not yet been determined, no near-nucleus coma observation has ever been conducted over a time longer than a fraction of the rotation period, nor at successive positions over the orbit. The ESA Rosetta Mission to the short-period comet 67P will fill this gap, but to interpret the most significant observations (i.e. images and in-situ samplings of the innermost part of the coma) requires the use of the whole set of inhomogeneous time-dependent dusty gas vacuum outflow modeling techniques. It is hoped, on the basis of the past pioneering works done by Kitamura, Rodionov-Zakharov-Crifo (RZC), and the „Swiss-Taiwanese-German" group (STG), that it will be possible to answer the questions mentioned above by trial-and-error fits to the observations, using the nucleus surface gas and dust flux maps as unknowns.

This image was taken by Philae's Rosetta Lander Imaging System, ROLIS, 3.1 km from Comet 67P/Churyumov–Gerasimenko on 12 November 2014. (Image Credit: ESA/Rosetta/Philae/ROLIS/DLR)

International Teams



The bottom two black spots on the sun, known as sunspots, appeared quickly over the course of Feb. 19-20, 2013. These two sunspots are part of the same system and are larger than six Earth diameters across. (Image Credit: NASA/SDO/AIA/HMI/Goddard Space Flight Center)

Asteroids and Self Gravitating Bodies as Granular Systems

Team leader: Daniel Hestroffer, Observatoire de Paris, France

Session: 6-8 January 2016 (BY 21)

Scientific Rationale: The team is composed of experts and specialists in the field of Planetary science & space exploration on one side, and in the field of Granular material & mechanics on the other side. The scientists test various models and approaches in different sub-groups, analyze the effects of the various parameters and modeling, develop and implement dedicated numerical tools. This helps developing future research projects considering the effect of gravity: test in laboratories on Earth (g), behavior of surface bodies in space (µg), and global behavior of self-gravitating bodies (G).

Improving the Reliability of Solar Eruption Predictions to Facilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field-of-View

Team leaders: Paul Higgins, University of Dublin, Ireland, and Manolis Georgoulis, Academy of Athens, Greece

Session: 26-30 January 2015

Scientific Rationale: A substantial amount of telescope time is wasted on unsuccessful attempts to capture flare observations. Considering the expense of running large ground- and space-based observatories, this lost time can be very costly. Therefore the team assemble international experts with the aim to improve current target-selection methods for the benefit of both flare prediction and instrument planners (e.g., for DKIST, Hinode, IRIS, etc.).

The team's work addresses the following science questions: 1. Do flaring sunspot groups emerge as unstable structures, or do they evolve, once emerged, to become unstable? 2. How do sunspot groups build up the energy that is released in eruptions, and what triggers that release? 3. What is the degree of stochasticity in flare occurrence? Can the onset of flares and eruptions, in general, be predicted in a practical manner?

Adding Value to Soil Moisture Information for Climate Studies

Team leader: William Lahoz, Norwegian Institute for Air Research (NILU), Norway

Session: 24-26 November 2014

Scientific Rationale: The amount of water stored in the unsaturated soil zone is generally referred to as soil moisture. It is one of the key geophysical variables for understanding the Earth's hydrological cycle. It is classed as an essential climate variable of the Global Climate Observing System, GCOS. Soil moisture determines the partitioning of incoming water into infiltration and run-off. It directly affects plant growth and other organic processes connecting the water cycle to the carbon cycle. Run-off and base flow from the soil profile determine river flows and flooding, connecting hydrology with hydraulics. Soil moisture also has significant impact on the partitioning of water and heat fluxes (latent and sensible heat), connecting the hydrological cycle with the energy cycle. Together, soil moisture, temperature and their impacts on the water, energy and carbon cycle play a major role in climate change projections.

Constraining the Dynamical Timescale and Internal Processes of the Saturn System from Astrometry

Team leader: Valéry Lainey, Observatoire de Paris, France
Session: 30 March - 1 April 2015
Scientific Rationale: The team is composed of experts from different fields related to planetary sciences (including astrometry of the Solar system objects, orbital and rotational dynamics, physics of tidal dissipation in planetary and stellar interiors). First, using the accurate positions of Saturn's satellites observed for more than a century and adding the new Cassini data, the team provides updated secular variations of the orbital elements of the satellites that are to be related to internal dissipation processes, via the quality factor Q. Second, the past orbital history of the Saturn system will be revisited, including Enceladus' tidal dissipation and ring interactions. Finally, new results concerning the resurfacing and interior modeling of the satellites will be produced.

Large-Amplitude Oscillations in Solar Prominences

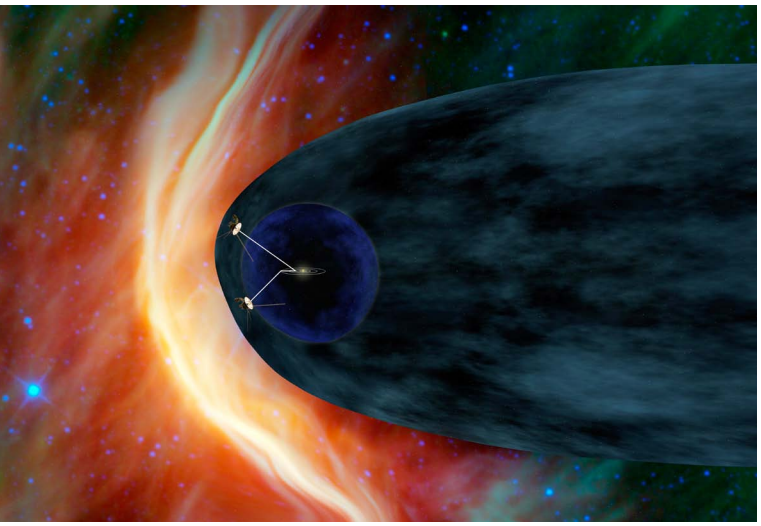
Team leader: Manuel Luna Bennasar, Instituto de Astrofisica de Canarias (IAC), Spain
Session: 2-5 March 2015
Scientific Rationale: The aim is to advance the understanding of large-amplitude oscillations on prominences. Based on the current knowledge about solar prominences, the team produces new developments in the theory of prominence oscillations and analysis of high-resolution observations. Recent studies have shown that such oscillations open a new window on coronal connectivity, as well as novel diagnostics for hard-to-measure prominence properties such as magnetic field strength and geometry.

Saturn reigns supreme, encircled by its retinue of rings. The image was taken with the Cassini spacecraft wide-angle camera on 4 May 2014 using a spectral filter which preferentially admits wavelengths of near-infrared light centered at 752 nanometers. (Image Credit: NASA/ JPL-Caltech/Space Science Institute)

Contemporary Regional and Global Sea Level Rise: Assessment of Satellite and In-situ Observations and Climate Models

Team leader: Benoit Meyssignac, Laboratoire d'Etudes en Géophysique et Océanographie Spatiale (LEGOS), France
Session: 11-14 November 2014
Scientific Rationale: The objective is to (1) evaluate state-of-the-art General Circulation Models (GCMs) against observations of sea level rise and (2) select those models, which best simulate the observed sea level changes and its contributors over the last 100 years. The goal is to assess both the regional and global sea level rise in historical runs of GCMs (1860 through 2005/2014) by carefully comparing models with observations with a particular focus on near-global satellite observations.

International Teams



This artist's concept shows NASA's two Voyager spacecraft exploring a turbulent region of space known as the heliosheath, the outer shell of the bubble of charged particles around our sun. After more than 33 years of travel, the two Voyager spacecraft will soon reach interstellar space, which is the space between stars. (Image Credit: NASA/JPL-Caltech)

There it Spins: the Hunt for Black Hole Spins

Team leaders: Sara Elisa Motta, European Space Astronomy Centre (ESAC), Madrid, Spain, and Tomaso Belloni, INAF - Osservatorio Astronomico di Brera, Italy

Session: 14-18 September 2015 (BY 21)

Scientific Rationale: The team considers spin measurements in stellar mass and supermassive accreting compact objects and addresses the following few major questions:

1. What is the agreement on the methods currently used to measure spin of accreting compact objects? What is the level of detail that can be currently reached with theoretical models and how these models influence the understanding of the spin-related physics? These questions are important to consolidate results on relativistic effects such as the presence of an innermost stable orbit or the measurement of black-hole spins.
2. What links can be made between the different models and methods? Can relativistic measurements with different methods be reconciled? The outcome of the team work will help define strategies and instrumentation set ups for upcoming high-energy missions.

Aeronomy of Terrestrial-Sized Bodies (ISSI - ISSI-BJ Team)

Team leader: Ingo Mueller-Wodarg, Imperial College London, United Kingdom

Session: 20-23 April 2015

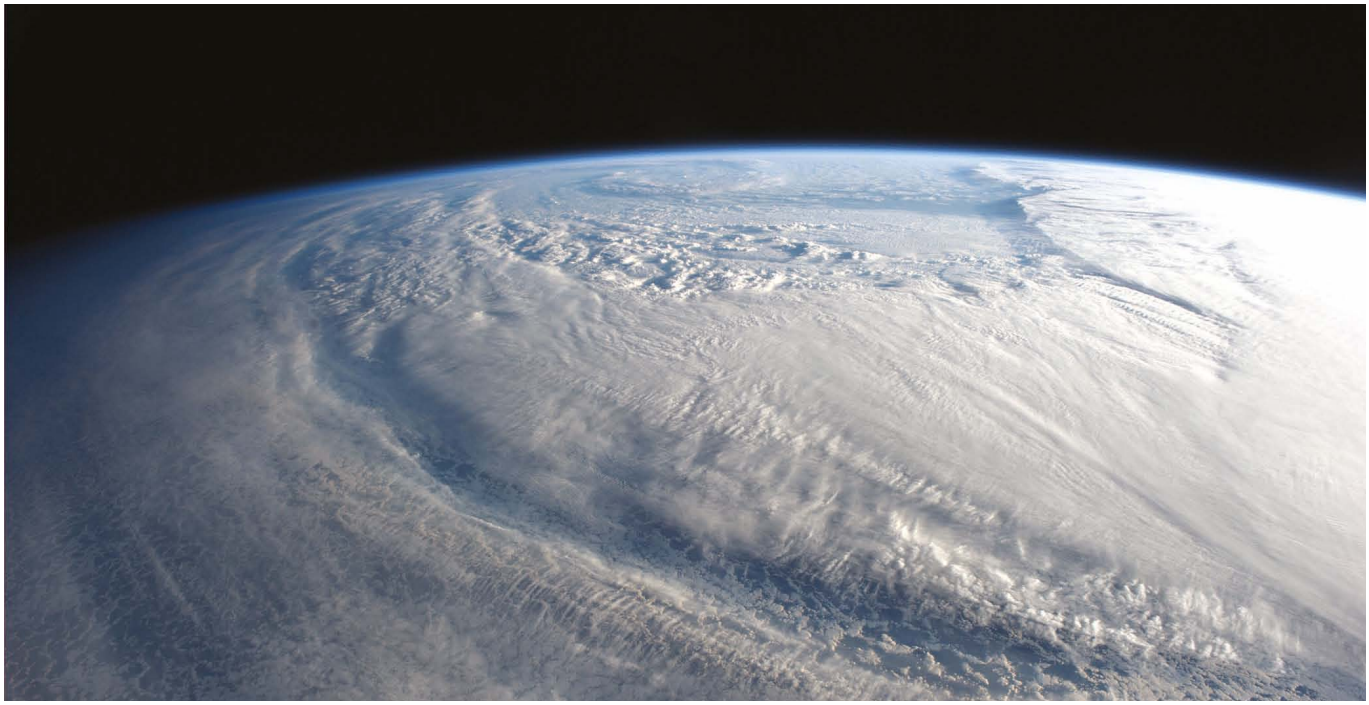
Scientific Rationale: The team discusses comparative aeronomy of terrestrial sized bodies in the solar system (Titan, Venus, Mars) as well as predictions for extrasolar terrestrial sized planets. The scientists focus on four key topics related to small-scale structures and perturbations, including waves, large-scale background structures and solar cycle/seasonal/diurnal variations as well as ionospheric structure, variability and chemistry. The key innovation lies in the comparative understanding of these bodies, which are characterized by different boundary conditions, and development of a more fundamental physical understanding of their properties.

Facing the Most Pressing Challenges to Our Understanding of the Heliosheath and its Outer Boundaries

Team leaders: Merav Opher, Boston University, USA, and Matthew E. Hill, The Johns Hopkins University, USA

Session: 13-17 April 2015

Scientific Rationale: The team confronts some of the most pressing challenges that we are facing in the heliosheath (HS) and its outer boundaries as observed by Voyager 1 and 2. The goal is to make progress on challenging but tractable questions that have arisen over the last several years, and advance key aspects of our understanding of the HS. The team consists of the principal investigators or expert representatives from each of the relevant Voyager instruments, as well as a tailored selection of theorists and modelers who bring the perspectives that will allow the team to better understand and develop a consensus on focused aspects of the nature of the HS. This is a goal that the experimentalists, modelers, or theorists cannot achieve independently. Following the crossing of the heliopause by Voyager 1 in late 2012, several fundamental gaps in our understanding of the HS became clear. The team aims to advance the understanding of: 1. The puzzling orientation of the interstellar magnetic field beyond the heliopause. 2. The unexpectedly narrow width of the heliosheath. 3. The complex particle and field structure near the heliopause.



ESA astronaut Alexander Gerst took this image of our planet during his six-month Blue Dot mission on the International Space Station. He wrote: „Amazing to see that weather is such a global phenomenon. So where was the butterfly?" (Image Credit: ESA/NASA)

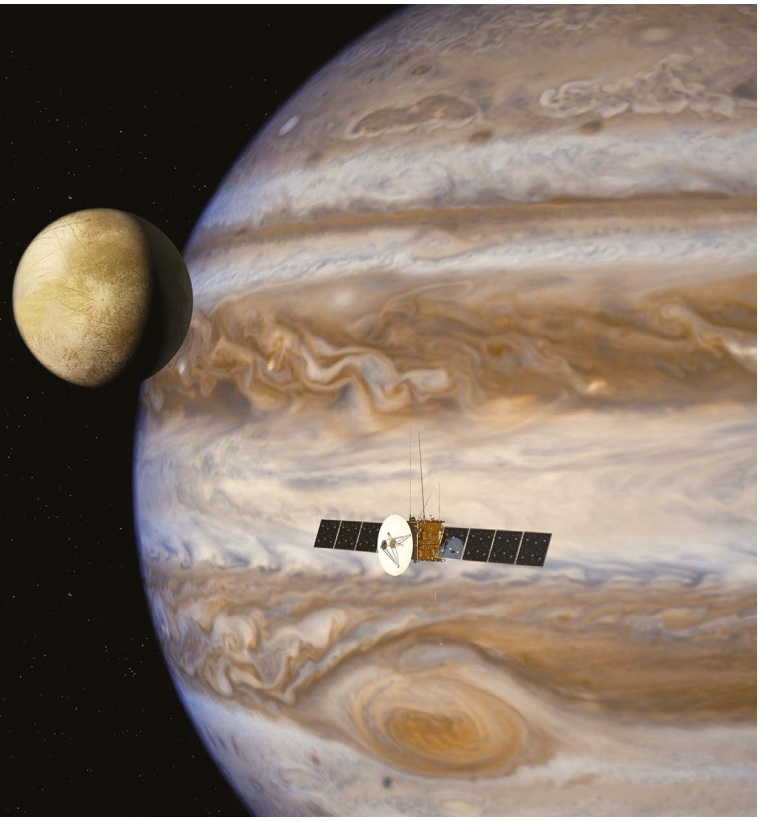
The Disk-magnetosphere Interaction Around Transitional Millisecond Pulsars

Team leader: Alessandro Papitto, Institut de Ciències de l'Espai (IEEC-CSIC), Bellaterra, Spain
Session: 2-6 March 2015
Scientific Rationale: Accretion of the mass transferred by a low-mass companion star is the driver of the spin-up of a subset of neutron stars (NS) to millisecond rotational periods. When the rate of mass transfer decreases at the end of a Gyrlong X-ray bright phase, a radio pulsar powered by loss of NS rotational energy turns on. In 2013-2014, the evolutionary link between these two classes of objects was finally proven by the discovery of transitional millisecond pulsars, sources alternating between accretion and rotation-powered states depending on the rate of mass in-flow towards the NS. At odds with expectations, the observed transitions took place on short time scales (less than a few weeks), involving also an intermediate state characterized by the onset of centrifugal inhibition of accretion. Such fast transitions hold the potential to revolutionize our understanding of the interaction between a quickly rotating magnetosphere and the in-falling plasma, the evolutionary paths of ms pulsars, and the formation and structure of accretion disks. This team brings experts from X-ray and Radio pulsar communities together to discuss these newly discovered transitional millisecond pulsars.

A Three-Dimensional Ground-to-Space Understanding of Sudden Stratospheric Warmings through a Combination of Numerical Models, Satellite and Ground-Based Observations

Team leader: Nicholas Pedatella, University Corporation for Atmospheric Research, Boulder, USA
Session: 26-30 January 2015
Scientific Rationale: In an effort to establish a thorough understanding of atmospheric coupling during Sudden Stratospheric Warmings (SSWs), the team brings together experts in middle atmosphere chemistry and dynamics with experts in the ionosphere-thermosphere system. Through combining ground-to-space whole atmosphere models with ground-based and satellite observations, the team aims to develop an in-depth understanding of the three-dimensional global variability that occurs throughout the atmosphere during SSWs. The comparison of model simulations with a compre-

International Teams



An artist's illustration of the JUpiter ICy moons Explorer (called JUICE) spacecraft in the Jovian system. The mission will launch in 2022 and arrive at Jupiter in 2030 to study the planet and its largest moons. (Image Credit: ESA/AOES)

hensive set of observations will not only serve to validate the model simulations, but also allows for the model simulations to aid in the interpretation of the observations. This will significantly improve the understanding of the processes that drive vertical coupling. Three goals are defined: 1. How do whole atmosphere model simulations of SSWs compare to observations in the mesosphere, thermosphere, and ionosphere? And, is this consistent across SSWs? 2. Can a classification scheme of SSW-related disturbances in the upper atmosphere lead to better understanding the link between the drivers of SSWs and upper atmosphere variability? 3. What is the connection between local and global variability?

Climatological Aspects of Water Vapour and Wet Tropospheric Correction Covering the Altimetry Era

Team leader: Bruno Picard, Collecte Localisation Satellite, Ramonville Saint Agne, France
Session: to be determined
Scientific Rationale: Water vapor in the atmosphere is a key parameter of climate change generally speaking and of the mean sea level rise as well. Exploitation of altimetry measurements over ocean relies on the feasibility of correcting the altimeter range for different perturbations. One of them, the wet tropospheric correction is nearly proportional to the integrated water vapor and is provided by a dedicated instrument, a microwave radiometer, operating around the water vapor absorption line (22 GHz). The objective of the team is to provide answers to the following questions: 1. Are there instrumental drifts on the various sources of water vapor and wet tropospheric corrections, how are they detected and with which accuracy? 2.What are the differences in trends between the various sources (satellite measurements, modeling) and the corresponding uncertainties? 3. Could we agree on a reference for the water vapor and an error on this reference?

Towards a Global Unified Model of Europa's Exosphere in View of the JUICE Mission

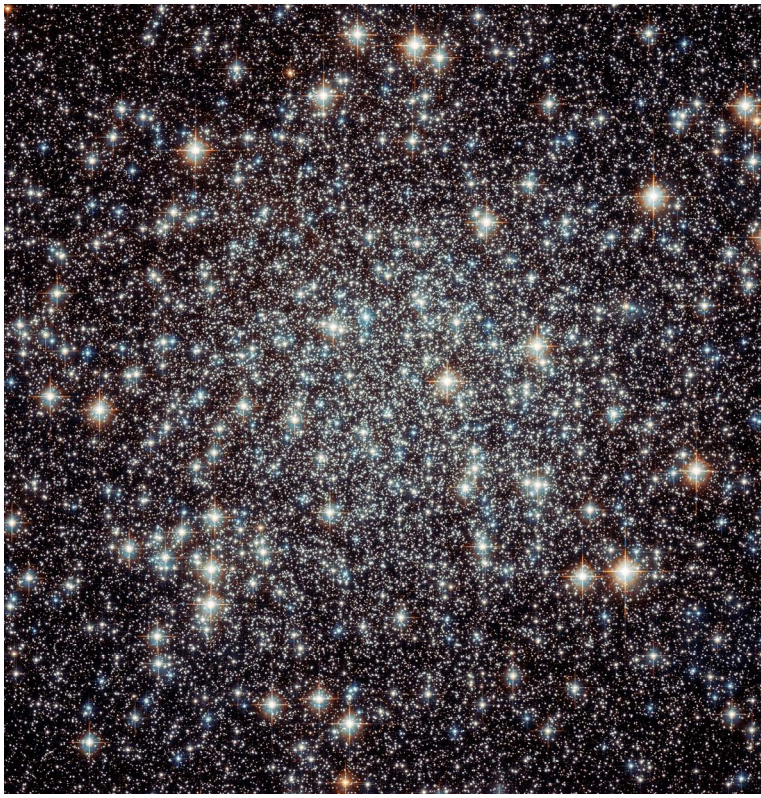
Team leader: Christina Plainaki, IAPS, INAF, Italy
Session: 1-5 December 2014
Scientific Rationale: In a coherent logical frame including theoretical, observational and space activities, the team includes representatives from the major disciplines (MHD, exosphere/ionosphere science and remote sensing) related to the science of Jupiter's moon Europa. The main science goals of this ‚larger view approach' are: 1. Search for potential synergies between different datasets and to assess the related variability. 2. To compare all existing models of Europa's exosphere and to determine the main improvements required to current models 3. To define the required characteristics for a community unified model (main physical phenomena to be included, acceptable assumptions and approximations) 4. To assess possible future experimental work required to constrain the models 5. to define suitable observation strategies for future missions namely JUICE and Europa Clipper.

Bayesian Modeling of the Galactic Magnetic Eld Constrained by Space and Ground-based Radio-millimetre and Ultra-high Energy Cosmic Ray Data

Team leader: Jörg Rachen, Radboud University Nijmegen, The Netherlands
Session: 8-12 December 2014
Scientific Rationale: Given the status of the research field in our research topic, it is time to undertake a critical review of the applied models and methods by an international distinguished expert team. In particular, it would be important to discuss in which respect the current direction of research, i.e., using improved models of the Galactic Magnetic Field (GMF) derive conclusions on Ultra-high energy cosmic rays (UHECR) models, can be reversed and to use existing theoretical and experimental knowledge on the UHECR origin as a constraint for improved modeling of the GMF.

Coordinated Numerical Modeling of the Global Jovian and Saturnian Systems

Team leaders: Licia C. Ray and Japhet Yates, University College London, United Kingdom
Session: 5-9 January 2015
Scientific Rationale: The team aims to develop a comprehensive numerical description of the jovian and saturnian global systems from the outer magnetosphere, where the solar wind interacts with the magnetopause, to the upper planetary atmosphere. Currently, models focus on a specific spatial domain (i.e., magnetosphere, atmosphere, etc.), using simplified boundary conditions to approximate the neighboring regions. The team plans to build a global view of the numerical system by: (1) Comparing and contrasting the existing models within the same physical regime; (2) Refining model boundaries and inputs to increase the exchange of information between models of two neighboring spatial regimes; and (3) Standardizing visualizations, data assimilation, and communication of model details and results to maximize usefulness to the broader community.



This image shows the center of the globular cluster Messier 22, also known as M22, as observed by the NASA/ESA Hubble Space Telescope. Globular clusters are spherical collections of densely packed stars, relics of the early years of the Universe, with ages of typically 12 to 13 billion years. This is very old considering that the Universe is only 13.8 billion years old. (Image Credit: ESA/Hubble & NASA)

The Effect of Dense Environments on Gas in Galaxies over 10 Billion Years of Cosmic Time

Team leader: Gregory Rudnick, University of Kansas, USA
Session: 14-18 September 2015 (BY 21)
Scientific Rationale: The team brings together experts to work on a coherent picture of how gas is affected by the environment. The immediate goals are to:
- Determine the response of the ionized gas to the environments by combining results of HST spectroscopic observations of intermediate redshift galaxy clusters with Gran-TeCan 10-meter Telescope (GTC) tunable filter observations of local galaxy clusters.
- Determine how the star formation rate and dust content are affected by the environment through the use of Spitzer observations of dust emission and millimeter-wave interferometric observations of the

International Teams

Magnetic Waves in Solar Flares: Beyond the "Standard" Flare Model is the topic of this ISSI Team led by Alexander Russell and Lyndsay Fletcher

molecular gas and dust continuum in galaxy clusters spanning 10 Gyr of cosmic time.
- Compare the state of the gas to that of the stars to constrain the transformative mechanism. Initiate new observational programs to measure the physical state (temperature and density) and spatial distribution of the molecular gas and compare it to the state of the ionized gas.
- Make powerful new constraints on the implementation of gas depletion in galaxy formation models.

Magnetic Waves in Solar Flares: Beyond the "Standard" Flare Model

Team leaders: Alexander Russell, University of Dundee, United Kingdom, and Lyndsay Fletcher, University of Glasgow, United Kingdom
Session: 23-27 February 2015
Scientific Rationale: Solar flares are the most energetic events in the solar system and an important reference for magnetic energy release and particle acceleration throughout the Universe. The team works on the following key questions: 1. How do acceleration processes that are known to produce Earth's auroras operate during solar flares, and can they explain flare observations better than the standard flare model? 2. How do the chromosphere and transition region respond to energy input from the corona in the form of Alfvénic waves, given that propagation and damping of waves are subject to nonlinear feedbacks, e.g., via expansion flows and ionization? 3. What observations with current and upcoming instruments would unambiguously determine whether flare energy is transported from the energy release site to the low corona and chromosphere as Poynting flux (equivalently, by Alfvénic waves)?

Solar Heliospheric Lyman Alpha Profile Effects (SHAPE)

Team leader: Martin Snow, University of Colorado at Boulder, USA
Session: 13-15 April 2015
Scientific Rationale: The team studies the effect of solar Lyman alpha (121.6 nm) radiance and irradiance variability on the heliosphere. In particular, the scientists investigate the variability in the line profile over the solar cycle from both theoretical and observational perspectives. The standard solar irradiance data product available to the scientific community has been binned to 1 nm intervals, losing all information about the line shape. Heliospheric and planetary observations and models have become more sophisticated in recent years, and the wavelength dependence of the variability in the line profile is now a significant source of uncertainty.

Extension and Improvement of the Mean Sea Level Estimation in the Arctic Regions Using Space Altimetry Data

Team leaders: Pierre Thibaut, Collecte Localisation Satellite, Ramonville Saint Agne, France, and Eero Rinne, Finnish Meteorological Institute, Helsinki, Finland
Session: 15-18 June 2015
Scientific Rationale: The general objective is to bring experts together to discuss the feasibility of fully exploiting and integrating EO-products information from different altimetry missions. Specifically, the team aims at achieving a more intense communication between the Sea Level and Sea Ice communities. These two communities are using the same data set, are facing the same issues with the measurements and are involved in developing processing methods that could be shared and improved significantly for the benefit of both communities. The team mem-

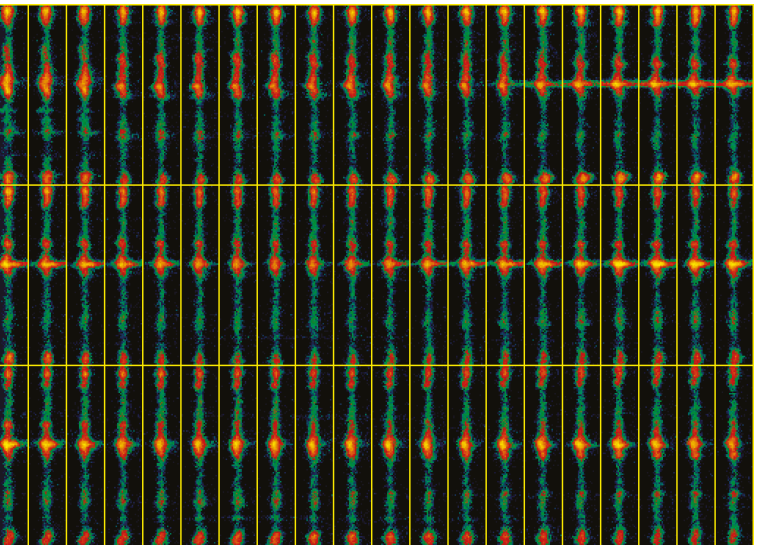
bers i) review the data set that can potentially be used for the observation of these regions ii) identify their potential advantages and drawbacks iii) compare our processing methods and results iv) identify potential synergies between methods and areas for improvement.

Understanding Energetic Particle Injections and their Effect on Earth's Outer Radiation Belt Electrons using Multipoint Observations

Team leaders: Drew L. Turner, University of California, Los Angeles, USA, and Geoffrey Reeves, Los Alamos National Laboratory, USA
Session: 26-30 January 2015
Scientific Rationale: The team takes advantage of the current, unprecedented level of observational coverage throughout Earth's inner magnetosphere and conducts focused research pertaining to the dynamics of Earth's radiation belts. Specifically, the team aims an observationally oriented study to address a set of topical questions in magnetospheric physics concerning the nature of energetic particle injections and their importance in driving outer radiation belt variability. The team is comprised of outstanding researchers hailing from top institutes based in five different European nations, the United States, Canada, Japan, Korea, and China; all of the members share an expertise on observations of particles and waves in Earth's radiation belts. These members also represent several of the missions providing the data that will serve as the basis for our focused research, namely, NASA's Van Allen Probes and THEMIS missions, ESA's Cluster mission, the BARREL Antarctic balloon campaigns, NSF CubeSats, ground-based observatories, and upcoming missions (e.g., ERG).

This broad image of the Carina Nebula, a region of massive star formation in the southern skies, was taken in infrared light using the HAWK-I camera on ESO's Very Large Telescope. Many previously hidden features, scattered across a spectacular celestial landscape of gas, dust and young stars, have emerged. (Image Credit: ESO/T. Preibisch)

International Teams



This image shows a series of observations performed with the ESA/NASA Solar and Heliospheric Observatory (SOHO) to study the evolution of reconnection jets on a small patch of the Sun's surface. (Image Credit: ESA/ NASA/SOHO/The SUMER team, Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany)

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Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field

Team leaders: Gherardo Valori, INAF - Osservatorio Astronomico di Roma, Italy, and Etienne Pariat, Observatoire de Paris-Meudon, France
Session: 1-5 December 2014
Scientific Rationale: The goal is to redefine the state of the art of existing methods for the estimation of magnetic helicity, based both on photospheric injection, inferred photospheric magnetic connectivity, and volume computations. The comparison between different methods will firstly exploit a few numerical test cases that are used in the literature for modeling solar events. This first part of the project is aimed at assessing the accuracy of different methods in a controlled environment. Secondly, the team work applies the methods to actual observations, using models of the coronal atmosphere and active regions where necessary (eg., obtained using nonlinear force-free extrapolation). Such a comparison of methods for the estimations of magnetic helicity has never been thoroughly performed yet.

Improving the Analysis of Solar and Stellar Observations

Team leader: Harry P. Warren, Naval Research Laboratory, Washington, USA
Session: 11-13 May 2015
Scientific Rationale: During the past several decades the amount of high quality solar and stellar data has exploded. These data, however, must be interpreted in the context of complex atomic processes to derive insights into the underlying physics. It is unclear how robust our inferences can be once the uncertainties in the atomic data and instrument calibration are properly accounted for. The goal of this team is to develop and apply the robust statistical techniques needed to fully understand the limits of our ability to interpret remote sensing observations.

The Teams below have been selected for implementation from the proposals received in response to the 2015 Call for International Teams:

Rotational Phenomena in the Saturnian Magnetosphere
Team leaders: David J. Andrews (SE) and Georg Fischer (AT)

Analysis of Persistent Regional Air Pollution in Asia *(ISSI-ISSI BJ Team)*
Team leaders: Guy Brasseur and Idir Bouarar (DE)

Researching the Diversity of Planetary Systems
Team leader: Juan Cabrera (DE)

Towards New Models of Solar Spectral Irradiance based on 3D MHD Simulations
Team leader: Serena Criscuoli (US)

Plasma - Surface Interactions with Airless Bodies in Space and the Laboratory
Team leaders: Jan Deca and Wang Xu (US)

Nuclear Reactions in Superdense Matter – From the Laboratory to the Stars
Team leader: Duncan Galloway (AU)

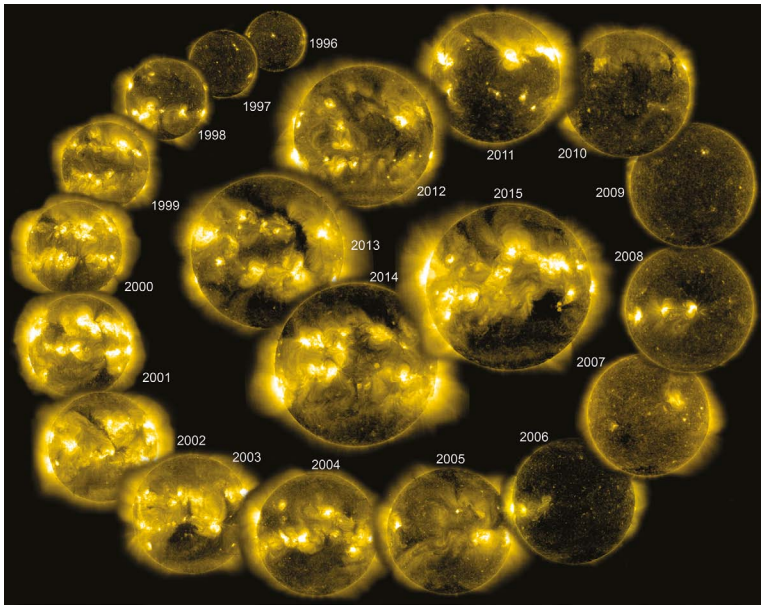
EuroMoon: Lunar Surface Composition and Processes
Team leader: Manuel Grande (UK)

Cosmology with Size and Flux Magnification
Team leaders: Alan Heavens and Hendrik Hildebrandt (UK)

Ring Current Modeling: Uncommon Assumptions and Common Misconceptions
Team leaders: Raluca Ilie (US) and Natalia Ganushkina (FI)

Structure and Dynamics of Jupiter's Magnetosphere and Boundary Regions
Team leaders: Caitriona Jackman (UK) and Christopher Paranicas (US)

The Connection Between Coronal Shock Wave Dynamics and Early SEP Production
Team leaders: Kamen A. Kozarev and Nariaki V. Nitta (US)



The Solar and Heliospheric Observatory (SOHO) has been watching the Sun for almost 20 years. In that time it has seen solar activity ramp up and die down repeatedly. Its Extreme ultraviolet Imaging Telescope has taken images of the resulting waxing and waning of the Sun's corona – its atmosphere – that are impossible to record from the ground. In this composition, brighter images show times when there was more activity on the Sun. Each of the images shown here was taken in the springtime. (Image Credit: SOHO (ESA&NASA))

EO Validation Across Scales
Team leaders: Alexander Loew and Christian Klepp (DE)

Accelerated Ions – The Elusive Component of Solar Flares
Team leader: Alexander MacKinnon (UK)

Understanding Solid Earth/Ocean-Ionosphere Coupling: Improving Models and Observational Capabilities for Monitoring Tsunamis from Space
Team leaders: Jonathan Makela (US) and Lucie M. Rolland (FR)

A Comprehensive View of Stellar Winds in Massive X-ray Binaries
Team leader: Silvia Martínez-Núñez (ES)

Particle Acceleration in Solar Flares and Terrestrial Substorms
Team leader: Mitsuo Oka (US)

International Teams approved in 2015

Image showing ESO's Paranal Observatory in Chile soon after sunset. The last rays of the day create a spectacular orange haze as they pass through the dusty lower levels of the atmosphere. In this long exposure image we can see star trails caused by the movement of stars across the sky as the earth rotates. These tracks look a little like dotted lines, an effect caused by combining a number of individual shots taken with short gaps in between. (Image Credit: ESO/G. Brammer)

Decoding the Pre-Eruptive Magnetic Configurations of Coronal Mass Ejections
Team leaders: Spiros Patsourakos (GR) and Angelos Vourlidas (US)

Polar Stratospheric Cloud initiative (PSCi) Workshops
Team leader: Michael Pitts (US)

Jets Downstream of Collisionless Shocks
Team leaders: Ferdinand Plaschke (AT) and Heli Hietala (UK)

Galactic Cosmic Ray Origin and Composition
Team leader: Nikos Prantzos (FR)

The Formation and Evolution of the Galactic Halo – Setting the Scene for the Large Modern Surveys
Team leader: Donatella Romano (IT)

Radiation Interactions at Planetary Bodies
Team leader: Nathan Schwadron (US)

Physical Properties of Cometary Nuclei Assessed from the Development of 67P CG's Activity
Team leader: Yuri Skorov (DE)

New Diagnostics of Particle Acceleration in Solar Coronal Nanoflares from Chromospheric Observations and Modeling
Team leader: Paola Testa (US)

Astrobiology in the New Age
(ISSI-ISSI BJ Team)
Team leader: Feng Tian (CN)

How Does the Solar Wind Influence the Giant Planet Magnetospheres?
Team leaders: Marissa Vogt (US) and Adam Masters (UK)

Multi-Scale Variations in Auroral Electron Precipitation
Team leader: Daniel Whiter (UK)

Comparison and Validation of Global Non-Potential Magnetic Models of the Solar Corona
Team leader: Anthony Yeates (UK)

Solar UV Bursts – A New Insight to Magnetic Reconnection
Team leader: Peter Young (US)

Individual Scientists are invited for extended periods to work on scientific subjects at the forefront in areas of interest to ISSI. The results of this research are to be published as books or in major scientific journals, with appropriate acknowledgment to ISSI.

The following scientists worked at ISSI in the course of the twentieth business year:

André Balogh, Space and Atmospheric Physics, Imperial College London, UK, working period: 6.-11.11.2014.

Donald Ellison, North Carolina State University, USA, working period: 22.10.-1.11.2014.

Shin Hang Lee, JAXA Japan Aerospace Exploration Agency, working period: 22.10.-1.11.2014.

Ken McCracken, IPST, University of Maryland, College Park, USA, working period: 17.10.-14.11.2014.

Götz Paschmann, Max-Planck-Institute for Extraterrestrial Physics, Garching, Germany, working periods: 7.-18.9.2014 and 29.5.-7.6.2015.

Georg Moragas-Klostermeyer, University of Stuttgart, Germany, working period: 5.-12.5.2015.

Volodymyr M. Reshetnyk, Kyiv National Taras Shevchenko University, Ukraine, working periods: 18.2.-2.3.2015 and 8.-26.6.2015.

Jean-Pierre Rozelot, OCA-LAGRANGE-CNRS, University of Nice, France, working period: 20.-24.4.2015.

Yuri Skorov, Institute for Geophysics and Extraterrestrial Physics, University of Braunschweig, Germany, working periods: 29.9.-10.10.2014, 3.-18.12.2014, 18.2.-2.3.2015 and 8.-26.6.2015.

Thomas Zurbuchen, Department of Atmospheric, Oceanic & Space Sciences College of Engineering, University of Michigan, Ann Arbor, USA, working periods: 20.7.-10.8.2014 and 23.-27.2.2015.

Volodymyr Reshetnyk from Kyiv University, Ukraine (left) and Yuri Skorov, Institute for Geophysics and Extraterrestrial Physics, University of Braunschweig, Germany (right), working on the release of dust particles and their acceleration in the inner coma of Comet 67P.

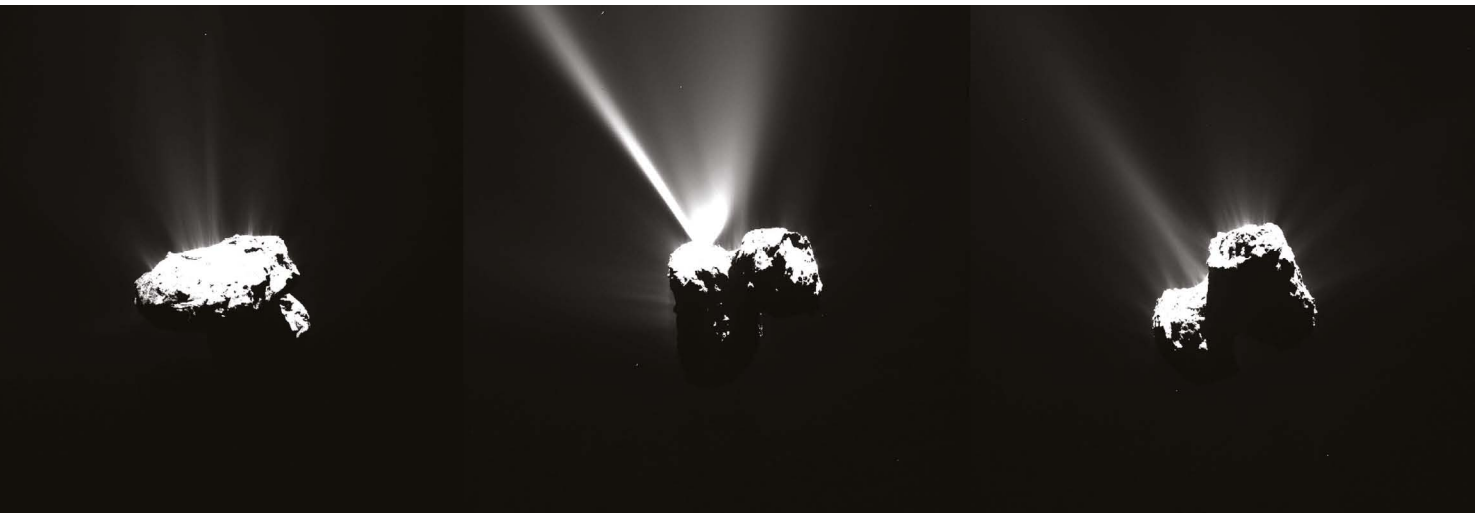
Yuri Skorov, Visiting Scientist at ISSI, answered some questions about his work:

Why have you chosen ISSI for your research?

Y. Skorov: For many years, I know about the ISSI from my colleagues. Every time they spoke about this place exclusively positive. They noted the excellent working conditions and special hospitality staff. I have visited the institute many times, participating in various working groups. However, I came here as a visiting researcher just last year. I have to say that the reality completely justified my expectations. Working at the Institute, I was able to fruitfully cooperate with my colleagues from the University of Bern. In addition, I met with my old friends, who came to the Institute in the framework of other projects.

On which projects did you work during your visit at ISSI?

Y. Skorov: I worked at the institute in the project: "The modeling of energy and mass transport



This series of images of Comet 67P/Churyumov–Gerasimenko was captured by Rosetta's OSIRIS narrow-angle camera on 12 August 2015, just a few hours before the comet reached the closest point to the Sun along its 6.5-year orbit, or perihelion. The image at left was taken at 14:07 GMT, the middle image at 17:35 GMT, and the final image at 23:31 GMT. The images were taken from a distance of about 330 km from the comet. The comet's activity, at its peak intensity around perihelion and in the weeks that follow, is clearly visible in these spectacular images. In particular, a significant outburst can be seen in the image captured at 17:35 GMT. (Image Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA)

within the cometary nucleus. Application to Comet 67P/Churyumov-Gerasimenko: gas production and thermal surface properties." Together with my colleague from Ukraine Dr. Reshetnyk I investigated release of dust particles and their acceleration in the inner coma. We investigated optical and dynamic properties of elevated dust grains and role of various forces acting of them (solar and cometary gravity, gas drag, radiative pressure). We developed a new computational tool simulating motion of an ensemble of polydisperse porous particles. The obtained results were incorporated into 3D transient kinetic model of inner coma developed in the group led by Prof. Nicolas Thomas (University of Bern) and applications to Comet 67P/Churyumov-Gerasimenko were successfully performed.

Is ISSI somehow involved in your projects?

Y. Skorov: Prof. Rafael Rodrigo, Executive Director of the ISSI is deeply involved into the international Rosetta mission. With the advent of the European Space Agency's Rosetta spacecraft at the Jupiter family comet 67P/Churyumov-Gerasimenko, unique scientific data is returned which will allow us to better understand the origin of our solar system. Thus our small research project is a part of wide and very intensive international cooperation.

What is your final impression about ISSI?

Y. Skorov: As I said, I found comfortable working conditions in the ISSI, excellent opportunities for contact with my colleagues and staff hospitality. Definitely I will strongly recommend this place to my colleagues! And I will try again and again to come back to Bern.

The International Space Science Institute in Beijing (ISSI-BJ) was jointly established by the International Space Science Institute (ISSI) and the National Space Science Center (NSSC) with the support of the International Cooperation Bureau and the Space Science Strategic Project of the Chinese Academy of Science (CAS). ISSI-BJ is a close cooperation partner of ISSI. Both institutes share the same Scientific Committee, the same study tools, and other information of mutual relevance and interest. However, both use independent operational methods and different funding sources. More information can be found on its website: www.issibj.ac.cn.

Claude Nicollier is giving an Understanding Science talk on Hubble: 25 years of utilization and on-orbit servicing during the Swiss Day at Beihang University.

In 2014/2015 ISSI-BJ organized three forums to discuss the science and related technology to achieve the scientific goals for future candidate missions within the Space Science Strategic Pioneer Project of the Chinese Academy of Sciences: Micro-arcsecond Astrometry Exoplanets Detection around Nearby Stars in August 2014, Exploring Solar Eruptions and their Origins in October 2014 and Synergetic Observations of the Water Cycle in November 2014. In addition, a fourth forum was held in November 2014 to review the achievements of ISSI-BJ and discuss its future orientations and development with experts from all around world.

The insight gained from these forums are published in the ISSI-BJ TAIKONG Magazine. In 2014/2015 three issues have been published: An Out-of-ecliptic View of our Sun (no. 4), Exploring Solar Eruptions and their Origins (no. 5) and Exploring the Dynamic X-ray Universe (no. 6). All issues of TAIKONG can be downloaded from the website www.issibj.ac.cn.

Furthermore, ISSI-BJ hosted two workshops in the past year, inviting scientists for one week to Beijing to exchange their views on a scientific topic. The first workshop (jointly organized with ISSI) was held in August 2014 on the subject of The Disk in Relation to the Formation of Planets and Their Protoatmospheres. In April 2015 followed the second workshop on Gamma-Ray Bursts: a Tool to Explore the Young Universe. The results of both workshops will be published as refereed papers in the Space Science Reviews and in parallel, as volumes of the Space Science Series of ISSI/ISSI-BJ (SSSI).

ISSI/ISSI-BJ released a joint Call for Proposals for International Teams in Space and Earth Sciences in 2015. Five teams have been selected by the Science Committee. Two out of these five teams will share the meetings between Beijing and Bern. Together with the six selected teams of 2014, ISSI-BJ will host total of 11 International Teams in the upcoming year.

ISSI-BJ is promoting outreach and education activities to the general public and to young scientists as a member of the "Understanding Science" seminars. These informal seminars, held in a coffee shop in Beijing's university area. Around 50 young people attended each of the three Understanding Science lectures of ISSI-BJ held in 2014/2015. Rafael Rodrigo, Executive Director of ISSI, talked about the ESA mission Rosetta, Ji Wu, Director General of NSSC, presented the past and upcoming achievements of China's Space Science and Claude Nicollier, the first Swiss Astronaut, provided an insight into his two missions to service the Hubble Space Telescope on orbit.

To further extend its activities and outreach, ISSI-BJ was able to establish fruitful new partnerships all over Asia during the past year. The newly acquired supporters are the Asia-Pacific Space Cooperation Organization (APSCO) and Tohoku University, Japan. In January 2015, a delegation from the Japan Aerospace Exploration Agency (JAXA) also visited ISSI-BJ to discuss potential cooperation opportunities for the future.

Events and ISSI in the media at a glance

Der kleine Bund – Dienstag, 2. September 2014 29

Wissen

Zurück auf den Mond

Mit dem Schweizer Sonnensegel auf dem Mond wurde Johannes Geiss vor 45 Jahren weltbekannt. Der Forscher, der in Bern lehrte, plädiert für neue Mondmissionen, um die Frühgeschichte der Erde besser zu verstehen.

Barbara Vonarburg

«Das Gesicht des Mondes hat sich in den letzten 3000 Millionen Jahren kaum verändert», sagt Johannes Geiss. Deshalb sei der Mond der Schlüssel, um mehr über die Entstehungsgeschichte unseres Sonnensystems und vor allem auch über die Vergangenheit der Erde zu erfahren. Das hält er für besonders wichtig. «Denn wir sind Erdenbürger, und unsere Forschung wird von Erdenbürgern bezahlt.» Abgehoben hat der Pionier der Weltraumforschung trotz internationaler Anerkennung nie - auch in seinen Träumen nicht. Er selbst wäre nie gern ins All geflogen, dafür sei er viel zu ängstlich, meint er, ist aber überzeugt: «Man muss unbedingt wieder auf den Mond fahren.» Und er weiss auch genau wohin: zum Mare Orientalis auf der Rückseite des Mondes, unmittelbar unter dem Westhorizont und in der Nähe des Mare Nectaris im Osten. Mondproben aus diesen Regionen könnten Rätsel lösen, welche nach den amerikanischen Apollo- und den russischen Luna-Mondmissionen in den 70er-Jahren offen geblieben sind.

Kein bisschen müde

Tatsächlich stehen die Chancen gut, dass nach über 40 Jahren Pause ein Raumschiff - allerdings ohne Menschen an Bord - wieder Mondproben zur Erde zurückbringen wird. Im Dezember 2013 setzte die unbemannte chinesische Mondsonde Chang'e 3 einen Rover auf dem Mond ab. Damit wurden Gesteinsproben zwar nur vor Ort analysiert. Doch bereits 2017 soll Chang'e 5 folgen und mit mindestens zwei Kilo Mondgestein zur Erde zurückkehren. Bei der Auswahl des Landeplatzes könnten die Vorschläge von Geiss durchaus Gehör finden. Denn der emeritierte Universitätsprofessor ist Ehrendirektor des International Space Science Institute (Issi) in Bern, einer Institution, die seit Sommer 2013 ein Pendant in China hat. Das Issi-Beijing wurde mit Unterstützung des Berner Vorbilds und des chinesischen Nationalen Zentrums für Weltraumwissenschaften gegründet. Es soll den internationalen Austausch von Forschungsergebnissen fördern.

Weltweit vernetzt war Geiss, lange bevor dies jedermann anstrebte. Im heutigen Polen geboren, studierte er in Deutschland und arbeitete in der Schweiz und den USA. Der 87-jährige Forscher scheint kein bisschen müde, wenn er engagiert von Erlebnissen und Plänen erzählt. «Erinnerst du dich?», fragt er ab und zu Martin Huber, den ehemaligen Leiter des Wissenschaftsdepartements der europäischen Raumfahrtorganisation ESA, der bei einem Treffen am Issi-Bern neben ihm sitzt. Gerne erzählen die beiden von den Highlights der europäischen Weltraumforschung, vom Vorbeiflug der Raumsonde Giotto am Halleyschen Kometen 1986 oder vom Start des Sonnenobservatoriums Soho 1995, einem Projekts von ESA und Nasa. «Bei Soho hatten wir Europäer die Federführung, was die Amerikaner nur schwer akzeptieren konnten», erinnert sich Huber. Geiss gilt als einer der Väter der Kometensonde Rosetta, die vor einem Monat beim Kometen Tschury eingetroffen ist.

Alte Zeiten, neue Zeiten

In den 60er-Jahren zählte Geiss zu den wenigen Europäern, die engen Kontakt mit der Nasa hatten. 1969, als die Apollo-Astronauten erstmals auf dem Mond landeten, stellten sie noch vor der amerikanischen Flagge ein Stück Alufolie aus der Schweiz auf - ein Segel, mit dem Partikel des Sonnenwindes eingefangen wurden. Das war ein Experiment, das Geiss mit seinem Team in Bern entwickelt hatte. Eigentlich war das Sonnensegel gar nicht für diesen Flug vorgesehen, doch die Nasa hatte kurzfristig beschlossen, aus Sicherheitsgründen auf eine Plutoniumbatterie zur Energieversorgung zu verzichten. Im Gegensatz zu anderen Experimenten brauchte das Schweizer Experiment keinen Strom. Geiss packte die Chance, die sich damit bot.. Die Messung des Sonnenwindes zeigte unter anderem, dass dieser einen Stoff enthält, der nur beim Urknall entstanden sein kann: schwerer Wasserstoff, auch Deuterium genannt - eine Substanz, von der auch etwa zwei Gramm in unserem Körper vorhanden sind. Die Folie aus Bern war auch bei den weiteren Mondflügen dabei, ausser bei der letzten Landung 1972. «Meine Freunde bei der Nasa konnten das Schweizer Erfolgsexperiment nicht mehr ertragen», erzählt Geiss. «Jetzt habe ich wieder zu viel geredet», meint er selbstkritisch und lacht spitzbübisch.

Eigentlich will er gar nicht von alten Zeiten, sondern vom Inhalt seines neusten Artikels erzählen, den er zusammen mit Martin Huber und einem weiteren Kollegen, Angelo Pio Rossi, für das Wissenschaftsmagazin «Europhysics News» verfasst hat. Es handelt sich um einen Überblick über 60 Jahre Mondforschung, der den aktuellen Stand des Wissens zusammenfasst. Der Artikel beruht auf einer ausführlicheren Arbeit, die Geiss und Rossi kürzlich in einer Fachzeitschrift publiziert haben. «Wir zitierten dort 200 Arbeiten und versuchten dabei, möglichst neutral zu sein», sagt der Altmeister. Man nimmt heute an, dass unsere Sonne und die Planeten vor 4600 Millionen Jahren aus einer interstellaren Wolke entstanden sind. 70 bis 110 Millionen Jahre später kam es zu einem kosmischen Zusammenstoss: Ein Körper mit Namen Theia von der Grösse des Mars prallte auf die Erde. Dabei entstand unser Mond. Alle wichtigen Erkenntnisse würden für diese Kollisionstheorie sprechen.

Ein Rätsel war bisher die Zusammensetzung der sogenannten Sauerstoffisotope. Diese ist von Planet zu Planet verschieden. Nur Erde und Mond zeigten keinen Unterschied, als ob sie einen gemeinsamen Ursprung hätten, sagt Geiss. Wenn Theia in der Nähe der Erde geformt wurde, könnte die Isotopenzusammensetzung tatsächlich fast gleich sein. Dass sie nicht vollkommen identisch ist, wies eine Gruppe deutscher Wissenschaftler kürzlich nach, indem sie Mondproben der Apollo-Landungen mit empfindlicheren Messgeräten analysierte, als dies bisher möglich war. Die Forscher fanden eine kleine Differenz in der Isotopenzusammensetzung des Mondgesteins im Vergleich zum Erdmaterial, wie sie Anfang Juni im Wissenschaftsmagazin «Science» berichteten - eine wichtige Bestätigung der Kollisionstheorie.

Auch nach diesem Zusammenprall war das Sonnensystem kein kosmisch geschützter Ort. 500 Millionen bis 1600 Millionen Jahre nach der Mondentstehung gab es nochmals ein heftiges Bombardement. «Das hat man früher nicht gewusst», sagt Geiss. Erst die Analysen der Mondproben und die Kraterzählung zeigten das. «Das Bombardement muss auch die Erde getroffen haben», sagt Geiss. Nur seien bei uns sämtliche Spuren davon durch die Plattentektonik verwischt worden. Deshalb müsse man unbedingt den Mond weiter erforschen, wenn man mehr über die erste Milliarde der Erdgeschichte erfahren wolle.

Legendäre Überzeugungskraft

Der Elan und die Überzeugungskraft von Geiss sind legendär. Als er von 1966 bis 1989 Direktor des Physikalischen Instituts der Universität Bern war, stieg die Zahl der Professuren von zwei auf sieben. Als Manager pflegte er die Kontakte zu Entscheidungsträgern und nutzte geschickt die sich bietenden Gelegenheiten. Im Herzen blieb er aber Wissenschaftler - bis heute. «Der Mensch lebt linear», sagt der Physiker und meint damit, dass wir die Zeit nicht anhalten, beschleunigen oder umkehren können. «Ich würde die Zeit gern um die Hälfte zurückdrehen», meint er. Wegen eines Rückenleidens geht er an Stöcken, bewegt sich damit aber so geschickt, dass er das Tempo der jüngeren Kollegen scheinbar problemlos schafft.

Unermüdlich, hartnäckig und liebenswürdig zugleich versucht er, seine Begeisterung für die Forschung weiterzuvermitteln. Das heftige, kosmische Bombardement in der Frühzeit könnte auch wichtige Konsequenzen für die Erde gehabt haben, meint er. Wurde dadurch die Entstehung von Leben auf der Erde verzögert? Löschten Einschläge bereits existierendes Leben aus, oder hat eine primitive Form überlebt?

Geiss, Huber und Rossi spekulieren aber auch über die Ursache des heftigen Beschusses und kombinieren Erkenntnisse aus der Monderkundung mit Ergebnissen der Exoplanetenforschung. In den letzten Jahren haben Astronomen viele jupiterähnliche Planeten ausserhalb unseres Sonnensystems entdeckt, die ihren Muttersternen in unerwartet geringem Abstand umkreisen. Man vermutet, dass Planeten nicht dort geformt werden, wo sie sich nach Jahrmillionen aufhalten. «Wahrscheinlich sind auch in unserem Sonnensystem die Planeten auf engerem Raum entstanden und dann gewandert», sagt Geiss. Als sich Saturn von Jupiter entfernte, könnte die Umlaufbahn von Saturn so verändert worden sein, dass es zu engen Begegnungen mit Kleinplaneten kam, bei denen Brocken ins innere Sonnensystem geschleudert wurden. Besonders Mondgestein vom Mare Orientalis und nahe dem Mare Nectaris könnte mehr Aufschluss über ein heftiges Bombardement in der Frühzeit unseres Sonnensystems geben, glaubt Geiss.

Johannes Geiss hat mit 87 die Ergebnisse von 60 Jahren Mondforschung zusammengefasst. Foto: Ruben Wyttenbach

Astronaut Buzz Aldrin setzt 1969 das Schweizer Sonnensegel auf dem Mond. Foto: Nasa

Spektakuläre Mission

Landeplätze für Rosetta

Im November wird die Mission in die Geschichte der Weltraumfahrt eingehen: Der Landeroboter Philae der Sonde Rosetta der Europäischen Weltraumorganisation (ESA) soll auf dem Kometen 67P/Tschurjumow-Gerasimenko landen, um den Kometen auf seinem Weg in Richtung Sonne zu untersuchen. Die Forscher haben nun fünf Kandidaten ausgewählt, wo Philae niedergehen könnte. Viele Gebiete fielen schnell aus der Auswahl, weil verschiedene Kriterien erfüllt sein müssen: Die Landestelle muss erreichbar und flach sein. Ein optimaler Funkkontakt zur Raumsonde ist bedeutsam, damit Daten ausgetauscht werden können. Und es ist nach der Landung täglich mindestens sechs Stunden Sonnenlicht für mindestens sechs Monate nötig, um die Solarzellen von Philae aufzuladen: alzu stark darf sich der Roboter aber auch nicht aufheizen. (mi)

Large newspaper article about ISSI's founder Johannes Geiss in the Swiss newspaper „der Bund" appeared on September 2, 2014. (Portraiture by R. Wyttenbach)

ISSI in the media

Article "Researchers recover possible first samples of interstellar dust" with V. Sterken by G. Haley Massara, The Daily Californian, 17 August 2014.

Article "Sieben Körnchen Sternenstaub" with V. Sterken by H. Rietz in Neue Zürcher Zeitung, 19 August 2014.

Article "Zurück auf den Mond" with J. Geiss by B. Vonarburg, Tagesanzeiger and der Bund, 2 September 2014.

Radio Interview "Extraterrestrials" with R. von Steiger, Nachtklub, Swiss Radio SRF 1, 4 September 2014.

Interview with R. von Steiger on the Voyager Golden Record, Mad Scientist Festival, Naturhistorisches Museum Bern, 5 September 2014.

Article "Der Geist von Genf - Internationale wissenschaftliche Veranstaltung zur Feier des 50-Jahr-Jubiläums der ESA" with R.-M. Bonnet by A. Feusi, Neue Zürcher Zeitung, 13 September 2014.

Live TV Interview with R-M. Bonnet from ESOC to Paris Cité des Sciences de La Villette with French President present, at the occasion of the Rosetta-Philae landing, 12 November 2014.

Live TV transmission of the Rosetta-Philae landing featuring R-M. Bonnet among several others, 12 November 2014.

TV Interview with R.-M. Bonnet, J.-Y. Le Gall, J.-P. Bibring, and several others, Bibliothèque Medicis, French TV Chaîne Parlementaire, 3 December 2014.

Radio Interview with M. Blanc, M. Fontez, O. Grasset, A. Coustenis, on "Europe: Y-a-t-il de la vie sur le satellite de Jupiter?", Radio France Culture, 5 December 2014.

TV Interview with R.-M. Bonnet, by Xavier Sayanoff for Chanels CINE and Canal+, Series of three films for TV Cable Channel RMC, 17 December 2014.

TV Interview "Rosetta Mission" with R. Rodrigo, Newscast, Spanish Television TVE, 23 January 2015.

Radio Interview "Rosetta mission" with R. Rodrigo, Radio Nacional de España, 9 February 2015.

Interview "The Rosetta-Philae Landing" with R.-M. Bonnet by Pierre-Olivier Jay, Une saison en Guyane, N°14, 106-109, March 2015.

Radio Interview with R.-M. Bonnet "celebrating 25 years of Hubble Space Telescope", French Radio RFI, 22 April 2015.

Radio Interview "Philae wake up" with R. Rodrigo, Radio Nacional de España, 15 June 2015.

"The multidisciplinary character of the research activities at ISSI in a bottom-up team approach has proven to be a unique selling point over the years and is greatly acknowledged by a broad international user community. ISSI's compact organisation, comprising a very supportive and competent staff, accomodates a large degree of flexibility and adaptability resulting in an informal and friendly working atmosphere. Over the 20 years of its existence this has been a key factor to its success story!"

Johan Bleeker

"Before ISSI was born I have been deeply involved in a feasibility study together with Hubert Curien from France and Yash Pal from India for the creation of a World Institute on Space and Society (WISS) in 1988. This institute was supposed to become a Research and Training Centre of the United Nations University. Based on this experience I was pleased to participate in the pioneering work for ISSI bringing together scientists from all over the world for the joint analysis of data obtained in outer space. The immense international reputation of its first Executive Directors Johannes Geiss and Roger Bonnet and the competence, the positive and constructive spirit of its staff and the pleasant working climate at ISSI founded the basis for its tremendous success. I also admired the most competent guidance of the first Chairman of ISSI's Board of Trustees, the late Hans-Peter Schneiter."

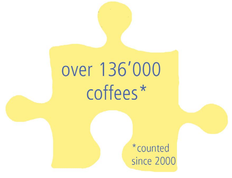
Johannes Ortner

"Contributing to the creation of ISSI was a once in a lifetime experience for me: an exciting variety of challenges came up beginning with drafting and signing the Public Deed of Foundation over settling ISSI's accounting mechanisms to conceiving and editing the Spatium magazine. Many experts granted us their valuable support thereto; still, what made this experience truly unforgettable was the collaboration with ISSI's spiritus rector Johannes Geiss."

Hansjörg Schlaepfer

"It was Christmas 2008 when the directors of ISSI gave me the opportunity to work as a research scientist at ISSI. During the following three years, I had the pleasure to work on a multitude of scientific topics related to climate research and, to my great honor, in collaboration with leading scientists in the field. In addition to that, the casual interaction with several visiting scientists at ISSI's premises has been inspiring and a constant source of learning and laughter. But ISSI has been much more than a scientific home for me. ISSI has been -and still is- a place of sincere collaboration, of mutual help and trust, and most importantly, a place where I meet my friends."

Simos Koumoutsaris



"As ISSI's first post-doc (1996-1998) I had the fortune to work closely with my mentor and one of ISSI's Directors, Professor Bengt Hultqvist. At ISSI post-docs have the unique opportunity to meet and interact with many experts who come for workshops and visits. As a result I was part of a large professional network early in my carrier. I continue to benefit tremendously from the "ISSI network", both professionally and privately."

Marit Oieroset

"Twenty years ago two successful related stories were initiated in Europe. ISSI took its first steps in 1995 when SOHO, the mission opening the ESA program Horizon 2000, was launched. From the very beginning the SOHO community found a hospitable and stimulating environment at ISSI, where many special meetings and working groups were hosted. ISSI provided the best setting for fruitful discussions and a beneficial exchange of ideas among scientists involved in complementary heliophysics missions. In this way the newly-born, developing ISSI, with the enlightening presence of its founders, played a crucial role in facilitating the achievement of important breakthroughs, made possible thanks to the SOHO observations of the Sun from L1, with the best suite of instruments available at the time."

Ester Antonucci

"Pro ISSI organizes public lectures of new developments in space sciences and related fields, such as astronomy, astrophysics, cosmology, particle physics as well as earth and climate sciences. Encouraged by the growing public interest, the number of lectures was recently increased from two to three per year. SPATIUM, the printed version of the lectures, enjoys great popularity and is widely distributed among institutions, companies and private persons within and outside Switzerland."

Klaus Pretzl

ISSI a Catalyzer for Space Research for 20 Years

In 1995, the International Space Science Institute opened its doors for scientists from different countries to meet and work together in a multi- and interdisciplinary setting to reach out for new scientific horizons. What started as a small project turned into an Institute well-known all over the world with about 1000 visitors per year. In this centerfold you will find statements from personalities who were involved in the creation and early evolution of ISSI. Together with a timeline of ISSI's history and a few key numbers and outputs.

"The day I saved ISSI

As always there were some delicate issues to settle in the meeting of the ESA Council. These issues were discussed before any formal decision in a so-called "Heads of Delegation lunch". I hated those lunches because instead of chatting with one of the charming ladies in the normal ESA-Restaurant we were confined to a windowless room and had to discuss business over lunch.
On the Agenda of the December 1994 Council meeting was the point about ESA cofounding thee emerging International Space Science Institute in Bern, Switzerland. Things did not look good: the Science Committee had voted 8 to 6 against. I tried my best to convince my colleagues. According to country, opinions varied from positive to very hesitant. Individually, I put forth my arguments. And the tide began to turn. In the formal meeting, there was an informal show of hands before the decisive vote. To my satisfaction, more than two thirds of the Delegations were indicating they would vote positively. And then, in one of my spontaneous moves, I asked for the floor again, seconds before the vote. I said "look, the two thirds necessary for a positive decision are attained anyway. So why don't you vote all in favor – to do ISSI and me personally a special favor." To my great delight, in the end, all hands rose and Council thereby pronounced itself unanimously in favor of ESA cofinancing. Nobody knows how the situation would have evolved, if this decision had not been taken. Some eminent colleagues are convinced that the idea of creating ISSI would – sadly – have died."

Peter Creola

"Quite rightly we are celebrating the 20th anniversary of ISSI since the activities of ISSI have been a great success. Well, but its origin goes back for more than twenty years. I remember very well the visit of Johannes Geiss and Gustav Tammann on January 12th, 1989 at my office in Paris being at that time the DG of ESA. Geiss and Tammann informed me about their ideas which I found very attractive. As a consequence I wrote letters to the Chairman of the US National Research Coucil Frank Press, as well as to the Director of the Space Research Institute of the USSR Prof. A.A. Galeev. This started the procedure for setting up ISSI. The final decision of ESA took place on November 24th 1994 by the ESA Council.
I hope ISSI will be also successful in the future."

Reimar Lüst

"For 20 years, ISSI has provided space scientists with a unique environment where reflecting on results with colleagues from all over the world can be fruitfully undertaken. As a Director (2005-2010), I was privileged to be able to contribute to the scientific gatherings and publications of ISSI – and I'm particularly pleased the way ISSI covered magnetic fields everywhere in the Universe, aspects of space plasmas and solar activity in series of Workshops. I am proud to have worked with Johannes Geiss, with Ruedi von Steiger and I am grateful to the staff of ISSI for always making me feel at home. The ISSI post docs I have worked with have helped me to tackle aspects of turbulence close to my heart. My appreciation of ISSI would not be complete without a mention of its support for the Summer Schools in Alpbach which has enabled me to contribute over the past decade to this other unique European institution that furthers the cause of space sciences."

André Balogh

"ISSI has provided a focus of my work since its foundation 20 years ago. It has allowed me to serve as workshop organizer, leader of teams and working groups, book editor, and director. But the largest impact has been the insights gained from discussions with the many outstanding colleagues ISSI brought me together with."

Götz Paschmann

"ISSI A very special place!
ISSI is one of the very few places in the world where Science is in the driving seat. For all of us that have been driven by an ever-lasting curiosity to understand the physical world around us and our place in the universe, we cannot find a more stimulating place to visit. I am deeply grateful to have been given this opportunity and equally grateful for the warm, positive and generous atmosphere of the ISSI staff."

Lennart Bengtsson

"ISSI is an outstanding institution. Since its foundation, it has significantly extended its subject area coverage and now has major impact on virtually all of the space sciences. Participants in its programmes come from all parts of the world thus giving it a similar reach to that of COSPAR. It has been my privilege to serve ISSI both as Science Committee chair and as a Director. This has allowed me to fully appreciate its unique role in enabling the hugely successful exploitation of a wide range of space observations."

Len Culhane

"When Johannes Geiss convinced me 25 years ago that an international advanced study institute for space science, similar to Trieste, should be established in Switzerland I was (for financial reasons) a bit sceptical. But the "gang of 4" (Geiss, Balsiger, Maeder and Tammann) started its mission to convince decision makers in the Swiss and Bern governements and in ESA that this was not only a good idea but really a need for space science. The breakthrough was achieved at the International Lunar Workshop in Beatenberg in 1994 when the Secretary of State for Research, Ursprung, and the Director General of ESA, Luton, met and agreed that the Institute should be established and the costs would be equally shared by ESA and Switzerland. A few more hurdles had to be overcome but nothing and nobody was able to stop the momentum gained in Beatenberg. As always: "success has many fathers", it would be futile to list the names. Optimists started the endeavour, but none of them would have dared to predict the success story ISSI has become."

Hans Balsiger

"In 1994 I was asked by Prof. Geiss to see him in Bern. At that time I was a Secretary to the IACG (Inter-Agency Consultative Group) which was founded in the 1980s to promote cooperation among space science agencies of the world, namely, ESA, IKI, ISAS of Japan, and NASA. We met at a coffee shop on the upper floor of the Bahnhof. He told me about his dream plan of a space science institute of a novel kind, where scientists from over the world can spend some extended time to address scientific issues together. It was a fantastic idea, I thought, and I am very pleased that his dream has come true; ISSI has established its position as a corner stone of the international space science community, and a number of Japanese space scientists have taken active part in ISSI programs. I admire the foresight and drive of Prof. Geiss."

Atsuhiro Nishida

"ISSI has always been a dream experience for me. Joining forces with other scientists around the world with the common goal of getting the best out of in-orbit space missions is a great experience that ISSI provides naturally and efficiently. Many thanks for all these years of continuous success!"

Alvaro Giménez

"ISSI is a gem, not least through its capacity to attract the best scientists from all over our blue planet. A key driver of its success lies in the hard work of its highly qualified staff, coupled with the light structure it preserves. ISSI contributes substantially to the international reputation of Switzerland in space. I'm proud of ISSI!"

Daniel Neuenschwander

"ISSI - A superb multidisciplinary space science platform with first class output for the professionals and for the public! Since its creation in 1995, it has become an indisputable reference in Solar System and Earth science, astrophysics, cosmology, and astrobiology."

Claude Nicollier

"Best wishes to the future of ISSI with the same and excellent spirit and culture which have been developed over the past 20 years. We hope also that this spirit and culture can be relayed to the east in our joint initiative, ISSI-Beijing."

Ji Wu

16 Working Groups

"In the early 1990s, when I was NASA Associate Administrator, Johannes Geiss visited me in Washington, D.C. and told me about this wonderful idea he had for a new institute. I offered my encouragement, advice, and whatever assistance NASA could provide. I thus have the satisfaction of having participated in the birth of ISSI, and I must say the breadth of its activities and the influence it has had on space science have far exceeded my original expectations."

Len Fisk

"ISSI has been a part of my professional life as a planetary scientist ever since I attended the first workshop on Mars' evolution in the year 2000. The lively but at the same time almost cozy atmosphere at ISSI has been the same over the many years since. About ten more workshops followed all packed with intensive scientific discussion and with writing review papers thereafter. I am proud to have contributed to the ISSI book series that I rank extremely high for providing an excellent launch pad for work in the fields they cover. I am sure that the scientific community and more specifically the planetary science community would not be as lively and as successful were it not for the forum ISSI continues to provide. My thanks go to Johannes Geiss and his colleagues for founding ISSI, Roger Bonnet and Rafael Rodrigo for directing it over the past years and to the ISSI directors and staff for keeping it smoothly going in an excellent atmosphere, including the famous ISSI dinners."

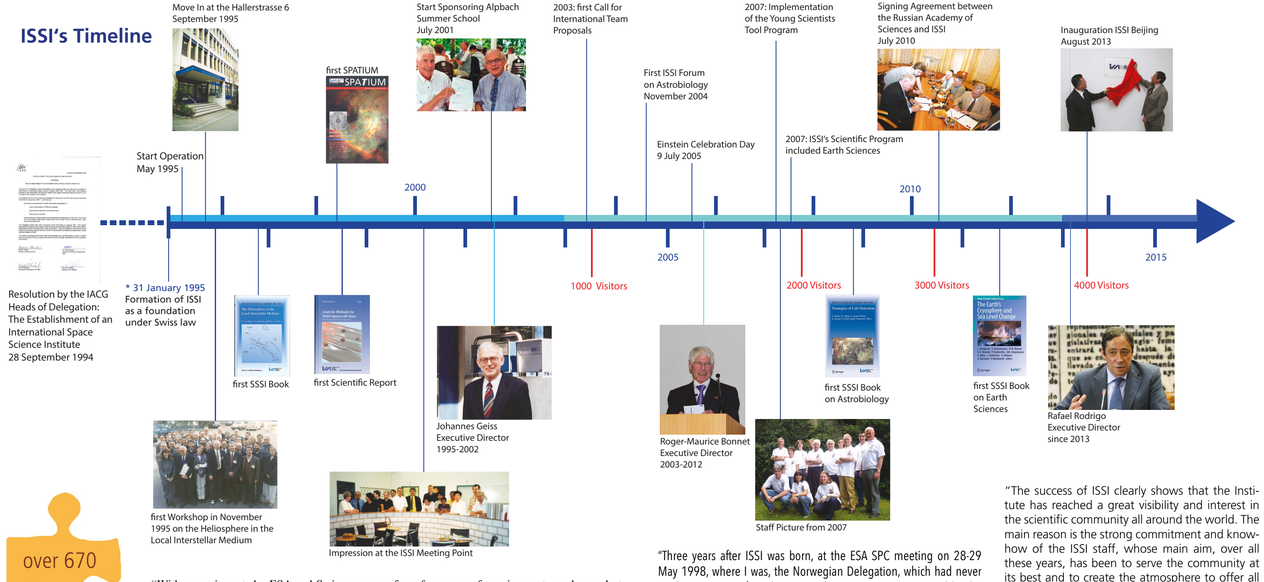
Tilman Spohn

52 Countries

"ISSI has become the global Forum for Space- and Earth Sciences to meet."

Michael Rast

ISSI's Timeline



"With commitments by ESA and Swiss sponsors for a few years of running costs, and a modest foundation capital, Bent Hultqvist, Rudi von Steiger and I started in May 1995 to convert vision into reality: renting and refurbishing the place, buying furniture and computers, hiring staff, arguing the deed - and organizing the first ISSI Workshop "The Heliosphere in the Local Interstellar Medium". I invited participants at the UGGI General Assembly in Boulder, and by phone. Almost everybody came. Sixth November 1995, Hallerstrasse 6: the Workshop opened: 42 participants from 32 institutes in 11 countries looked at the heliopause from all sides and argued about data and interpretations. It was a great success. For the first time I thought: ISSI is here to stay."

Johannes Geiss

"Three years after ISSI was born, at the ESA SPC meeting on 28-29 May 1998, where I was, the Norwegian Delegation, which had never made any secret of its skepticism about ISSI, most impressed by the high praise it had received from the Evaluation Group chaired by Martin Rees, declared: "while others could have taken on the role performed by ISSI, they had not done so"! Norway then voted for the continuation of the Institute. ISSI is never so strong as when it does what the others do not do! ISSI's added value is the gold nugget to assiduously prospect in the forthcoming 20 years."

Roger-Maurice Bonnet

"The success of ISSI clearly shows that the Institute has reached a great visibility and interest in the scientific community all around the world. The main reason is the strong commitment and know-how of the ISSI staff, whose main aim, over all these years, has been to serve the community at its best and to create the atmosphere to offer all our visitors a successful and pleasant stay. Thank you for these first 20 years!"

Rafael Rodrigo

"ISSI – 20 year of success and service to the world space community.
Thinking about ISSI I always recall the Bible story of the tower of Babylon. This very ambitions endeavor failed because people lost a common language.
Th tower of Babylon in Bern, however, appeared to be more than successful. People from the multitude of countries visiting ISSI easily found a common language – science – and even more left Bern establishing new friendships and new collaborations.
I remember very well the prenatal period of ISSI birth. First reports of Martin Huber and Johannes Geiss at IACG meeting in Saint Petersburg in 1993, where they clearly articulated their ambitious idea of a world Space Science Center in Switzerland. We should give credit today to IACG – Inter Agency Consulting Group and its leaders of the 90s (Four Agencies heads) who endorsed and persistently supported this idea. IACG was dismantled unfortunately in 2002, but its offsprings: ISSI, IMEWG, ILEWG are still very productive and active, especially ISSI.
In the late Fall of 1996 I visited ISSI for the first time to participate in a Bengt Hultqvists workshop "Sources and losses in the Earth's magnetosphere". I fell in a love with ISSI from the first day. The atmosphere of open and very intense scientific discussions mixed with the Charm of the old Bern town and hospitality of Swiss people produced an irresistible effect. Once I tried to count my visits to Bern during these 20 years and failed – something between 30 and 40.
I think, I participated in all forms of ISSI activities: Workshops, International Teams, Forums and Working Groups.
I think that ISSI benefited a lot from the strategic vision of its directors: Johannes Geiss, Bengt Hultqvist and Roger Bonnet. I am pleased to witness that Rafael Rodrigo continues to move now along the difficult path of his great predecessors.
Success also brings challenges. The growing popularity of ISSI in space science community resulted in an almost explosive growth of a number of applications to various ISSI programs.
ISSI responded to this challenge forming a daughter organization: ISSI – Beijing. High ISSI standards of preparation of scientific meetings will now be extrapolated to a new ISSI – type platform in China.
I think that this peaceful expansion of ISSI will continue during the third decade of its existence, and we, in Russia, are also thinking about extrapolation of ISSI experience to our country.
Concluding these notes I would like to wish ISSI to keep its momentum, its high standards and traditions.
Many of us, consider ISSI now as our second scientific home and we believe that each time coming to Bern we will meet great enabling environment for science, which we get used to during these unforgettable 20 years."

Lev Zelenyi

"When I joined ISSI twenty years ago as employee no. 2 it was a high-risk endeavour with no guarantee for success. Yet I took it with youthful exuberance to support Johannes Geiss in implementing his dream of an open forum for discussing space science. To our great advantage the funding agencies gave the idea sufficient credit and the community largely responded with enthusiasm, but it was not until I held the first copy of Vol. 1 in the Space Sciences Series of ISSI in my hands that I first thought ISSI might be here to stay. — Today the series is approaching Vol. 60, I have spent the better part of my scientific life at ISSI, and I couldn't wish for a better place to do so. This makes me feel deeply grateful to Johannes, all my colleagues, and most of all each and every guest who have made ISSI such a unique and rewarding place to be."

Rudolf von Steiger

13 ISSI Scientific Reports

"Gurli and I came to Bern in the late summer of 1995 in order to help Johannes put his ideas into effect. We had four immensely interesting years there, feeling like we were young again, with Johannes and Carmen as our closest friends and seeing how ISSI quickly became an important new tool for developing space research. It was a very happy period in our lives.
We congratulate ISSI for its enormous success in the years after ours and send our very best wishes for the future."

Gurli and Bengt Hultqvist

over 670 published Staff Papers

ISSI and the Alpbach Summer School 2014

The topic of the Summer School Alpbach 2014, held from 15 to 24 July, was the geophysics of the terrestrial planets: Mercury, Venus, the Earth and Mars. The topic was covered in lectures by leading European experts that provided the background to four student teams, each composed of 15 students, to propose and elaborate space missions that addressed the outstanding topics in the field. This year, all four teams selected Venus as their target: it is indeed the Earth's closest neighbor in the solar system, in many ways similar to Earth, yet with dramatic differences, not only because its almost impenetrable atmosphere, but also because of its very different geological history. By the end of the Summer School, four different, but equally excellent mission proposals were presented to a Jury of experts. The four missions targeted the observation of the surface and interior of Venus by spacecraft and scientific instruments, with objectives that covered the tectonics and volcanism of the planet, its evolution, and the differences between terrestrial and Venusian geophysics. As in previous years, the presentations were received with great compliments by the Jury who selected the best scientific case, the best technical case, the most competitive mission and the best presentation, together with a special mention to one of the teams by the President of the Jury. Appropriately, all four teams received prizes from the Jury. Following the Summer School, a specially selected team of 15 students from Alpbach elaborated further the mission concepts; the main objective of the proposed mission, Hesperos, is to be the study of tectonics and associated time scales as well as the structure and composition of Venus. This mission was presented at the 46th Lunar and Planetary Conference in Houston, Texas, USA, in March 2015 by representatives of the Alpbach students. In 2014, in line with its long association with the Summer School, ISSI was represented at the Summer School Alpbach through the support of Roger-Maurice Bonnet (Chairman of the Jury), André Balogh (Scientific Coordinator) and Silvia Wenger (Administrative Support).

Roger-Maurice Bonnet (Chairman of the Jury) and André Balogh (Scientific Coordinator) during the Alpbach Summer School 2014.

Events

22 October 2014: Pro ISSI talk "GAIA: Die Vermessung der Milchstrasse" by Stefan Jordan.

6 November 2014: Meeting of the Science Committee.

7 November 2014: Meeting of the Board of Trustees and ISSI Dinner.

25 March 2015: Pro ISSI talk "Ein Salzwasserozean im äusseren Sonnensystem: Die Raumsonde Cassini erforscht den spektakulären Saturnmond Enceladus" by Frank Postberg.

27 May 2015: Pro ISSI talk "Philae, Landung auf dem Kometen Churyumov-Gerasimenko" by Stephan Ulamec.

26-27 May 2015: Meeting of the Science Committee.

2 July 2015: Meeting of the Board of Trustees.

Staff Activities

Listed are activities in which ISSI staff scientists participated between 1 July 2014 and 30 June 2015. This includes presentations given, meetings attended, honors received, and chairmanships held.

Presentations

4 July 2014 – V. Sterken: Interstellar dust in the solar system, Semianr talk, Planetary Imaging Group, Space Research & Planetary Sciences Division, University of Bern, Switzerland.

14 July 2014 – R. von Steiger: Solar Wind Observations with Ulysses-SWICS, Seminar talk, University of Heidelberg, Germany.

16 July 2014 – R.-M. Bonnet: Fifty Years with a Star and More, Keynote Speech, Alpbach 2014 Summer School, Austria.

2-10 August 2014 – R. von Steiger: Sources of the Solar Wind – the Heliospheric Point of View, COSPAR 40th Scientific Assembly, Moscow, Russia.

2-10 August 2014 – A. Bykov: Cosmic ray acceleration in starburst regions and their nonthermal emission, 40th COSPAR Scientific Assembly, Moscow, Russia.

6-8 August 2014 – N. Champollion: Spatial & temporal variations of snow density near the surface on the Antarctica Plateau, from AMSR-E passive microwave observations and ENVISAT radar altimetry measurements (Poster Presentation), Microstructure in Snow Radiative Transfer Model, MicroSnow Workshop, Reading, UK.

6 August 2014 – V. Sterken: Interstellar dust in the solar system: the Ulysses perspective, 7th meeting on Cosmic Dust, Osaka, Japan.

12 September 2014 – R.-M. Bonnet: Historical perspective of European Space Science, 50th Anniversary of ESA, Centre International de Conférences, Geneva, Sitzerland.

16 September, 2014 – M. Falanga: Eclipsing HMXBs: 10 years of INTEGRAL Observations, 10th INTEGRAL Workshop, Annapolis, MD, USA.

23 September 2014 – V. Sterken: Dynamics of interstellar dust in the heliosphere as a tool to reveal its secrets, Seminar talk, Center of mathematics and Plasma-Astrophysics, KU Leuven, Belgium.

8 October 2014 – V. Sterken: The flavor of local interstellar dust in the solar system, Seminar talk, Space Research & Planetary Sciences Division, University of Bern, Switzerland.

14 October 2014 – R.-M. Bonnet: 30th Anniversary of the Disappearance of Beppi Colombo, Video presentation, CISAS, Padova, Italy.

15 October 2014 – J. Zarnecki: Happy Landings!?: Spacecraft Landings on Titan and Comet CG, Public Lecture, Liverpool John Moores University, United Kingdom.

7 November 2014 – M. Falanga: Millisecond X-ray pulsars: 10 years of progress, öffentliche Habilitationsvorlesung, University of Basel, Switzerland.

7 November 2014 – R. Rodrigo: Discovering a comet: 67P/Churyumov-Gerasimenko as observed by Rosetta/OSIRIS, ISSI, Bern, Switzerland.

14 November 2014 – R.-M. Bonnet: Du Bébé Univers à Rosetta, Public conference, Scène aux Champs, Verdelot, France.

19 November 2014 – R. Rodrigo: Conquering the comet: Spacecraft Rosetta writing History, Institute of Physics, Beijing, China.

25, 27 and 28 November 2014 – R.-M. Bonnet: The Historical Flight of Rosetta to Comet 67P, Beijing IAA Day, China Academy of Space and Technology, NSSC, Beijing, China.

10 December 2014 – V. Sterken: Understanding interstellar dust in the heliosphere, Seminar talk, Laboratory for Atmospheric and Space Physics, University of Boulder, CO, USA.

11 December 2014 – M. Falanga: Poynting Robertson effects in General relativity, Astronomical Institute of the Academy of Sciences, Prague, Czech Republic.

15 December 2014 – V. Sterken: The role of the heliosphere for interstellar dust trajectories - revisited (SH13B-4124) (Poster presentation), Fall Meeting of the AGU San Francisco, USA.

15 December 2014 – N. Champollion: Spatial & temporal variations of snow density near the surface on the Antarctica Plateau (Poster presentation), Fall Meeting of the AGU, San Francisco, USA.

15-19 December 2014 – R. von Steiger: Solar Wind C, N, and O Abundances and the Solar Metallicity, (Poster presentation), Fall Meeting of the AGU, San Francisco, USA.

6 January 6 2015 – R. von Steiger: Wasser in unserem Sonnensystem – und darüber hinaus, Talk at Lions-Club Burgdorf, Switzerland.

16 January 2015 – R. von Steiger: Workshop Summary, Talk at the ISSI Workshop on Solar Magnetic Fields, Bern, Switzerland.

22 January 2015 – R. Rodrigo: Descubriendo un cometa: La mission Rosetta hacienda Historia, Centro Nacional de Investigaciones Metalúrgicas, Spanish National Research Council, Madrid, Spain.

2 March 2015 – V. Sterken: Interstellar dust in the solar system and in the lab, Seminar talk, Physics Department, Chinese University of Hong Kong, China.

4 March 2015 – M. Falanga: Millisecond X-ray pulsars: 10 years of progress, Physikalisches Kolloquium, University of Bern, Switzerland.

13 March 2015 – R.-M. Bonnet: Du V2 à Rosetta, Université Interage, Créteil, France.

16 March 2015 – R. von Steiger: Solar Wind Observations with Ulysses-SWICS, Talk at the Slow Solar Wind ISSI Team Meeting, Bern, Switzerland.

13 April 2015 – R. von Steiger: Wie Wasserstoff zu Gold wird, Lecture to a course on material science of the Fachhochschule Bern, Switzerland.

5 May 2015 – R. Rodrigo: La misión Rosetta y los instrumentos Osiris y Giada: Contribución científica y tecnológica española en la misión, Fundación Areces, Madrid, Spain.

7 May 2015 – N. Champollion: Le niveau des mers & l'Antarctique, Lecture, University Joseph Fourier, Valence, France.

11 May 2015 – R. Rodrigo: Resultados científicos de la misión Rosetta, Universidad de León, León, Spain.

21 May 2015 – R. von Steiger: Working with observations from spacecraft, Lecture to gifted students of cantonal secondary schools, Bern, Switzerland.

15 June 2015 – M. Falanga: Masses of ten Eclipsing HMXBs neutron stars, Peking University, Beijing, China.

15 June 2015 – R. von Steiger: Die Ulysses-Mission, Talk at Rotary-Club Thun, Switzerland.

20 June 2015 – J. Zarnecki: Mission to Titan: Anglo-Polish Cooperation in Space, Conference „Polish Scientific Networks", Warsaw, Poland.

30 June 2015 – R.-M. Bonnet: First Asteroid Day, Asteroid Day Foundation, Video presentation, California Academy of Sciences, San Francisco, USA.

Meetings

14 July 2014 – V. Sterken, R. von Steiger, J. Zarnecki: Preparation of measurement campaign, MPIK Heidelberg, Germany.

15-24 July 2014 – R.-M. Bonnet: Alpbach Summer School Keynote speech and Jury Chair, Austria.

2-10 August 2014 – R.-M. Bonnet, A. Bykov, R. von Steiger, Silvia Wenger: Cospar 40th Scientific Assembly, Moscow, Russia.

6-8 August 2014 – N. Champollion: Microstructure in Snow Radiative Transfer Model, MicroSnow Workshop, Reading, UK.

4-8 August 2014 – V. Sterken: 7th Meeting on Cosmic Dust, Osaka, Japan.

10-11 September 2014 – M. Falanga: Chinese Swiss Space Science Workshop, Lenk, Switzerland.

12 September 2014 – R.-M. Bonnet, R. Rodrigo, and J. Zarnecki: 50th Anniversary of ESA, Centre International de Conférences, Geneva, Switzerland.

15-19 September 2014 – M. Falanga: A Synergistic View of the High Energy Sky, 10th INTEGRAL Workshop, Annapolis, MD, USA.

22-23 September 2014 – R.-M. Bonnet: Herschel Lessons Learnt, ESTEC, the Netherlands.

22-23 September 2014 – R. Rodrigo: Rosetta 38 Science Working Team, European Space Astronomy Center, Madrid, Spain.

7-10 October 2014 – R. Rodrigo: OSIRIS Full Team Meeting, MPI für Sonnensystemforschung, Göttingen, Germany.

Staff Activities

14 October 2014 – R.-M. Bonnet: 30th Anniversary of the Disappearance of Bepi Colombo, CISAS, Padova, Italy.

16-17 October 2014 – R.-M. Bonnet: Association of Universities Inc. Board of Trustees, Socorro, New-Mexico, USA.

22 October 2014 – R. Rodrigo: HISPAC Meeting, ESRIN, Frascati, Italy.

31 October 2014 – R.-M. Bonnet: First Alpbach Summer School 2015 Program Committee, Vienna, Austria.

3-5 November 2014 – V. Sterken: work visit, MPI für Sonnensystemforschung Göttingen, Germany.

6 November 2014 – R.-M. Bonnet: ExoMars Review Board, ESTEC, Noordwijk, the Netherlands.

7 November 2014 – R.-M. Bonnet: Solar Orbiter Contamination Conrol Review, ESTEC, Noordwijk, the Netherlands.

12 November 2014 – R.-M. Bonnet, R. Rodrigo, J. Zarnecki: Rosetta-Philae landing, ESOC, Darmstadt, Germany.

17-20 November 2014 – R.-M. Bonnet and R. Rodrigo: Visit to NSSC and ISSI-BJ Brainstorming Forum, NSSC, Beijing, China.

20-21 November 2014 – R.-M. Bonnet: ISSI-BJ Forum "Synergic Observations of the Water Cycle", ISSI-BJ, NSSC, Beijing, China.

25 November 2014 – R.-M. Bonnet: IAA Academy Day, Beijing, China.

26 November 2014 – R.-M. Bonnet: Visit to the China Academy of Space and Technology, Beijing, China.

4 December 2014 – R.-M. Bonnet: Institut Français d'Histoire de l'Espace, Conseil d'Administration, Paris, France.

8-12 December 2014 – V. Sterken: Work visit and lab. experiment, LASP University of Colorado, Boulder, USA.

11-12 December 2014 – M. Falanga: Relativistic Astrophysics group meeting, Astronomical Institute of the Academy of Sciences, Prague, Czech Republic.

15-19 December 2014 – N. Champollion, R. von Steiger, V. Sterken: AGU Fall Meeting, San Fransisco, USA.

12 January 2015 – R.-M. Bonnet: Association Française d'Astronomie, Conseil d'Administration, Paris, France.

26 January 2015 – R.-M. Bonnet: Second Alpbach Summer School 2015 Program Committee, (by Skype from ISSI).

17-20 February 2015 – R. Rodrigo: OSIRIS Full Team Meeting, Instituto de Astrofisica de Andalucia, Granada, Spain.

19-20 February 2015 – R.-M. Bonnet: Association of Universities Inc. Board of Trustees, Pasadena, California, USA.

25 February 2015 – R. von Steiger: Strategietreffen 2015 der Abteilung Unternehmensführung und Entrepreneurship, University Bern, Switzerland.

5-6 March 2015 – M. Falanga: Astronomy & Astrophysics Executive committee meeting, Paris, France.

6-18 April 2015 – R.-M. Bonnet: Visit to NSSC, Beijing China.

10 April 2015 – R.-M. Bonnet and R. Rodrigo: ISSI-BJ Board of Trustees, ISSI-BJ, NSSC, China.

4-5 May 2015 – M. Falanga: Astronomy & Astrophysics Journal Board meeting, ISSI, Bern, Switzerland.

6 May 2015 – R.-M. Bonnet: ExoMars-2018 Mission System Design Review, ESTEC, Noordwijk, the Netherlands.

2 June 2015 – R.-M. Bonnet: Solar Orbiter Contamination Control Review, ESTEC, Noodwijk, the Netherlands.

15-16 June 2015 – R.-M. Bonnet: EXPLORNOVA ISSI Working Group, Institut d'Astrophysique de Paris, France.

17-20 June 2015 – R.-M. Bonnet: Association of Universities Inc. Board of Trustees, Cornell University, Ithaca, New York, USA.

22-26 June 2015 – M. Falanga: The European Week of Astronomy and Space Science (EWASS) 2015, Tenerife, Spain.

30 June 2015 – R.-M. Bonnet: First Asteroid Day, Asteroid Day Foundation, California Academy of Sciences, San Francisco, USA (by Skype).

Chairman- and Memberships

R.-M. Bonnet:
- Administrateur de l'Association Française d'Astronomie, France
- Vice-President of Institut Français d'Histoire de l'Espace, France
- Member of the Association of Universities Inc. Board of Trustees, Washington DC, USA
- President of the Alpbach Summer School Jury 2015, Austria
- Expert and Consultant to the ESA Director General and the Director of Science and Robotic Exploration for the ESA ExoMars Missions, and Contamination control of the ESA Solar Orbiter Mission
- Co-President of the ESA Solar Contamination Review of the ESA Solar Orbiter Mission
- Senior Advisor to the NSSC Director General for ISSI-BJ matters

A. Cazenave:
- European Research Council, Earth System Science panel, Brussels, Belgium (March 2015)
- Joint Science Committee of the World Research Climate Programme, Geneva, Switzerland (April 2015)
- Science Committee of MeteoFrance, chair, Paris, France
- "Comite superieur des programmes", French ministry of education, Paris, France
- Science Committee of the ESA-EUMETSAT Climate Symposium, Darmstadt, Germany (October 2014)

M. Falanga.
- Member of the Ph.D. evaluation commission University of Basel, Ph.D. candidate Sofie Fehlmann "Simulations of X-ray bursts and superbursts" (23 April 2015)
- Member of the Astronomy & Astrophysics Journal Board of Directors & Executive Committee
- Member of the International Academy of Astronautics Member of the Editorial Board for Advances in Astronomy Journal

R. Rodrigo:
- Member of the Arecibo Observatory Science and Management Advisory Committee
- Member of the Board of Trustees of the International Academy of Astronautics
- Member of the Search Committee for ESA Director General
- Member of the Editorial Board of Space Science Reviews
- Co-Investigator of the Instrument "Giada" of the ESA Mission Rosetta for the exploration of minor bodies in the Solar System
- Spanish Lead Scientist of the "Osiris" instrument of the ESA Mission Rosetta for the exploration of minor bodies in the Solar System
- Co-Investigator of the BepiColombo Laser Altimeter of the ESA Mission BepiColombo to planet Mercury
- Co-Investigator of the Instruments Janus and Gala of the ESA Mission JUICE for the exploration of the Jovian system

Roger-Maurice Bonnet, former ESA Science Programme Director (1983-2001) and ISSI Executive Director (2003-2012), surrounded by journalists at the Philae Landing Event at ESOC, Darmstadt on 12 November 2014. (Image Credit: ESA, J. Mai)

R. von Steiger:
- Review of an FP7 Space Research Project, Brussels, January 23, 2015
- Review of proposals for SNSF professorships, June 29, 2015

J. Zarnecki:
- Co-Chair of ESA's SARP (Science Asessment Review Panel) for the M4 mission
- Chair of ESA's SSC-M4 (Senior Science Committee for M4)
- Chair of ESA's Solar System & Exploration Working Group
- Member of ESA's HESAC (Human Exploration & Science Advisory Committee)
- Member of Council of Institute of Physics

Honors

A. Cazenave: Georges Lemaitre Prize from the "Universite Catholique de Louvain", France (May 2015)

Staff Publications

Listed are all papers written or co-authored by ISSI staff that were submitted or that appeared between 1 July 2014 and 30 June 2015.

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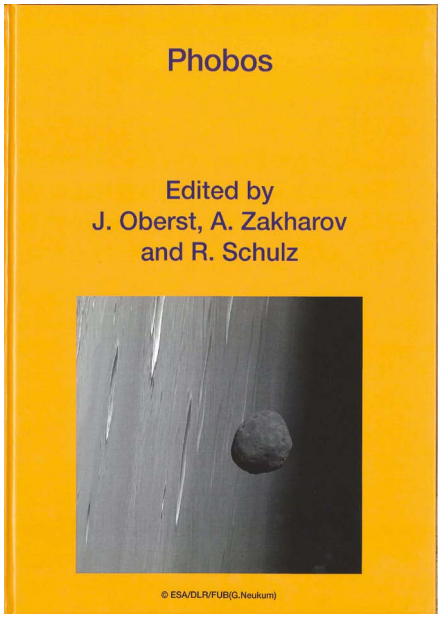

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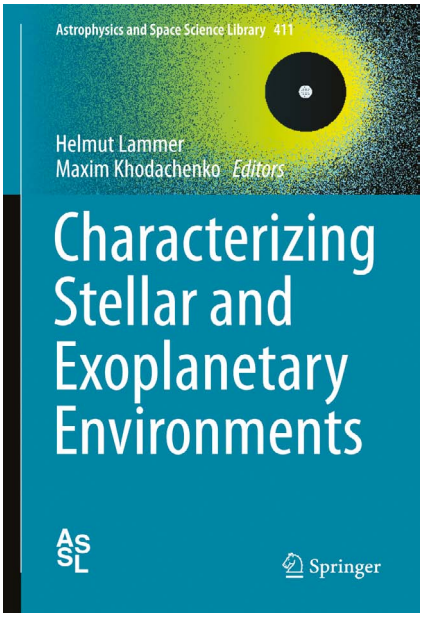

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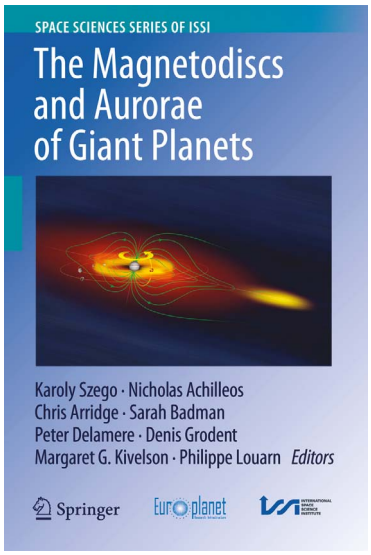

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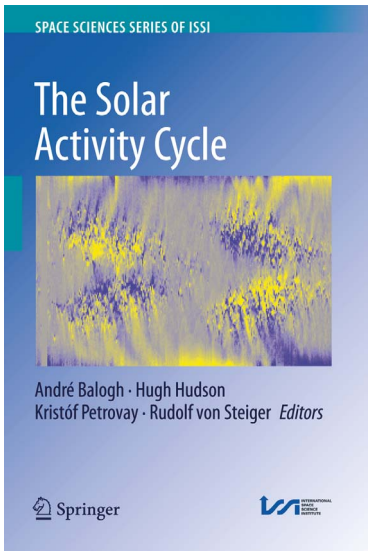

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