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2013
2014 Annual Report

Imprint

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Cover Page

Puzzle composed of six images (from the upper left to the lower right):

1. Artist's impression of a coronal mass ejection launched towards Earth. The image is based on data collected by the ESA/NASA SOHO space telescope and comprises an extreme-ultraviolet image of the Sun's disc (not to scale) superimposed on an image of the stormy solar environment. (SOHO (ESA/NASA/S. Hill)

2. Satellite data provides sea-surface temperatures to help understand climate change. (ESA/Crown)

3. Collage of solar images from NASA's Solar Dynamics Observatory (SDO) showing how observations of the sun in different wavelengths helps highlight different aspects of the sun's surface and atmosphere. (NASA/SDO/Goddard Space Flight Center)

4. Image was obtained by Planck's High Frequency Instrument at a frequency of 857 GHz (corresponding to a wavelength of 350 micrometres). The dark horizontal band is the plane of our Galaxy, seen in cross-section from our vantage point. The colours represent the intensity of heat radiation by dust. (ESA and the HFI Consortium)

5. Concentric layers in a cutaway image show variations in the speed of sound in the deep interior of the Sun, as gauged by two instruments on the SOHO spacecraft. (SOHO (ESA & NASA), MDI/SOI and VIRGO data imaged by A. Kosovichev, Stanford University)

6. Image showing all visible colors of the Sun, produced by passing the Sun's light through a prism-like device. (N. Sharp (NSF), FTS, NSO, KPNO, AURA, NSF)

Table of Contents

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.

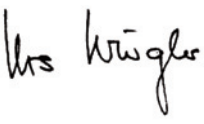
From the Chairman of the Board of Trustees

One year ago, I have – after some hesitation – taken over the role of Chairman of the ISSI Board of Trustees from Simon Aegerter. The familiarization with the various subject areas was then surprisingly easy, thanks to his comprehensive and complete preparation of the transition; many thanks to my predecessor!

There are nothing but good news to report of the past business year. The Directorate, which had been changed considerably, has tackled its duties with great dedication and very successfully, pursuing vigorously the scientific development of the Institute according to the guidelines of the Board of Trustees. A summary of the manifold activities of the Institute and in particular of the scientific results can be found on the following pages of the annual report.

The Board of Trustees held two meetings during the past business year. Its most important decisions should be mentioned briefly: On November 1, 2013 the BoT ratified the "Agreement of Cooperation between ISSI and the National Space Science Center of the Chinese Academy of Sciences (NSSC/CAS)". The purpose of this agreement is to define the cooperation between ISSI and the newly established Institute ISSI-BJ in Beijing. In the meantime, ISSI-BJ took up its operation and I presume that it will further the international efforts for promoting the Space Sciences on an even broader basis. At its June meeting the BoT approved a number of modifications to the management rules, which should make the procedures more transparent and notably take into account the international character of ISSI in a better way. Moreover, the strategic guidelines, a paper that serves the ISSI Directorate as a basis for developing the detailed strategy of the Institute, were also adopted.

It is my pleasure to thank all employees of ISSI for their excellent work throughout the year. The high reputation of ISSI is a result of the continuous commitment of its Directorate and Staff. I also should like to thank the Science Committee for its outstanding work and the fact that it has absorbed the additional burden resulting from the cooperation with ISSI-BJ without complaint. Finally, I thank our funding agencies: ESA, the Federal Government and the University of Bern for their continual confidence in our institution. I allow myself to combine these thanks with the faint hope that in the future it might be possible to broaden the financial basis of ISSI somewhat.



Urs Würgler
Bern, July 2014

The most important event in the 19th year of ISSI was the evaluation by a visiting committee on October 1-3, 2013. This was the first time since the institute had been evaluated some 15 years ago by a committee chaired by Sir Martin Rees, a very important event for establishing the very young ISSI back then. This year's committee was chaired by Jesus Martin Pintado, chair of the ESA AWG, and had the equally important task to advise ESA regarding its funding of ISSI during the next period of three years. After an intense three-day session, the committee, in its report, "… concluded that ISSI is fulfilling its mandate without any reservation." The report also contains a number of very useful recommendations that will be implemented in the course of the forthcoming years.

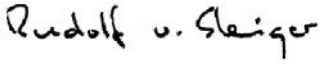
Equally important was the decision of the Swiss Confederation, received in December 2013, to fund ISSI during the period 2013-2016 with a slightly increasing amount, based on the strategy and funding request submitted in the previous year. Likewise, the proposal submitted to the Swiss National Science Foundation in early 2013 was also fully approved. Hence the first goal of the new Directorate, namely to secure the ISSI funding on a time scale of several years, has been achieved. Now is the time to consolidate this situation by seeking out new international partnerships while at the same time strengthening the existing ones.

The ISSI program in the reporting period saw three Workshops, four Working Group meetings, 83 Team meetings, and one Forum, as detailed in the subsequent pages. Together they once again broke the record number of visitors and brought it up to 973. With five Workshops planned and 33 new Teams it is well possible that in the next year it will be broken again and for the first time reach 1000. One of the Workshops will be in collaboration with the High-level Science Policy Advisory Committee of ESA (HISPAC), with which an agreement to hold a Forum followed by a Workshop and a book publication once every year is currently being finalized. Three of the 33 Teams and one foreseen Workshop are joint between ISSI and ISSI-Beijing, testifying that this partnership is also beginning to bear fruit.

The publication record has grown by three volumes and, more importantly, the impact factor of Space Science Reviews (from which the ISSI volumes are reprinted) has increased further from 5.5 to 5.9; the journal is now ranked 9th among the 40+ astronomy and astrophysics journals evaluated by Thompson Scientific.

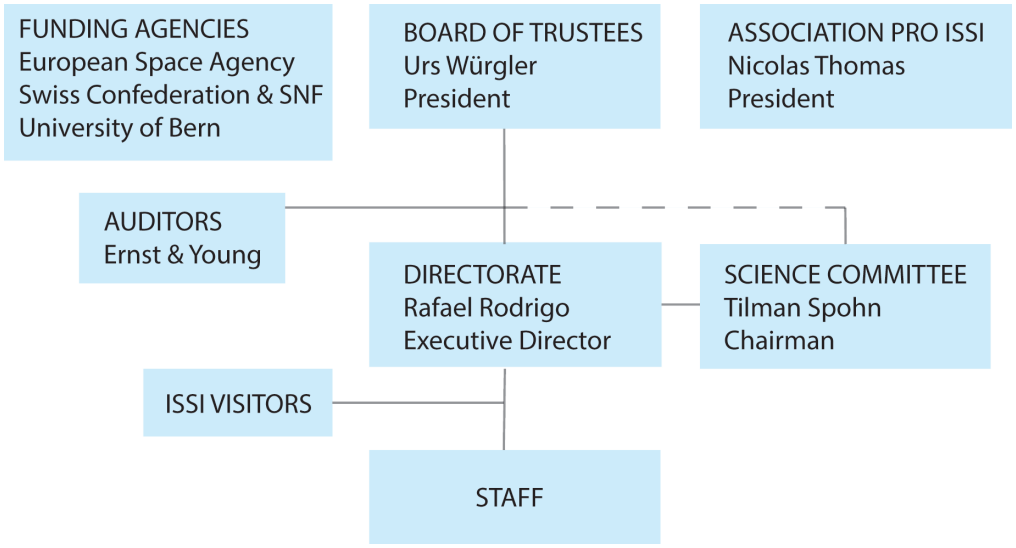
The ISSI staff has evolved in several ways: First of all, our Program Manager, Maurizio Falanga, has received his habilitation from the University of Basel and we congratulate him for this outstanding achievement. Then our two postdocs, Pia Zacharias and Marco Calisto, have completed their two-year terms and left ISSI in the course of the year. We thank them for all their valuable contributions, scientific and personal, and wish them all the best in their new positions in Oslo and Zurich, respectively. Following an open announcement and a highly competitive series of interviews we have now hired two new postdocs: Nicolas Champollion is working with one of us (A. Cazenave) on Earth sciences, and Veerle Sterken with two of us (J. Zarnecki, R. von Steiger) on cosmic dust. One PhD student has also joined ISSI, Vittorio de Falco, working with Maurizio Falanga. We also thank our part-time secretary, Danielle Zemp, who has chosen to fully move "across the street" to work for the University's Center of Space and Habitability, and wish her all the best. She will be replaced by Greta Kurpicz, to whom we bid a warm welcome for her start in August 2014.


Rafael Rodrigo


Rudolf von Steiger


Anny Cazenave


John Zarnecki



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. Since 2010 the Russian Academy of Sciences has been 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.

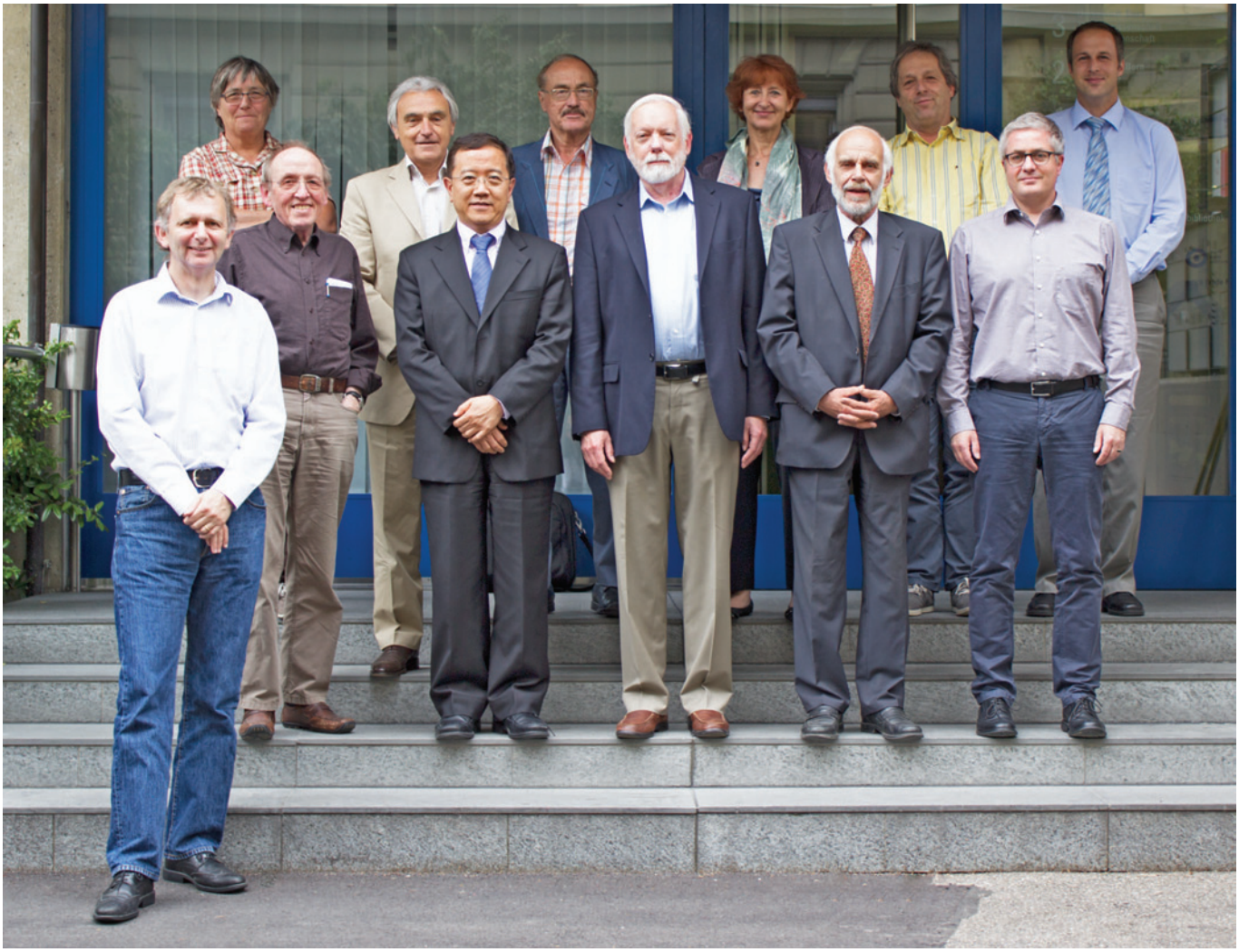
ISSI's Board of Trustees oversees the work accomplished at the Institute, exerts financial control, and appoints the Directors and members of the Science Committee. It consists of representatives of the Founder, and of the funding Institutions. Furthermore the Board of Trustees may nominate up to five 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 128 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.

The Board of Trustees



front row from left to right:
Nicolas Thomas, President of the Association Pro ISSI, Bern, Switzerland
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Wu Ji, National Space Science Center (CAS) and International Space Science Institute Beijing, China
Lennard A. Fisk, University of Michigan, Ann Arbor, USA
Urs Würgler, Bern, Switzerland *(Chairman)*
Daniel Fürst, RUAG, Zurich, Switzerland

back row from left to right:
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Sergio Volonté, Former Head of the Planning and Coordination Office in the Science and Robotic Exploration Directorate, ESA, Paris, France (retired)
André Maeder, Observatoire de Genève, Sauverny, Switzerland
Rosine Lallement, Observatoire de Paris-Meudon, France
Willy Benz, University of Bern, Switzerland *(Vice Chairman)*
Daniel Neuenschwander, Swiss Space Office, Bern, Switzerland

missing from the picture:
Alvaro Giménez, ESA, Paris, France
Lev M. Zelenyi, Russian Academy of Sciences, Moscow, Russia

front row from left to right:
Andrei Bykov, Russian Academy of Sciences, St. Petersburg, Russia
Michel Blanc *(ISSI Consultant to the Science Committee)*
Lidia van Driel-Gesztelyi, MSSL, University College London, Dorking, United Kingdom
Luisa M. Lara, Instituto de Astrofisica de Andalucia, CSIC, Granada, Spain
Tilman Spohn, German Aerospace Center (DLR), Berlin, Germany *(Chairman)*
Athéna Coustenis, Observatoire de Paris-Meudon, France
Lennart Bengtsson, University of Reading, United Kingdom
back row from left to right:
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Vladislav Izmodenov, IKI, Russian Academy of Sciences, Moscow, Russia (ex officio RAS)
Georges Meylan, Ecole Polytechnique Fédérale de Lausanne, Switzerland
Hugh Hudson, Space Sciences Laboratory, University of California, USA
Mark McCaughrean, ESTEC ESA, Noordwijk, The Netherlands (ex officio ESA)
Richard Marsden, ESTEC ESA, Noordwijk, The Netherlands (ex officio ESA)
Masahiro Hoshino, Department of Earth and Planetary Science, University of Tokyo, Japan*
Michael Rast, ESA ESRIN, Frascati, Italy (ex officio ESA)
Luigi Stella, INAF, Rome, Italy
Xiaolong Dong, International Space Science Institute Beijing, China (ex officio)
missing from the picture:
Rumi Nakamura, Space Research Institute, Graz, Austria
Joanna D. Haigh, Imperial College London, United Kingdom
Marco Velli, NASA Jet Propulsion Laboratory, Pasadena, USA

* Membership ended on 30 June 2014

from left to the right:
Rafael Rodrigo, Executive Director
Michel Blanc, Discipline Scientist
Andrea Fischer, Editorial Assistant
Saliba F. Saliba, Computer Engineer and System Administrator
Irmela Schweizer, Librarian
Veerle Sterken, Post Doctoral Scientist
Jennifer Fankhauser, Secretary
Maurizio Falanga, Science Program Manager
Silvia Wenger, Assistant to the Executive Director
Nicolas Champollion, Post Doctoral Scientist
Rudolf von Steiger, Director

missing from the picture:
Marco Calisto, Post Doctoral Scientist
Anny Cazenave, Director
Roger-Maurice Bonnet, Discipline Scientist
Vittorio De Falco, PHD Student
Johannes Geiss, Honorary Director
John Zarnecki, Director

All lists show the status at the end of the nineteenth business year on 30 June 2014.

Pictures above showing ISSI's meeting point and working station

The ISSI facilities offer an area of 700 m^2 on two floors, consisting of office space for staff members, a conference room, 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 two 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 19th business year saw a major change with projectors. ISSI bought two new powerful projectors. The first projector was installed in the large seminar room on the third floor. The second one, a Full HD projector, was mounted to the ceiling in the large seminar room on the first floor. In addition, two new speakers were installed on the front wall of the conference room.

Other new items were also bought during the 19th business year, among these items are: new computers (2 Macs, 3 Windows), 2 printers, other computer accessories, teleconference phone 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 – Mac (10.6 server) and Linux (Ubuntu 12.04 server)
- Five Windows workstations one of which runs Windows 8.1
- Seven Mac workstations running Mac OS 10.6 - 10.9
- Twelve laptops (four Windows and eight Macs)
- Six printers, one of which is color
- Five projectors (four fixed on the ceiling and two mobile ones)
- Two wireless access points
- One digital video camera, one still camera, 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.

Please feel free to visit our up to date website www.issibern.ch for more information or follow ISSI on Twitter @ISSIBern or Facebook.

The nineteenth financial year of ISSI ended with a surplus of nearly 17 kCHF, as opposed to a budgeted deficit of 122 kCHF. As in any non-profit organization the annual results of ISSI should be close to zero. Because of unexpected "profits" made in previous years we have budgeted a modest deficit in order to return these to the scientific community, and we will continue to do so in the forthcoming years.

On the revenue side the ESA contributions were close to budget thanks to the current stability of the exchange rate of the Euro. For the first time there is a contribution from ESA's High-Level Science Policy Advisory Committee (HISPAC). On the other hand the Russian Academy of Sciences is undergoing a reorganization that might endanger its annual contribution received since 2010. The Board and Directorate are working to rescue this and also to find other international partners making similar contributions. On the expense side all lines were close to or somewhat below budget, leading to the above-mentioned surplus.

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.

Operating Revenues in CHF for the 19th Business Year (1.7.2013-30.6.2014)

ESA Science Directorate		1'494'000.00
ESA Earth Observation Programme		396'000.00
ESA HISPAC		20'000.00
Swiss Confederation		900'000.00
EuroPlaNet		17'900.00
Russian Academy of Sciences		0.00
Other income [3]		45'396.84

Operating Expenses in CHF for the 19th Business Year (1.7.2013-30.6.2014)

Salaries and related Costs[1]	1'315'194.26	
Fixed Costs	253'538.05	
Operating Costs [2]	225'590.32	
Investment (depreciated)	21'398.04	
Workshops, Working Groups, Teams, Visiting Scientists (ISSI funded) [4]	1'040'681.19	
Result of the Year	16'894.98	
Subtotal	2'873'296.84	2'873'296.84

Audited by Ernst & Young, Bern

Swiss National Science Foundation (SNF)

Grant from SNF [5]		200'298.90
Workshops, Working Groups, Teams, Visiting Scientists (SNF funded)	200'298.90	
Total	**3'073'595.74**	**3'073'595.74**

Audited by SNF

Remarks:

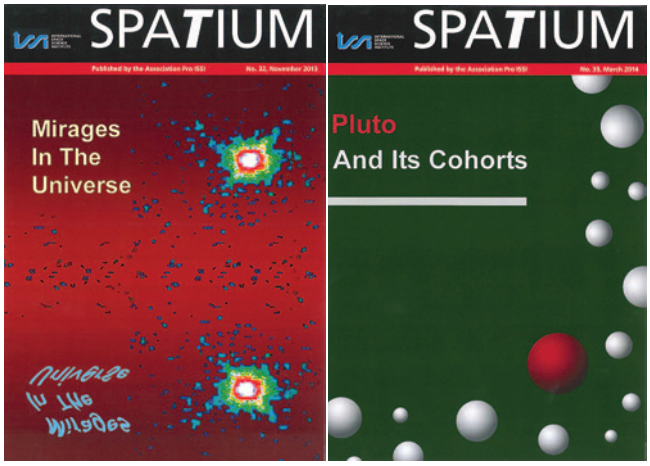
[1] **Salaries:** It should be noted that the majority of the ISSI staff members (including directors) are scientists actively conducting research as well as taking care of organizational, editorial, and administrative tasks.

[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.



Covers of the SPATIUM No. 32 and 33 published in the 19th ISSI Business Year.

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 consists presently of 128 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 30th October 2013 followed by a lecture by former ISSI Director, Lennart Bengtsson. He spoke about "How space observations and super-computer have made global weather prediction possible". This presentation highlighted the remarkable efforts that have been made to predict the weather but also touched upon the fact we may actually becoming close to the limit of the possible in terms of long range weather forecasting.

On 19th March 2014, Thierry Courvoisier from the Integral Science Data Centre, University of Geneva, Versoix, spoke about "Surprises in the hard X-ray sky". This presentation identified the wonderful contributions high energy astronomy has made to our understanding of the Universe and made a strong case for the continuation of ESA's satellite, INTEGRAL and for further missions to detect high energy photons.

On 14th May 2014, Ralf Jaumann from the Deutsches Zentrum für Luft- und Raumfahrt (DLR) Institut für Planetenforschung, Berlin-Adlershof, Germany, took as his title, "Vulkanismus im Sonnensystem oder wie werden Planeten und Monde ihre Wärme los" where he discussed the importance of volcanic activity for the evolution of planets and moons in our Solar System.

SPATIUM

The Association's magazine SPATIUM summarizes selected lectures offered by Pro ISSI. During the reporting period, issue no. 32 saw the light of the day in November 2013 reporting on "Mirages in the Universe". As outlined by Georges Meylan from the Swiss Federal Institute for Technology in Lausanne, those fascinating appearances are a direct consequence of Albert Einstein's General Theory of Relativity. Apart from their beautiful aspect, they enable scientists to probe gravity fields in the universe. In contrast, issue no. 33 published in March 2014, deals with Pluto and its Cohorts. The author, Hermann Boehnhardt from the Max Planck Institute for Solar System Research in Göttingen, reports on the latest research regarding the most distant bodies orbiting our Sun that still hold many secrets on the evolution of the solar system.
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 19th business year a total of 973 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 19th year three Workshops were organized, summaries of which can be found on the following pages.

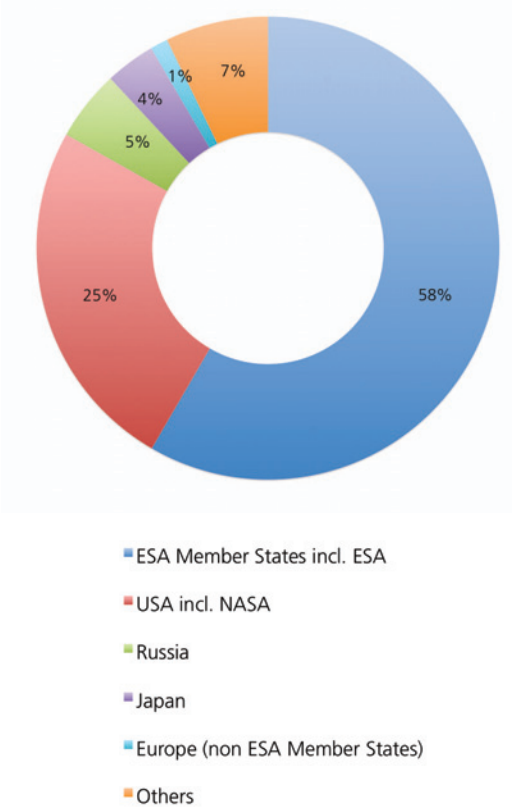
Working Groups have a smaller number of members and meet repeatedly as necessary to achieve the assigned objective. The results of the Working Groups activities are in general published as titles of ISSI Scientific Report Series. In the course of the 19th business year three Working Groups were active.

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 83 Team meetings took place in the 19th business year. Details can be found from page 23 on.

A **Forum** is an informal and free-ranging debate consisting of some 25 high-level participants on questions of a political and scientific nature for about two days. A Forum does not necessarily lead to formal recommendations or decisions. In the 19th 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. 133 young scientists participated in the ISSI activities in the course of the 19th year.



Pie chart showing the ISSI visitors countries of origin. A total of 973 scientists worked at ISSI during the nineteenth business year, 344 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.

Participants at the ISSI Forum

Understanding Gravity

3-4 December 2013

The Forum was organized in collaboration with the ESA High-level Science Policy Advisory Committee (HISPAC). The physics of Gravity spans all the activities of ESA from Science to Technology and Earth Observation to Communications. It is also a field of science in which major intellectual challenges are driving enormous technical developments. This forum brought together scientists and technologists to review the possibilities for cross-fertilisation between the programmes in different ESA directorates, propose mechanisms to improve the transfer of technology and suggest detailed topics for immediate development through focussed workshops. The recommendations from the forum were as follows:

• The wide ranging discussions during the meeting demonstrated that there are large benefits to be gained by detailed transfer of technical information between the different areas of science within ESA. The technical issues concerning gravity could include accelerometry, inertial sensors, atomic interferometers, atomic clocks and navigation/clock comparison methods. Novel analysis techniques and software developments are not to be excluded from such activity. Mechanisms should be sought for this transfer of information and actively pursued as a means of maintaining an efficient programme of science delivery.

• The opportunities for cross fertilisation of technical progress between science areas as diverse as Fundamental Physics and Earth Observation presents a major opportunity for ESA. In particular the techniques of interferometry, either using lasers or cold atom sources, may contribute substantially to new levels of performance in the study of the Earth via gravimetry.

• The many extremely novel aspects of instrumentation for fundamental physics require considerable care in allocating hardware development tasks between industry and academic institutes. At present the administrative processes for space mission management favour technical developments in industry where high risk development programmes are expensive and time consuming. The allocation of early stage development work needs to be made by analysing where the risks and costs are best managed.

• Whenever possible ESA should make available opportunities for small secondary payloads to maximise the science outcomes from missions. These might be fundamental physics experiments benefiting from deep space orbits in planetary missions or small payloads on Galileo platforms where multi-point measurements could be effective.

• An active watch should be maintained for synergy between other fast growing technical sectors (such as telecoms, for example) in which ESA could benefit from developments leading towards flight hardware of value to the science programme.

• The role of scientists in ESA is crucial to the success of all science missions. These scientists must maintain their knowledge base and community contacts by having formally allocated time for their own research in order to carry out their agency function effectively and act as a channel of communication between ESA and the scientific community. It has been proposed that the ESA Director General establish an inter-directorate scientific structure within which ESA scientists from all program areas could meet and foster scientific synergy across the Agency.

• A series of topics for future ISSI workshops was generated including: a. High Performance Clocks in Geodesy and Geophysics, b. Quantum Tests of the Einstein Equivalence Principle, c. Synergies and limitations of Space Gravity Sensors for Earth Observation and Fundamental Physics, and d. Planetary Metrology with New Technology.

A detailed report of this Forum can be found on the webpage www.issibern.ch in "Past Forums – Reports".

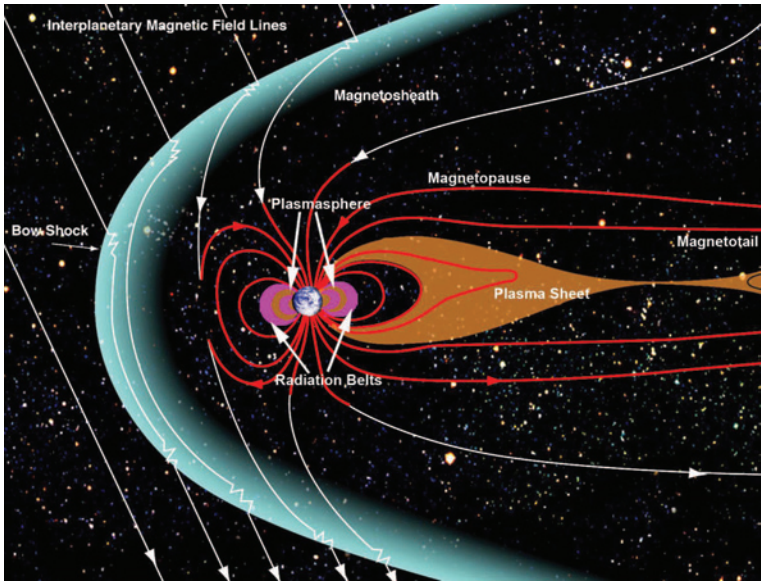
Forums are informal and free-ranging debates among some twenty-five high-level participants on open questions of scientific nature or science policy matters. Forums do not necessarily lead to formal recommendations or decisions.

Plasma Sources for Solar System Magnetospheres

23-27 September 2013

Forty-five scientists from around the world attended the Workshop, including a number of young scientists. The purpose was to review and discuss our present state of understanding of the major source processes responsible for the plasma population in the magnetospheres of planets with intrinsic dynamo magnetic fields. The emphasis was on Mercury, Earth, Jupiter and Saturn, given that these are the planets which have the best observational database and have received the most theoretical attention. Generally speaking, the workshop participants reviewed the potential contributions from the different generic sources of plasma at planetary magnetospheres: planetary thermospheres, ionospheres, exospheres, planetary satellites and rings, and the solar wind. Extensive discussions led to the following consensus on the source processes:
i) at Mercury it is the photoionization of exospheric neutrals which is the dominant source
ii) at Earth a significant source is outflow from the ionosphere and also at time solar wind penetration on the flanks of the magnetosphere; plasma injection from the magnetotail plays a significant role at high energies
iii) at Jupiter the moon Io is by far the dominant source; and at Saturn the moon Enceladus is the major source, but the rings also make a significant contribution. Unexpectedly, Titan is only a minor source.
In addition to identifying the main primary sources, the Workshop also studied the way plasma sources at low energies are partly energized, and what are the main acceleration processes via which the high energy particle populations, up to the radiation belts, are produced and maintained. This is particularly important for the magnetospheres of Earth, Jupiter and Saturn.
A book outlining the results of this Workshop is in preparation, which will present our current knowledge and also will indicate where the gaps are in our understanding of magnetospheric plasma sources.
The workshop was convened by Michel Blanc, Emma Bunce, Rick Chappel, Andrew Nagy, Hermann Opgenoorth, and James Slavin.

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.



A magnetosphere is that area of space, around a planet, that is controlled by the planet's magnetic field. The shape of the Earth's magnetosphere is the direct result of being blasted by solar wind, compressed on its sunward side and elongated on the night-side, the magnetotail. The shock wave where the solar wind encounters the Earth's magnetosphere is called the Bow Shock, which slows and diverts the solar wind around the Earth into the Magnetosheath. The outer boundary of Earth's confined geomagnetic field is called the Magnetopause. The Earth's magnetosphere is a highly dynamic structure that responds dramatically to solar variations.
(Image Credit: NASA)

Participants in the Workshop on "the Solar Activity Cycle"

The Solar Activity Cycle: Physical Causes and Consequences

11-15 November 2013

The objectives of this Workshop were to review systematically, from a physical viewpoint, all the indicators of solar activity (focusing on the Schwabe and Hale cycles) and to elaborate possible/likely/proven causal chains from the solar interior to the corona; to formulate the most likely physically based causal time sequence(s) from one solar cycle to the next (as a physical basis of predictive models); to outline the likely causes/mechanisms of longer term memory – how solar conditions and activity parameters map from one cycle to feed through the next cycle(s); to include the topic of stellar activity cycles for a comparative study with the solar activity cycle, and to conclude about the state of knowledge/ignorance of the physics of solar activity. The Workshop was convened by André Balogh, Hugh Hudson, Kristóf Petrovay, and Rudolf von Steiger, and brought together some 45 invited participants (including several young scientists). Their presentations were structured into six sessions on:

- Solar activity indices and their interdependences - a detailed review
- Physical inferences from the activity indices (5 talks scheduled)
- The interior drivers of solar activity (5 talks scheduled)
- Magnetic feedback and magnetic flux dynamics related to solar activity
- Solar cycles, stellar cycles - a comparative view of solar/stellar activity
- Drawing conclusions: the physical foundation of the solar cycle

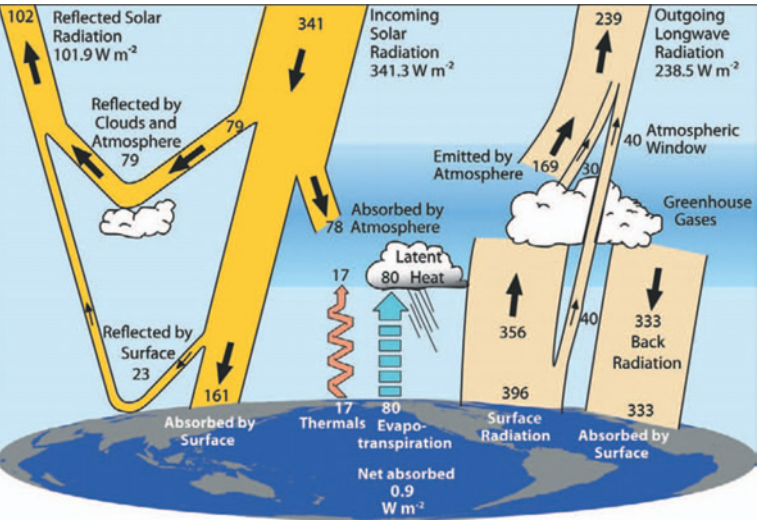
Currently the Workshop papers are being edited for publication as a volume in the Space Science Series of ISSI by Springer, in parallel with the publication of the papers in Space Science Reviews. Some 22 review style and quality papers, submitted to the usual refereeing process will be published in the book. The papers are based on talks presented at the Workshop but also reflect the discussions among the participants during the Workshop, thus giving a comprehensive overview of the status of the field.

The Strongest Magnetic Fields in the Universe

3-7 February 2014

It has become customary at ISSI to follow the progress in knowledge of magnetic fields in all regions of the Universe for various reasons. One is that monitoring the magnetic fields on spacecraft is necessary for spacecraft control. The other is that magnetic fields in space are a key to understanding most of the processes in space plasma. In the past few years ISSI hosted a number of workshops on magnetic fields in different objects, the Sun, Earth, Planets, Interplanetary Space, on the large scale in the Universe. The present Workshop dealt with the remaining topic of very strong magnetic fields in the Universe. Very strong in this respect means strong compared to the large-scale magnetic field which is of the order of several micro-Gauss up to nano-Teslas. Hence strong fields cover the range from milli-Gauss to the largest known fields near and above the quantum limit. These are magnetic fields in accretion disks and in radio jets emitted from massive central objects for the weaker fields, and in white dwarfs, neutron stars, pulsars, magnetars, strange stars in the strong field range. A particularly interesting problem is the properties and generation of fields apparently above the quantum limit. The Workshop covered the origin of all these strong magnetic fields in those objects, their stability and their effects on the matter as well as observable astrophysical effects, as far as known from observation to theory. There were 36 participants in the Workshop including four young scientists supported within the framework of ISSI's special program. The Workshop was convened by André Balogh, Vasily Beskin, Maurizio Falanga, Maxim Lyutikov, Sandro Mereghetti, Tsvi Piran, and Rudolf Treumann.
The book on the "The Strongest Magnetic Fields in the Universe" that will be published in the Space Science Series of ISSI, as a tangible outcome of the lively presentations and discussions during the Workshop, is planned to have some 23 substantial, multi-authored reviews of the topics covered in the Workshop.

Illustration of a magnetar that emitted 40 visible-light flashes before disappearing again. Magnetars are young neutron stars with an ultra-strong magnetic field a billion times stronger than that of the Earth.
(Image Credit: ESO/L.Calçada)



The global annual mean Earth's energy budget for the March 2000 to May 2004 period (W m^{-2}). The broad arrows indicate the schematic flow of energy in proportion to their importance. (Image Credit: Trenberth et al., Bull. Amer. Meteor. Soc., 90, 311-323, 2009.)

Consistency of Integrated Observing Systems Monitoring the Energy Flows in the Earth System

Climate change is very much related to an energy disturbance. Over the last decades, human activities have significantly impacted our climate, mainly through emission of greenhouse gases and aerosols, causing global warming and forcing a net flux imbalance of 0.5 - 1 W m^{-2} at the "Top Of the Atmosphere" (TOA). Quantifying how much extra heat related to the Earth's energy imbalance has been generated by human activities, and how it affects our climate system is one of the key challenges faced by the climate research community.

The issue of the energy budget closure, taking into account the strong interplay between the Earth's sea-level and energy cycles, has now become one of the hot topics in climate science, regarding the issue of an apparent "plateau" in global surface temperature evolution over approximately the last 15 years. During this period, the global Earth surface temperature has increased more slowly than during the previous decades, while the greenhouse gas emissions (now at about 400 ppm concentration) have accelerated. Moreover, land ice melt and sea level have continued to rise steadily. The Working Group is also focusing on the following questions:

Working Groups are set up for specific tasks, also of technical nature. The results of the Working Groups activities are published as volumes of ISSI Scientific Report Series (SR) or in the scientific literature.

- Where the extra heat building up in the system is going?
- How do Earth's energy imbalance and ocean heating rate change?

Developing the knowledge, and observational capability, necessary to "track" the energy flows through the climate system is therefore critical to better understand the relationships between climate forcing, response, variability and future changes. The current observing systems are not complete. For example, there is no absolute measurement of the net TOA radiation imbalance or no measurement of the deep ocean heat content below 1500-2000m depth. In addition, observational uncertainties are still too large to analyze precisely the energy flows, given transitions in instrumentation data and data sampling. Hence, there is a critical need to combine different independent measurement approaches based on remote sensing and in situ measurements.

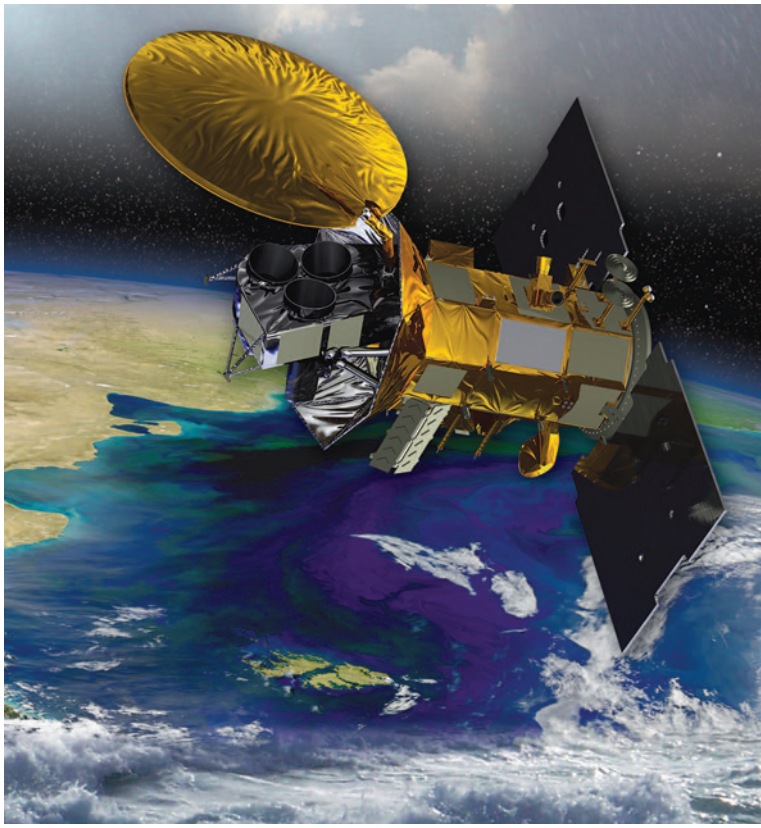
In this context, this initiative proposes to investigate the global Earth's energy and sea level budgets by using and confronting different and independent measurement approaches of the energy fluxes and sea-level rise to advance our understanding of the budgets. This activity brings a new integrated perspective on uncertainties in, and consistencies across, both the energy-sea-level budgets focusing on a "golden period", thereby complementing previous studies. It will also focus on observing systems, and in particular the space missions, needed to track energy flows in the Earth system. This Working Group will also discuss and analyze the processes recently involves in the literature to explain the apparent "plateau" in the increase of global mean Earth temperature.

The Working Group is led by Karina von Schuckmann (Mediterranean Institute of Oceanography, Toulouse, France) and includes the following members: Pierre-Philippe Mathieu, Simon Josey, Anny Cazenave, Don Chambers, Nicolas Champollion, James Hansen, Yu Kosaka, Norman Loeb, Benoit Meyssignac, Matt Palmer, Kevin Trenberth and Martin Wild. The first meeting took place from 11 to 13 June 2014. Further meetings are planned.

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

L-band microwave observations have been recently extensively used to derive and observe climate variables. Radiometric observations offer good accuracy as well as good spatio-temporal coverage of the Earth, very useful for climate applications. Especially, the recent SMOS (Soil Moisture and Ocean Salinity) and Aquarius missions, respectively ESA (European Space Agency) and NASA (National Aeronautics and Space Administration) missions, offer the possibility to monitor globally continental soil moisture, sea ice thickness and surface ocean salinity. These variables are essential for sea level and sea ice studies, hydrological cycle and climatic modeling, especially in the context of climate change. Some questions emerge from recent L-band missions and scientific objectives: How precisely to quantify the accuracy of the retrieval variables? How to maintain the continuity and consistency of microwave observations that is necessary to follow the climate evolution? How to follow up the scientific, user and international requirements? What are finally the expectations for the next generation of L-band missions?

Hence, the forum on the "Continuity of microwave observations in L-band for operational and climate applications" will focus on the following objectives: (1) Review the results and achievements from SMOS and Aquarius (and the expected results from future SMAP mission - Soil Moisture Active and Passive) and their (potential) impact on operational applications. Based on the impact analysis define key application areas driving the requirements for future missions; (2) Review and discuss the user requirements within the context of scientific challenges and international guidelines, e.g. as defined through WMO OSCAR (World Meteorological Organization - Observing Systems Capability Analysis and Review); (3) Define next generation L-band mission requirements and concepts responding to evolving user requirements. The initiative aims at advancing the discussion between agencies as to future mission concpets beyond SMOS-Aquarius-SMAP.



Aquarius satellite designed to measure ocean salinity. (Image Credit: NASA)

The Forum will bring together experts from operational agencies covering the following disciplines (geophysical variables): numerical weather prediction (soil moisture, sea ice thickness and ocean salinity), operational oceanography (ocean salinity and sea ice thickness), operational hydrology and water management (soil moisture, freeze and thaw state), ship routing (sea ice thickness). The key outputs from the Forum will be a document summarizing the impact of L-band observations on the skill of operational forecasting systems and a roadmap outlining further activities to quantify the value of current and future observation systems and to develop suitable observation systems for operational satellite missions. The Forum will take place on 30 September and 1 October 2014.

Remote Sensing and Water Resources

In recent 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. For example, satellite altimetry is routinely used for systematic monitoring of water levels 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 Soil Moisture and Ocean Salinity, SMOS, mission) as well as wetlands and snowpack. Space gravity missions (e.g., the Gravity Recovery And Climate Experiment, GRACE, mission) offer 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.

The purpose of this Workshop is to bring together scientists interested in land hydrology, water resources and the global water cycle either from observations or hydrological models – or both –. Two main issues will be addressed: (1) promote the 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 Workshop will be held from 6 to 10 October 2014.

Solar Magnetic Fields

At a Forum on "Solar activity and the solar cycle: future developments and applications" held in November 2012, ISSI considered how it can contribute to a better understanding of the physics of the solar activity cycle. Two Workshops were proposed, one on "The Solar Activity Cycle: Physical Causes and Consequences", which was held in November 2013, and another on "Solar Magnetic Fields: From Measurements to Understanding". Solar activity is driven by the solar magnetic field. This Workshop will focus on the observational and measurement techniques of magnetic fields and the complex processes that control the variability of solar magnetic phenomena. The objective is 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 following topics will be covered:

- 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 versus local dynamos)
- Requirements and perspectives for solar magnetic field measurements

The Workshop will bring together some 38 experts in the relevant fields plus a few young scientists for the week of 12 to 16 January 2015.

Integrative Study of Sea Level Budget

Providing long, accurate records of sea level (global and regional), and of the various components causing sea level changes (land ice, ocean thermal expansion, salinity changes, land water storage, etc.) is crucial for validating the climate models used for future projections. The ESA Climate Change Initiative (CCI) program has provided the framework to produce consistent and continuous space-based records for several climate parameters (so called 'Essential Climate Variables' (ECV)); among them, sea level, glaciers, ice sheets, sea surface temperature (SST) and Ocean Colour.
The objective of this Workshop is to discuss in an integrative context recent results obtained by the ESA CCI program for the sea level, glaciers and ice sheet ECVs. Improvement of these ECVs allows a better understanding of the mass contribution to sealevel rise, hence of the sea level budget. The Workshop will also address the regional variability in sea level, SST and Ocean Colour, and discuss the relative contributions of the natural/internal climate variability and anthropogenic forcing (detection/attribution) to associated spatial trend patterns. The Workshop will take place from 2 to 6 February 2015.

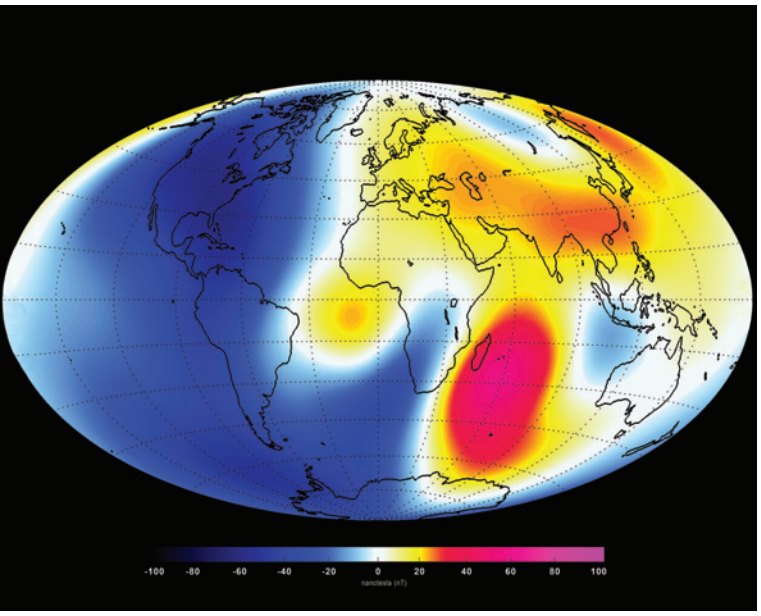
Dust Devils on Mars and Earth

Dust devils are convective vortices (or mini-whirlwinds) that lift dust from a planetary surface. They occur on Earth and Mars and contribute to dust entrainment into the atmosphere on both planets. Aerosols such as mineral dust play an important role in the atmosphere, influencing the climate by reflection of incoming solar radiation and absorption of outgoing thermal radiation. In addition, they have significant effects on the atmospheric energy budget as they act as cloud condensation and ice nuclei. On Earth, dust entrainment by dust devils is mainly limited to semi-arid and arid regions but its significance is not well constrained. At the least, they add significantly to reducing air quality in these regions. Some estimates suggest that dust devils and convective plumes contribute about 35% to the terrestrial global amount of airborne mineral dust and even more on Mars. However, the impact of dust devils on the climate of Earth and Mars is poorly understood. The Workshop aims to contrast and compare

Impression of a Dust Devil on the Earth (Image Credit: M. Patel, Open University, UK)

knowledge of dust devils from the two planets with the aim of developing a deeper understanding of this phenomenon.
In the last decade, many terrestrial field studies on Earth and many orbital as well as lander studies of dust devils on Mars have increased our knowledge of specific dust devil parameters dramatically. Important additional parameters have been obtained with laboratory experiments. These include measurements of the dust flux, particle threshold, and dust lifting mechanisms under terrestrial and Martian conditions. The laboratory experiments can provide important insights, especially as terrestrial and Martian field measurements can be uncertain due to the limited measurement frequency. Numerical modeling

is another powerful method to constrain the regional and global dust flux on Earth and Mars. The parameterization of dust devil formation, activity, and dust flux for numerical models can benefit from the wealth of new data refining the existing models. The multidisciplinary workshop would combine for the first time the science of terrestrial field studies, Martian orbiter and lander studies, and numerical models of dust devil processes and their impact on the climate of Earth and Mars. The Workshop is scheduled for 16 to 20 February 2015.



Changes in Earth's magnetic field from January to June 2014 as measured by the Swarm constellation of satellites. These changes are based on the magnetic signals that stem from Earth's core. Shades of red represent areas of strengthening, while blues show areas of weakening over the 6-month period. (Image Credit: ESA/DTU Space)

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

The Earth's magnetic field results from different sources: 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.
Magnetic field observations taken at ground level and in space can be used to describe and interpret the various sources, e.g. regarding core field secular variation, solar-terrestrial interaction in near Earth space, and processes in the ionosphere. However, a meaningful investigation of the different processes requires their proper isolation in magnetic field observations.
This Workshop aims at describing the characteristics of the different magnetic field sources with the goal to isolate them properly in magnetic field observations and to discuss suitable approaches for source characterisation.
It will bring together experts on the Earth interior and on ionospheric and magnetospheric electric currents, including observations and modelling, to tackle these questions properly. The resulting book will summarize the outcome including research on problems that benefit from proper source characterisation in the magnetic field, such as:

- How to define "magnetic quiet conditions" in polar and non-polar regions? Which sources are present during magnetically quiet conditions and what is their character?
- What are recent modelling capabilities for predicting magnetic field contributions during magnetically inactive conditions?
- What is the uncertainty in specifying unwanted field contributions for a study of external currents?

Especially with the advent of multi-satellite missions and an increasing number of ground stations, this book will largely contribute to a better understanding of the different sources of the Earth magnetic field. The Workshop will take place from 18 to 22 May 2015.

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.

Listed are Teams that had a meeting at ISSI in the period of the 19th business year. A rationale is given only for the selected teams in 2013; for the others see the previous Annual Reports.

Team Meeting on "Heating of the Magnetic Chromosphere: Confronting Models with Observations" led by Bart De Pontieu and Scott McIntosh.

Teams selected in 2010

Critical Assessment and Standardized Reporting of Vertical Filtering and Error Propagation in the Data Processing Algorithms of the NDACC Lidars

Team leader: Thierry Leblanc, JPL-Table Mountain Facility, Wrightwood, USA
Session: 16-20 September 2013

The Methane Balance – Formation and Destruction Processes on Planets, their Satellites and in the Interstellar Medium

Team leader: Wolfgang Geppert, Stockholm University, Sweden
Session: 2-4 October 2013

Plasma Entry and Transport in the Plasma Sheet

Team leader: Simon Wing, The Johns Hopkins University, Applied Physics Laboratory, Laurel, Maryland, USA
Session: 15-18 October 2013

Teams selected in 2011

Coronal Heating – Using Observables (flows and emission measure) to Settle the Question of Steady vs. Impulsive Heating

Team leaders: Stephen Bradshaw, Department of Physics and Astronomy, Rice University, USA, and Helen E. Mason, Department of Applied Mathematics and Theoretical Physics, University of Cambridge, United Kingdom
Session: 4-6 March 2014

Heating of the Magnetic Chromosphere: Confronting Models with Observations

Team leaders: Bart De Pontieu, LMSAL, USA, and Scott McIntosh, High Altitude Observatory, USA
Session: 25-28 February 2014

Updating The Lunar Chronology and Stratigraphy: New Laboratory and Remote Sensing Data, and New Approaches to the Interpretation of Old Data

Team leader: Vera Assis Fernandes, Museum für Naturkunde, Leibniz-Inst. für Evolutions- und Biodiversitätsforschung an der Humboldt-Universität zu Berlin, Germany
Session: 5-7 August 2013

The Crab Pulsar, a city-sized, magnetized neutron star spinning 30 times a second, lies at the center of this tantalizing wide-field image of the Crab Nebula. This picture combines optical survey data with X-ray data from the orbiting Chandra Observatory. The innermost ring structure is about a light-year across. With more mass than the Sun and the density of an atomic nucleus, the spinning pulsar is the collapsed core of the massive star that exploded, while the nebula is the expanding remnant of the star's outer layers. The supernova explosion was witnessed in the year 1054. (Image Credit: NASA, Chandra X-ray Observatory, SAO, DSS)

Multi-point Studies of the Auroral Acceleration Region using Cluster
Team leader: Colin Forsyth, UCL Mullard Space Science Laboratory, United Kingdom
Session: 8-12 July 2013

Flow-driven Instabilities of the Sun-Earth System
Team leader: Claire Foullon, University of Warwick, United Kingdom
Session: 5-9 May 2014

Zonal Jets and Eddies – Planetary Science and Satellite Oceanography at the Crossroads
Team leader: Boris Galperin, University of South Florida, USA
Session: 10-14 March 2014

Atmosphere-Ionosphere Coupling during Stratospheric Sudden Warmings
Team leader: Larisa Goncharenko, MIT Haystack Observatory, USA
Session: 14-18 October 2013

Aerosol Remote Sensing from Space
Team leader: Alexander Kokhanovsky, Bremen University, Germany
Session: 15-19 July 2013

An Assessment of the Accuracies and Uncertainties in the Total Solar Irradiance Climate Data Record
Team leader: Greg Kopp, University of Colorado, USA
Session: 2-3 June 2014

Spatial and Temporal Studies of the Heliospheric Interaction with the Local Interstellar Medium from SOHO/SWAN UV, IBEX Neutral Atom, and ACE and STEREO Pickup Ion Observations
Team leaders: Dimitra Koutroumpa, Service d'Aeronomie du CNRS, France, and Vlad Izmodenov, Space Research Institute (IKI), Moscow, Russia
Session: 2-6 June 2014

Characterizing Stellar and Exoplanetary Environments via Observations and Advanced Modeling Techniques
Team leader: Helmut Lammer, Austrian Academy of Sciences, Graz, Austria
Session: 10-13 December 2013

Generation of Climate Data Records of Sea-Surface Temperature from Current and Future Satellite Radiometers
Team leader: Peter J. Minnett, University of Miami, USA
Session: 12-16 May 2014

Deriving Physical Parameters of Atmosphere-less Bodies in the Solar System by Modeling their Thermal Emission
Team leader: Hans Rickman, University of Uppsala, Sweden
Sessions: 19-21 November 2013 and 13-15 May 2014

Comparative Jovian Aeronomy
Team leader: Tom Stallard, University of Leicester, United Kingdom
Session: 1-5 July 2013

Teams selected in 2012

Atmospheric Gravity Waves in Global Climate Prediction and Weather Forecasting Applications
Team leader: Joan Alexander, Colorado Research Associates (CoRA) Division, USA
Session: 31 March - 4 April 2014

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: 23-27 June 2014

Self-Organized Criticality and Turbulence
Team leader: Markus Aschwanden, Lockheed Martin Solar and Astrophysics Laboratory, USA
Session: 16-20 September 2013

Thermonuclear Bursts: Probing Neutron Stars and their Accretion Environment
Team leader: Andrew Cumming, McGill University, Montreal, Canada
Session: 10-13 June 2014

Nonlinear Force-Free Modeling of the Solar Corona: Towards a New Generation of Methods
Team leaders: Marc DeRosa, Lockheed Martin Solar and Astrophysics Laboratory, USA, and Michael S. Wheatland, The University of Sydney, Australia
Session: 13-16 January 2014

Polar Cap Arcs: Understanding Magnetosphere-Ionosphere Coupling and Magnetospheric Topology during Periods of Northward IMF
Team leaders: Robert Fear, University of Leicester, United Kingdom, and Romain Maggiolo, Belgian Institute for Space Aeronomy, Belgium
Session: 21-25 October 2013

Observations and Modeling of Flare Chromospheres
Team leader: Lyndsay Fletcher, University of Glasgow, United Kingdom
Session: 7-10 April 2014

Coronal Magnetometry: Building Tools for Discovery
Team leader: Sarah E. Gibson, National Center for Atmospheric Research, USA
Session: 10-14 March 2014

The first signal received from the Rosetta spacecraft ESA's Operations Centre in Darmstadt, Germany on 20 January 2014. Rosetta had woken up 807 million km from Earth after 31 months of deep-space hibernation. Rosetta is chasing Comet 67P/Churyumov–Gerasimenko. (Image Credit: ESA, J. Mai)

Towards an Integrated Retrieval of Antarctic Sea Ice Volume
Team leaders: Petra Heil, University of Tasmania, Australia, and Stefan Kern, University of Hamburg, Germany
Sessions: 22-26 July 2013 and 23-27 June 2014

Characterizing Diurnal Variations of Ozone for Improving Ozone Trend Estimates
Team leader: Klemens Hocke, Institute of Applied Physics and Oeschger Centre for Climate Change Research, University of Bern, Switzerland
Session: 12-16 May 2014

The Evolution of the First Stars in Dwarf Galaxies
Team leader: Pascale Jablonka, École Polytechnique de Lausanne EPFL, Lausanne, Switzerland
Sessions: 29-31 October 2013 and 18-20 December 2013

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: 20-24 January 2014

X-ray and Radio Diagnostics of Energetic Electrons in Solar Flares
Team leader: Eduard P. Kontar, University of Glasgow, Glasgow, United Kingdom
Session: 24-28 March 2014

Heavy Ions: Their Dynamical Impact on the Magnetosphere
Team leader: Elena Kronberg, Max-Planck-Institute for Solar System Research, Katlenburg-Lindau, Germany
Session: 14-18 October 2013

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: 26-30 August 2013

Quantifying Hemispheric Differences in Particle Forcing Effects on Stratospheric Ozone
Team leader: Daniel Marsh, National Center for Atmospheric Research, Boulder, USA
Session: 28 April - 2 May 2014

Unified View of Stellar Winds in Massive X-ray Binaries
Team leader: Silvia Martinez Nunez, University of Alicante, Spain
Session: 17-21 February 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: 9-13 December 2013

Large-scale Vortices and Zonal Winds in Planetary Atmospheres/Ionospheres: Theory versus Observations
Team leader: Oleg Pokhotelov, Institute of Physics of the Earth, Russian Academy of Sciences, Russia
Session: 2-6 June 2014

Dusty Plasma Effects in the System Earth–Moon
Team leader: Sergey Popel, Institute of Physics of the Earth, Russian Academy of Sciences, Russia
Session: 28 October - 1 November 2013

Understanding Solar Jets and their Role in Atmospheric Structure and Dynamics
Team leaders: Nour-Eddine Raouafi, The Johns Hopkins University, USA and Etienne Pariat, LESIA, France
Session: 17-21 March 2014

Particle Acceleration at Plasma Jet Fronts in the Earth's Magnetosphere
Team leader: Alessandro Retino, Laboratoire de Physique des Plasmas - CNRS, France
Session: 18-22 November 2013

Solar Wind Charge Exchange Soft X ray Imaging in the Solar System
Team leaders: David Sibeck and Michael R. Collier, NASA Goddard Space Flight Center, USA
Session: 21-25 October 2013

Vesta, the Key to the Origins of the Solar System
Team leader: Diego Turrini, Italian National Astrophysics Institute (INAF), Rome, Italy
Session: 25-29 November 2013

Dawn-Dusk Asymmetries in the Coupled Solar Wind-Magnetosphere-Ionosphere System
Team leaders: Andrew Walsh, ESTEC, The Netherlands, and Stein Haaland, University of Bergen, Norway
Session: 30 September and 4 October 2013

Magnetic Activity of M-type Dwarf Stars and the Influence on Habitable Extra-Solar Planets
Team leader: Sven Wedemeyer-Böhm, University of Oslo, Norway
Session: 5-9 May 2014

Magnetosphere and Ionosphere as a Coupled System: Theory and Observations
Team leader: Andrew Wright, University of St. Andrews, United Kingdom
Session: 5-9 August 2013

Teams selected in 2013

Slow Solar Wind Sources and Acceleration Mechanisms in the Corona

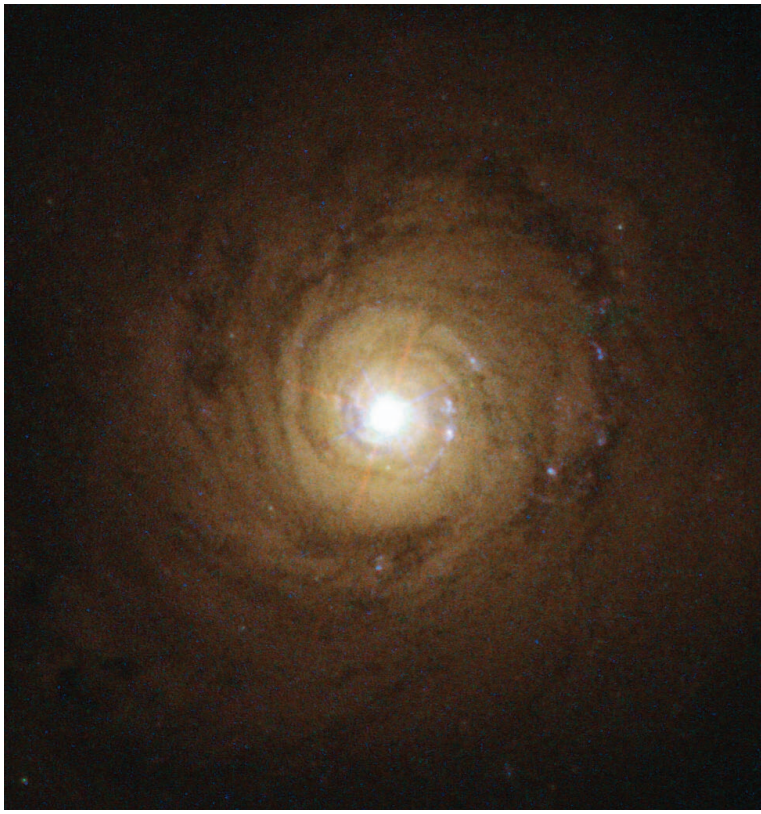
Team leaders: Lucia Abbo, INAF-Osservatorio di Torino, Italy, and Leon Ofman, NASA Goddard Space Flight Center, Greenbelt, USA
Session: 3-7 March 2014
Scientific Rationale: The main goal of the team is to merge observational and numerical modeling knowledge and expertise in order to investigate the sources of the Slow Solar Wind, the physical mechanisms at the base of its acceleration and the key role of the topology of the coronal magnetic field.

Partially Ionized Plasmas in Astrophysics (PIPA)

Team leader: José Luis Ballester, Universitat de les Illes Balears, Palma de Mallorca, Spain
Session: 27-31 January 2014
Scientific Rationale: The primary goals of the team are to exchange ideas, establish collaborative links and develop joint strategies for tackling current problems related with solar and astrophysical partially ionized plasmas. The team members discuss the latest developments in these fields, to interpret existing ground- and space-based observations, and decide modelling strategies to be carried out between the meetings. The expected outcome of the research is a better understanding of the different astrophysical environments in which partially ionized plasmas play a significant role, and the establishment of scientific links between different astrophysical communities.

Mapping the Northern Plains of Mars: Origins, Evolution and Response to Climate Change

Team leader: Matthew Balme, The Open University, Milton Keynes, United Kingdom
Session: 4-6 December 2013
Scientific Rationale: The team aims to detail the geologic and stratigraphic character of the martian northern plains, with particular regard to the role that near-surface ice has played in their evolutionary history. The goal is to produce new geomorphological maps of the northern plains of Mars, and to identify not only the range of geologically recent, ice-related landforms, but also their association with subtly-expressed geological units. The focus on latitudinal and longitudinal variations in surface geology, and the examination of the surface at high spatial scales, sets this mapping apart from previous work. The team includes members with cross-cutting expertise such as formal planetary mapping techniques and impact crater chronology, and experts in spectral dataset analysis to help understanding surface composition. The cartographic and topical science results will enhance the community's understanding of the geologic evolution of this region of Mars.



This is the galaxy known as NGC5548. At its heart, though not visible here, is a supermassive black hole behaving in a strange and unexpected manner. The ISSI team led by M. Cappi and J. Kaastra worked on this topic. (Image Credit: ESA/Hubble and NASA)

Deciphering AGN out Ows: Multi-Wavelength Monitoring of NGC5548

Team leaders: Massimo Cappi, Istituto di Astrofisica Spaziale e Fisica Cosmica INAF, Bologna, Italy, and J. Kaastra, SRON, Utrecht, the Netherlands
Sessions: 9-13 December 2013 and 19-23 May 2014
Scientific Rationale: The team study project aimed at deciphering the outflow properties of the bright Seyfert 1 galaxy NGC5548. The team work is based on an ambitious multi-wavelength campaign on

NGC5548 for which the team were approved in year 2012 a Large Program (14×50 ks) with XMM-Newton, 12 joint HST/COS orbits, 41×1.5 ks with SWIFT and 245 ks of Chandra/HETGS. Simultaneous hard X-ray observations with Nustar are also foreseen. The campaign started before the Summer 2013 (Swift started in May 17th, XMM in June 22nd) and lasted for >80 days in total. The main scientific goal of this large project is to determine unambiguously the location, geometry and physical properties of the various absorption (wind/outflow) and emission (accretion disc, corona) components in this source. The team covers the whole range of expertise needed for such a study: data reduction (at all wavelengths, from the optical-UV to the hard X-ray band), data analysis, data interpretation and theoretical simulations/modeling. The goal is to discuss the observational results, their possible interpretations, as well as to define, coordinate and plan the writing of several scientific papers expected to result from the above campaign.

Massive Star Clusters Across the Hubble Time

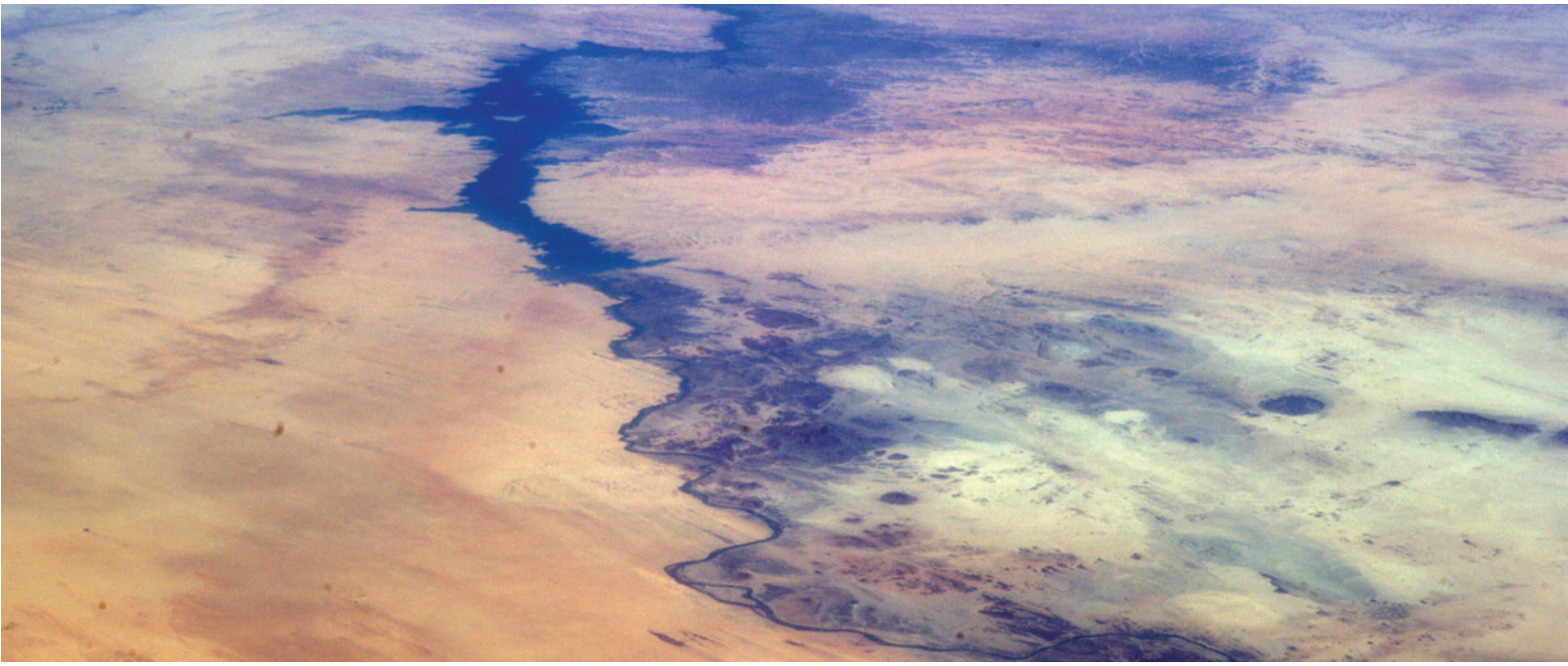
Team leader: Corinne Charbonnel, University of Geneva, Switzerland
Session: 13-17 January 2014
Scientific Rationale: The team gathers specialists working on stellar and interstellar matter magnetohydrodynamics, multi-dimensional numerical simulations, galactic chemical evolution, star and planet formation, spectroscopic analysis, and N-body simulations. The developments optimize the exploitation of large cutting-edge surveys with both ground-based telescopes and the ESA and NASA space missions GAIA, Herschel, and HST. They prepare the ground for future observations with ALMA and later SKA and JWST that open the possibility to resolve super star clusters and to study their relation to globular clusters, as well as with the next ESO multi-object spectroscopic facility being foreseen to become operational by 2018-19. The latter, especially, represents the ideal machine to follow-up on the results of this project, being able to target hundreds of objects simultaneously in any given field, thus mapping chemically, kinematically, and dynamically globular clusters.

Early Universe: Research On Plasma Astrochemistry

Team leader: Carla M. Coppola, University of Bari, Bari, Italy
Session: 24-28 February 2014
Scientific Rationale: The team extends the studies into the formation of the first structures, including extremely metal-poor stars (EMPs). The recent discovery of a low-mass star of almost pristine chemical composition (Caffau et al. 2011) has opened a new pathway to investigate observationally the properties of the first stellar generations. Of similar impact is the identification of gas clouds without any trace of heavy elements or with metallicities consistent with enrichment by primordial stars. It is clear that the observational effort to peer into these remote epoch of the evolution of the Universe is becoming possible thanks to the availability of dedicated instruments, such as UVES and X-shooter at the VLT (or similar spectrographs on Keck) and (sub)mm interferometers such as ALMA.
The goal consists in bringing together a group of experts from different scientific communities (theoretical chemists and physicists, theoretical astrophysicists, observational astrophysicists) in order to make use of these opportunities and to build up a consistent approach for the modeling and comparison with observational data.

Unveiling Multiple AGN Activity in Galaxy Mergers

Team leader: Alessandra De Rosa, INAF – Istituto di Astrofisica Spaziale, Rome, Italy
Session: 17-21 March 2014
Scientific Rationale: Over the last decade, several nearby dual and multiple Active Galactic Nuclei (AGNs) on kpc scales have been found serendipitously in local interacting galaxies. Although a significant number of candidates have been pre-selected so far only a few of them have been confirmed unambiguously. The team work is focused on the detection and study of dual and multiple SMBHs. It aims at investigating the physical properties of multiple AGN candidates in interacting/disturbed systems from both an observational and a theoretical point of view. The scientists study a sample of 12 dual AGNs, supplied by an extensive set of multiwavelength observations, both proprietary and already available in the optical/X-ray/radio archives. These data are interpreted within the most common

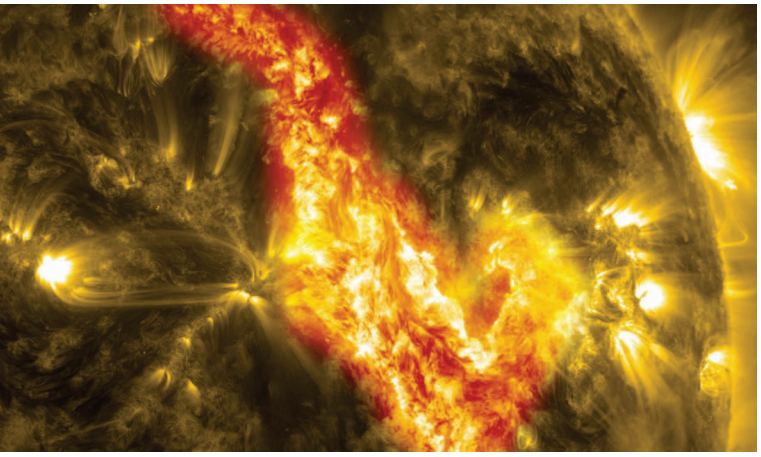


From 400 km above Earth ESA astronaut Alexander Gerst took this picture of the Nile river as the International Space Station flew by at 28 800 km/h. (Image Credit: ESA/NASA)

theoretical scenarios with the final aim of improving our knowledge about black hole history, demography and black hole-galaxy coevolution mechanisms.

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: 17-19 February 2014
Scientific Rationale: Terrestrial ecosystems and soils constitute a key component of the global carbon cycle. They constitute both a significant forcing of climate (historically about 30% of CO_2 emissions come from direct land-use change) and a strong feedback to it. While changes in climate (e.g. shifts of climate zones) will have an impact on how the current terrestrial sink will develop in the future, a second and perhaps more decisive factor is the direct and indirect anthropogenic impact on terrestrial ecosystems.
An increasing world population and its demand for wood, food, fiber and renewable energy drive this. In addition, a large fraction of the world's forests are already heavily managed for forestry products. Many of these land management practices modify the stored carbon pools, their turnover rates and other Greenhouse Gasses such as CH_4 and N_2O. Earth System Models (ESMs) are our current mathematical tools of the Earth and its climate.
Over the past decades, the number of processes represented in ESMs has considerably increased and individual process representation has matured to the extent that representing interactive carbon cycles within ESMs is a central part of IPCC scenarios and analysis. But inclusion of land-use information in these simulations has not delivered the advances hoped for because most aspects of anthropogenic effects i.e. land management, urbanization, drainage, canalization and river damming remain poorly represented in ESMs. Improving representations of land management effects in Earth System Models is hampered by a lack of suitable, harmonized global datasets of current and past land management practices and missing concepts of how to incorporate land management information into the model framework and evaluate model projections.
The input and need of EO data is obvious. In addition, future land management scenarios need to be established in order to understand the impact of land management on the land CO_2 sink, regional and global climate. This was highlighted as one of the key priorities at the ISSI Forum "Assessing Requirements for a Carbon Model Reference Validation Framework" held in January 2012.



A magnetic filament of solar material erupted on the sun in late September 2013, breaking the quiet conditions in a spectacular fashion. The 200,000 mile long filament ripped through the sun's atmosphere, the corona, leaving behind what looks like a canyon of fire. (Image Credit: NASA/Solar Dynamics Observatory)

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: 10-14 February 2014
Scientific Rationale: The team intends to reach an assessment of the progress in the fields of dynamic processes in the solar wind plasma, and the interaction of energetic particles with shocks/CMEs which was obtained from the evaluation of 1975-1983 Helios. The goal is to bring together scientists who are still familiar with the analysis of Helios data and the subtleties of the corresponding instruments, those who have in the past decade contributed to advances in the theoretical understanding and modeling techniques of heliopheric processes which were not available in the Helios era, and those who are now working on instrumentation for future missions which will explore the inner Heliosphere. As several of the envisioned Team members are co-investigators of particle and plasma instruments for the ESA/NASA Solar Orbiter mission, the outcome of the team effort could result in valuable input to the planning of science objectives of that mission and allow a fine-tuning of some instrument capabilities. The team also takes a second look at the evaluation of multi-point observations from IMP8, ISEE-3, the Solar Maximum Mission (SMM), and explore possibilities to organize similar observations from particle and plasma instruments on current (STEREOA/ B, Wind, ACE, MESSENGER) and future (Solar Orbiter, Bepi-Colombo, Solar Probe Plus, and possibly Interheliozond/Russia) missions in the inner Heliosphere.

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
Session: 2-5 December 2013
Scientific Rationale: The focus of the team is to study these complex non-equilibrium processes, with emphasis on their observational signatures in remote sensing measurements of the EUV and X-ray radiation. In particular, the members investigate whether these signatures can be linked to the in-situ measurements of the solar wind, and whether these signatures can be distinguished from the effects of plasma inhomogeneities. To tackle these questions, the team brings together experts on diverse fields, ranging from atomic physics and spectroscopic observations to solar wind modeling. The scientists contribute to the international development of future space missions for an advanced study of the coronal dynamics and associated non-equilibrium processes, and pave the way e.g. for the interpretation of the future Solar Orbiter observations.

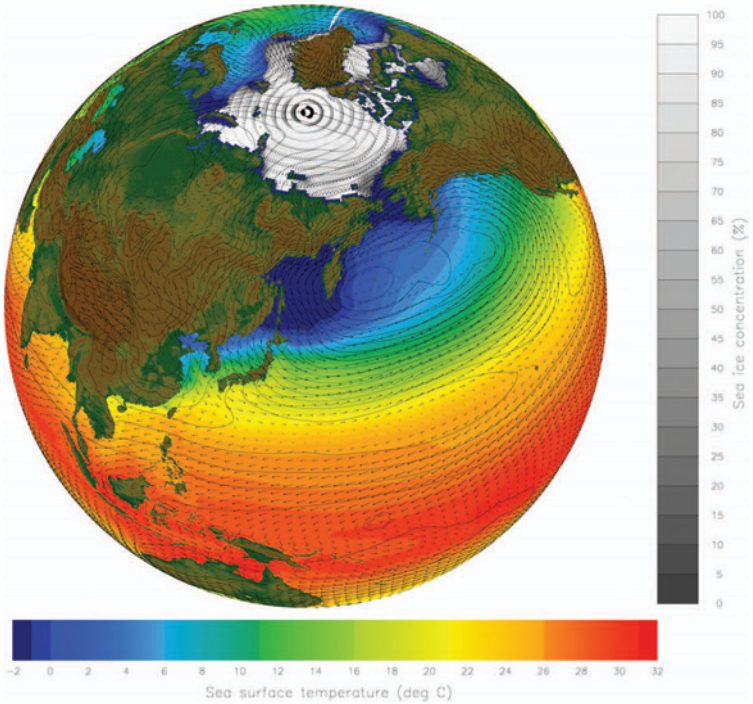
Multidisciplinary Search for Preservation Windows of Biomolecules in Modern and Ancient Terrestrial Analogs as a Proxy for Ancient Deposits of Mars

Team leader: David C. Fernandez Remolar, Centro de Astrobiología (INTA-CSIC), Madrid, Spain
Scientific Rationale: The team is composed of multidisciplinary scientists to optimize an integrated detection strategy for ancient signatures of life on Mars. The teams provides an integrated framework for searching for traces of life at different scales, which is achieved via the synthesis of planetary remote-sensing and rover-based datasets with information collected from terrestrial analog environments. This framework emerges via the pursuit of the following major objectives:

1) selection of potential preservation windows at different outcrops on Mars by using sedimentary, petrologic, mineralogic and geochemical studies of specific regions (e.g., Terra Sirenum, Aram Chaos or Gale Crater), 2) study of molecular preservation in terrestrial materials that are analogous to those present at the targeted Mars areas (e.g., sulfates, chlorides, perchlorates, nitrates) and, 3) comparative study of the preservation potential of different biomolecules in selected terrestrial analog deposits over time. After analyzing all information of the three objectives, the identification of resistant biomolecules bearing robust biological information under Mars-like extreme conditions will be the major, and final accomplishment. Such information will be also used to identify the best instrumentation and procedures for detecting microbial activity versus contamination in potential future sample return missions from Mars.

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

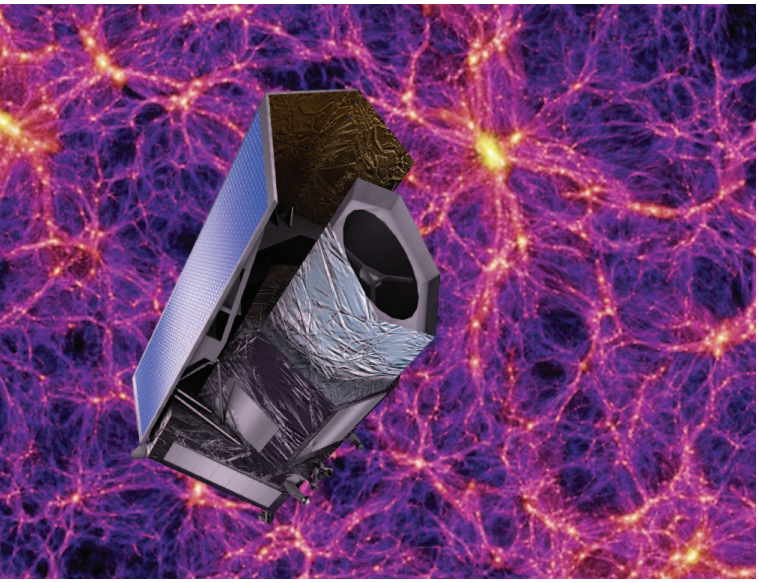
Team leader: Katya Georgieva, Bulgarian Academy of Sciences, Sofia, Bulgaria
Session: 24-28 March 2014
Scientific Rationale: The aim is to summarize the present level of knowledge and to critically discuss new ideas about the effects of interplanetary disturbances on the Earth's atmosphere and climate, and the mechanisms by which these influences are transmitted from the top to the bottom of the atmosphere. An output is a review paper to comprehensively and critically present and discuss the various mechanisms and effects that the charged environment has upon the neutral atmosphere and climate. One of the novelties not covered in any earlier reviews is to take into account the possibly different affects of the above mentioned two main solar wind drivers. The core team consists of experts covering a versatile range within solar-terrestrial sciences, including heliospheric physics, observations of energetic particles and the properties of the atmosphere at different altitudes, as well as modeling of atmospheric chemistry, dynamics and climate, as well as modeling of atmospheric chemistry and climate.



Modeling climate's complexity. This image, taken from a larger simulation of 20th century climate, depicts several aspects of Earth's climate system. Sea surface temperatures and sea ice concentrations are shown by the two color scales. The figure also captures sea level pressure and low-level winds, including warmer air moving north on the eastern side of low-pressure regions and colder air moving south on the western side of the lows. (Image Credit: Gary Strand, NCAR)

Energy Transformation in Solar and Stellar Flares

Team leader: Louise Harra, University College London, Surrey, United Kingdom
Session: 24-28 February 2014
Scientific Rationale: The team takes advantage of the new understanding of solar flares from Hinode and SDO, alongside the statistics and spectral detail available from XMM-Newton, SWIFT, Kepler and Chandra. The idea for this team was developed from the ISSI forum on the state of solar activity and the potential for future development of the subject held in November 2012. The overarching theme for the team is to understand the chain of energy transformations from magnetic energy to particle acceleration and kinetic energy, and finally to heat and radiation in solar and stellar flares. Scientists covering both solar and stellar flare spectroscopy areas alongside modelling expertise will be brought together to address the four science goals.



To be launched in 2020, Euclid's 1.2 m-diameter telescope and two scientific instruments will map the shape, brightness and 3D distribution of two billion galaxies covering more than a third of the whole sky and looking back over three-quarters of the history of the Universe. (Image Credit: ESA)

Understanding Intrinsic Galaxy Alignments

Team leader: Benjamin Joachimi, University College London, London, United Kingdom

Sessions: 18-22 November 2013 and 30 June - 4 July 2014

Scientific Rationale: The apparent distortions and alignments of faint galaxy images due to the gravitational lensing effect by the large-scale structure of the Universe is one of the potentially most powerful probes of cosmology. This so-called cosmic shear effect maps the matter distribution at different epochs and is thus sensitive to both the expansion history and the growth of structure. Forthcoming cosmic shear surveys such as the ESA Euclid mission will enable unprecedented insight into the properties of dark matter and dark energy, and test the validity of general relativity on cosmological scales.

The meetings bring together leading observational, theoretical, and numerical expertise on intrinsic alignments, with the goal to decisively advance the understanding of this astrophysical effect.

From 2D Mesoscale Surface Expressions to 3D Upper Ocean Dynamics

Team leader: Johnny A. Johannessen, Nansen Environmental and Remote Sensing Center, Bergen, Norway

Session: 24-27 March 2014

Scientific Rationale: There is ample evidence that the mesoscale to sub-mesoscale variability in the ocean is still not adequately resolved nor is its impact fully accounted for in the present ocean and coupled ocean-biological models, in particular in the upper ocean layers. The decay of mesoscale structures is generally too fast, and turbulent fluxes of tracer are systematically underestimated, especially in the vertical. These processes typically occur at horizontal spatial resolutions from order 100 m to several kilometers, but their ranges of influence are propagating to coarser spatial scales (20-50 km). The optimum use of high-resolution satellite sensor synergy is therefore vital to improve the understanding of processes at these finer scales (order kilometer), as adequate in-situ observations resolving these scales are usually rare, and key recent theoretical and numerical results provide novel perspectives.

The Science of Near-Sun Comets

Team leader: Geraint H. Jones, University College London, Surrey, United Kingdom

Session: 3-7 March 2014

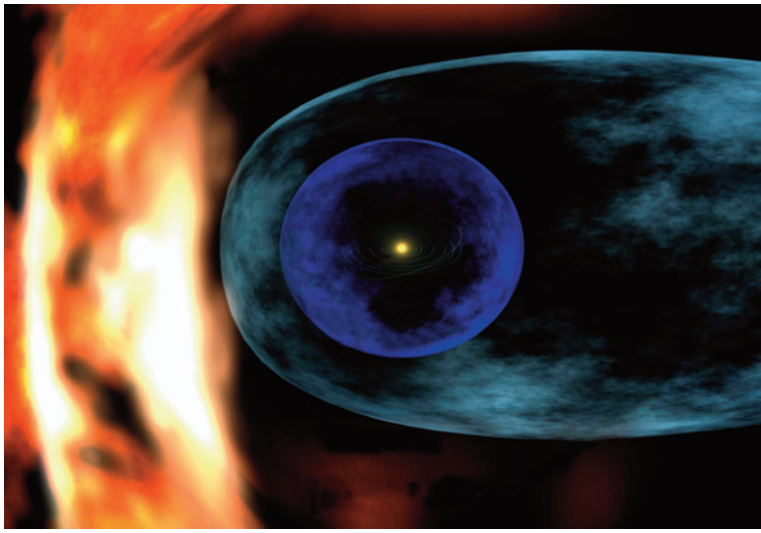
Scientific Rationale: The knowledge of comets is primarily based on observations of these bodies when they are one astronomical unit or more from the Sun. However, most known comets have reached perihelion much nearer to the Sun, experiencing extreme insolation conditions, and, in the case of sungrazers, often undergoing complete destruction. The team brings together experts in complementary areas of cometary science, in solar and heliospheric physics, as well as in the instrumentation and data analysis techniques associated with those fields, to better our understanding of comets when inside the orbit of Mercury as well as their effects on the near-Sun environment.

Sub-arcsecond Observations and Interpretation of the Solar Chromosphere

Team leaders: Lucia Kleint, BAER Institute, Palo Alto, USA and Alberto Sainz, Lockheed Martin Solar and Astrophysics Laboratory, Palo Alto, USA
Session: 27-31 January 2014
Scientific Rationale: The team combines the knowledge of the experts who interpret chromospheric spectropolarimetric data and of the experts developing and using inversion codes, especially for the chromosphere. With the combined experience the team makes progress in explaining the unexpected signatures that can be seen in the polarimetric data and advances the tools necessary to study this important solar layer. This is especially important, considering that future missions and telescopes (SOLAR-C, ATST, EST) will include chromospheric spectropolarimeters, whose data currently cannot be used without a large effort for the analysis.

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

Team leader: Sanjay S. Limaye, University of Wisconsin, Madison, USA
Sessions: 5-7 November 2013 and 16-18 June 2014
Scientific Rationale: Nearly three decades ago, an international effort led to the adoption of the Venus International Reference Atmosphere (VIRA) was published in 1985 after the significant data returned by the Pioneer Venus Orbiter and Probes and the earlier Venera missions (Kliore et al., 1985). The vertical thermal structure is one component of the reference model which relied primarily on the three Pioneer Venus Small Probes, the Large Probe profiles as well as several hundred retrieved temperature profiles from the Pioneer Venus Orbiter radio occultation data collected during 1978-1982. The scientists consider primarily the thermal structure of the atmosphere of Venus with a goal to arrive at an integrated model from the different measurement approaches that is not only self-consistent, but also consistent with the observed clouds/aerosols from the available observations. The effort will probably identify areas where further observations may be needed to resolve any inconsistencies in the available observations.



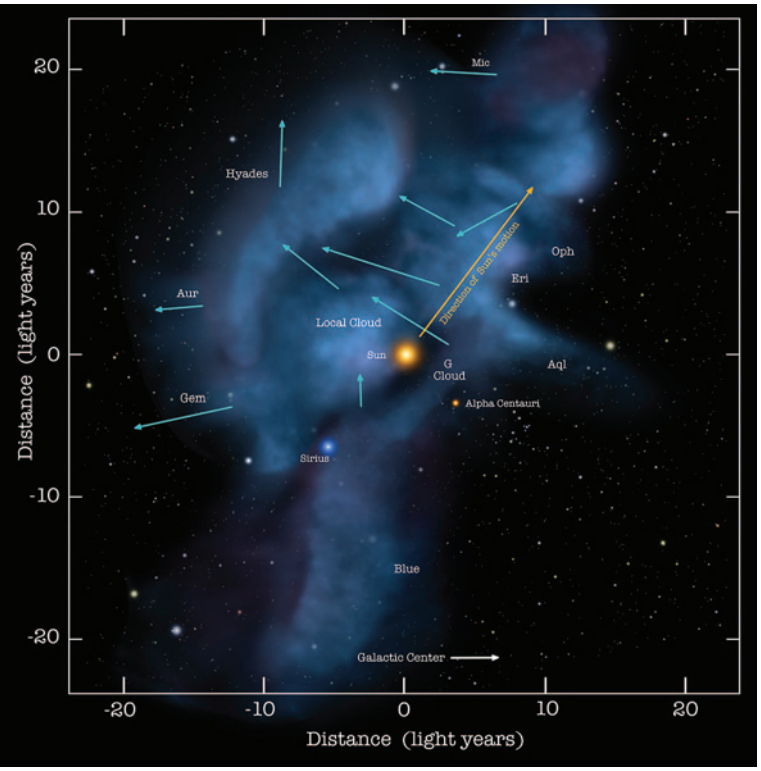
Artist's concept of our Heliosphere as it travels through our Milky Way galaxy. (Image Credit: NASA/Goddard/ Walt Feimer)

The Nature of Coronal Bright Fronts

Team leaders: David Long, University College London, Surrey, United Kingdom and Shaun Bloomfield, Trinity College Dublin, Ireland
Session: 20-24 January 2014
Scientific Rationale: The goal of the team is determining the true nature of Coronal bright fronts (commonly called "EIT waves"). Achieving this goal requires the use of a combination of observational and simulated data to extract physical characteristics of these coronal disturbances and compare them to the predictions of competing theories and models. The team consists of experts in the observation, simulation, and theory of "EIT waves" and has been chosen to provide a suitable balance between the wave and pseudo–wave interpretations of this phenomenon.

Study Group on the Added-value of Chemical Data Assimilation in the Stratosphere and Upper-troposphere

Team leaders: Richard Ménard, Air Quality Research Division, Gatineau QC, Canada and Quentin Errera, Institut d'Aéronomie Spatiale de Belgique, Bruxelles, Belgium
Session: 31 March - 4 April 2014
Scientific Rationale: The team consists of multidisciplinary scientists in observation studies, chemical modeling and processes (all of which are familiar



In the disk of our Milky Way Galaxy about 10 percent of visible matter is in the form of gas, called the interstellar medium (ISM). The ISM is not uniform, and shows patchiness even near our Sun. It can be quite difficult to detect the local ISM because it is so tenuous and emits so little light. This mostly hydrogen gas, however, absorbs some very specific colors that can be detected in the light of the nearest stars. (Image Credit: NASA, Goddard, Adler, U. Chicago, Wesleyan)

with data assimilation) to work with experts of chemical data assimilation. One of the host Institute, the Belgium Institute for Space Aeronomy (BIRA), have developed one of the best stratospheric chemical data assimilation system known, and which can handle the assimilation of both long-lived and short-lived species. The assimilation system implemented at BIRA is based on the most advanced techniques in the field, namely 4D Var and the ensemble Kalman filter. These systems can not only assimilate long-lived species, but also provide error estimates, and be adapted to improve knowledge of parameter of the model. Several scientific areas of research have been identified, which are either promising or have shown already scientific value with less comprehensive assimilation systems. Overall, the result of the work will help reduce the gap of uncertainties and enhance our knowledge of the stratosphere.

Specification of Ionization Sources Affecting Atmospheric Processes

Team leader: Irina A. Mironova, St. Petersburg State University, Russia
Session: 31 March - 4 April 2014
Scientific Rationale: This team is built on the membership from a previous ISSI team, but inviting new experts working with electrons models, atmospheric models and data. The team meetings address to progress the two streams of work identified as 1. long-term balloon observations of ionizing particles in the atmosphere and 2. to the development of atmospheric ionization model including all known precipitating energetic particles.

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: 9-13 September 2013
Scientific Rationale: The outer region of a neutron star, called the crust, is predicted to host novel states of matter containing exotic neutron-rich nuclei (which in the inner crust are highly deformed), relativistic electrons, and a superfluid of neutrons. Recently, transiently accreting neutron-star low-mass X-ray binaries have emerged as unique laboratories to study thermal and transport processes in these extreme environments and phases encountered in the crust. During a long period of accretion, years to decades, the crust is heated out of thermal equilibrium with the stellar core. When accretion ends, the subsequent thermal relaxation can, and has been, observed in detail. Modeling these events has been fairly successful, but with the introduction of "fudge parameters" which mask our current ignorance about the interesting physics of heat transport, nuclear reactions, and neutron superfluidity at these fairly extreme densities. It is now timely to bring together a team of X-ray observers, theoretical astrophysicists, and theoretical physicists to interpret and guide observations of thermal relaxation with a view to learn about fundamental processes and phases of matter encountered at these extreme densities.

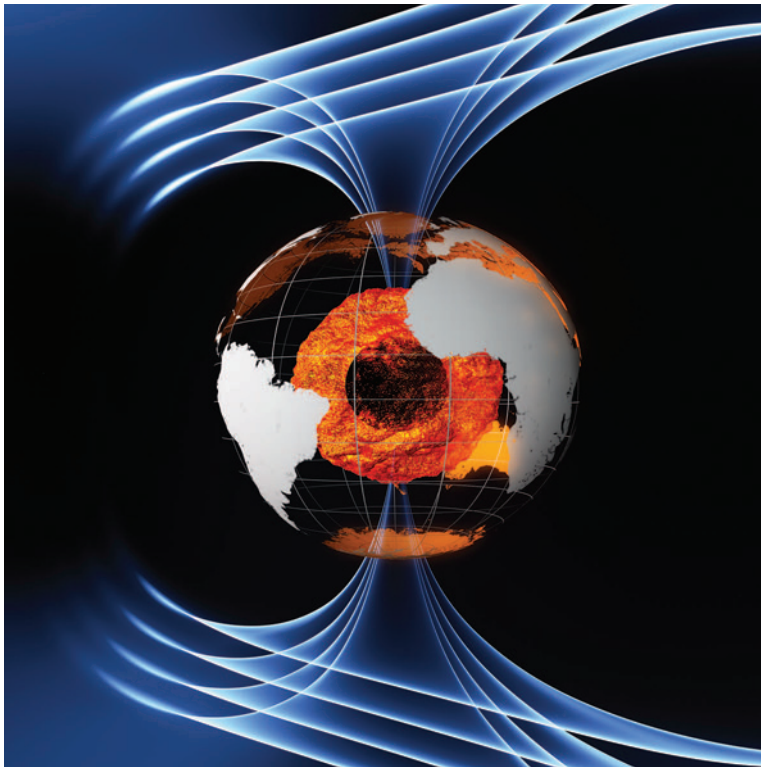
Modes of Radial Plasma Motion in Planetary Systems

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: 22-25 October 2013
Scientific Rationale: The team has extensive knowledge of the magnetospheres of Jupiter and Saturn, with decades of experience in the analysis of the relevant particles-and-fields data. The group also includes a wealth of imaging (both magnetospheric and auroral) and simulation experience. Themes of this work include bringing together the observational evidence of transport processes from different types of instruments and making more precise the physical picture of transport in different regions of a magnetosphere. This work is particularly timely given the wealth of Cassini data available, the upcoming arrival of the Juno spacecraft at Jupiter, and the involvement of several of our team members in the future JUICE mission to the Jovian system.

Ion and Electron Bulk Heating by Magnetic Reconnection

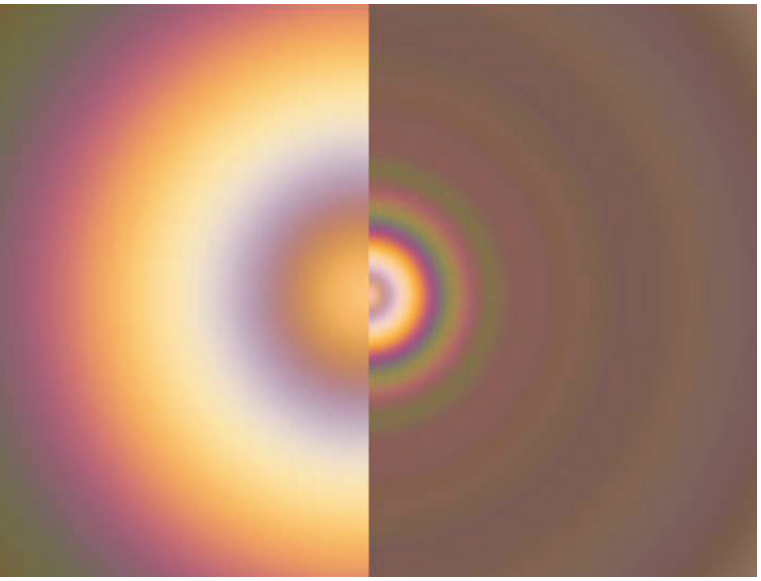
Team leader: Tai Phan, University of California Berkeley, USA
Session: 7-11 October 2013
Scientific Rationale: Magnetic reconnection is a universal plasma process that converts magnetic energy into plasma jetting and plasma (thermal and suprathermal) heating. The process is important in many space and laboratory contexts. While plasma jetting is well established, both theoretically and observationally, the mechanisms whereby bulk (thermal) plasma heating occurs in a collisionless plasma remain poorly understood. Since such heating is an important aspect of the overall reconnection process, there is a need to explore its sources and manifestations in detail. The team uses a combination of plasma simulations and in-situ spacecraft observations over a range of plasma conditions to systematically study bulk ion and electron heating. Specifically, the scientists focus on the following key unanswered questions:
(1) What plasma parameter regimes or inflow boundary conditions determine the degree of ion and electron thermal heating in reconnection exhausts?
(2) What are the characteristics (e.g., anisotropy and spatial profiles) of the ion and electron thermal heating and how do they change with inflow conditions?
(3) Where are the key heating sites for ions and electrons? What is the nature of the exhaust boundaries for different inflow boundary conditions?



Earth's magnetic field is thought to be generated largely by an ocean of superheated, swirling liquid iron that makes up Earth's outer core 3000 km under our feet. Acting like the spinning conductor in a bicycle dynamo, it generates electric currents and thus the continuously changing electromagnetic field. (Image Credit: ESA/AOES Medialab)

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

Team leaders: Nikolai V. Pogorelov, University of Alabama in Huntsville, USA, and Horst Fichtner, Ruhr-Universität Bochum, Germany
Session: 13-20 January 2014
Scientific Rationale: The team members anticipate producing new results which will be of importance for heliospheric physics (observation-based plasma model with pickup ions treated kinetically, particle acceleration, cosmic ray transport, magnetic reconnection, turbulence, heliopause instabilities, etc.) and physics of the local interstellar medium. The numerical codes are used to perform multi-component MHD simulations, kinetic modeling based on the Boltzmann and Fokker-Planck equations, and particle-in-cell (PIC) computations. Modeling results will be compared with the spacecraft measurements and used for the predictions of what Voyagers may expect when they cross the heliopause.



Simulated views of the glory phenomena on Venus (left) and Earth (right), without considering any effects of haze or background cloud brightness. Glories occur when sunlight shines on cloud droplets – water particles in the case of Earth, sulphuric acid particles for Venus. (Image Credit: C. Wilson/P. Laven)

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
Session: 20-24 January 2014
Scientific Rationale: The team makes an investigation of the near-Earth space plasma dynamics and electromagnetic environment by multiparameter analysis from variety of space-based missions and creation of physical model of the coupling between lithosphere, atmosphere, ionosphere and magnetosphere which are linked by the chain of processes initiated by atmospheric boundary layer modification by air pollution (dust aerosols, nuclear disaster) and modification of boundary layer by major natural disasters: earthquakes, tsunamis, hurricanes/typhoons and volcanoes. The intention is to find from experimental data and their detailed analysis the key processes in atmosphere, which modify the Earth plasma environment system under various geophysical conditions including natural and anthropogenic disasters. The team, including leading world experts in different disciplines, provides the unique opportunity of the knowledge fusion to make breakthrough in the understanding the coupling process between atmosphere of our planet and space environment.

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: 17-21 February 2014
Scientific Rationale: The team aims at studying Kinetic Turbulence and Heating in the Solar Wind mechanisms of energy dissipation. The scientists use a multiple approach that combines in-situ fields and particles data available from the multispacecraft missions, and numerical simulations to model the complex behavior of turbulence cascade at kinetic scales where it is dissipated. The observations using mainly data from the Cluster and Themis satellites, which offer a unique chance to identify and to characterize three-dimensional (3D) spatial plasma structures. Moreover, their high time resolution E and B measurements makes it possible to probe into the smallest scales ever explored in the SW. The simulation work will be done using different codes, Hall-MHD, PIC and Vlasov, available in the group.

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
Sessions: 4-6 November 2013 and 18-20 June 2014
Scientific Rationale: The team activity is timed to take advantage of a planned scientific observing campaign focusing on measurements of SO_2 and related sulfur cycle compounds, which was scheduled to take place in autumn 2013. Several of the key sulfur-oxide family species will be directly observed including: SO_2, SO, OCS, H_2SO_4 and aerosols. The coordinated observation campaign provides an unprecedented opportunity for comparisons among the observational and theoretical modeling techniques involved in defining the past and current variability of SO_2 and related gases.

Improved Understanding of Venus Clouds

Team leaders: Colin Wilson, University of Oxford, United Kingdom, and Emmanuel Marcq, LATMOS, Guyancourt, France
Sessions: 6-8 November 2013 and 16-18 June 2014
Scientific Rationale: The team brings together scientists from each of the relevant Venus Express investigation teams as well as from previous missions, as well as those developing computational and analytical models of clouds and hazes. The aims of the project are (1) to create self-consistent reference cloud/haze models which capture not only a mean cloud structure but also its main modes of variability; and (2) to bring together modelers and observers, to reach an understanding of clouds and hazes on Venus which matches all observables and is physically consistent.

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: 28-31 January 2014
Scientific Rationale: Recent work has shown that in order to fully understand the dynamic behavior of geospace we must treat the ionosphere and magnetosphere as a fully coupled system. Extensive networks of all-sky imagers, photometers, spectrographs, and riometers enable inferring the regional conductance structure that can be compared with the results of our global reconstruction. Together with recent advances in global modeling these observational capabilities can lead to major breakthroughs in our understanding of how the magnetosphere-ionosphere-thermosphere system operates as a whole. In particular, the team can address numerous fundamental questions including the global conductance distribution's role in regulating the state of magnetospheric evolution, polar cap saturation, and connections between Joule heating and ionospheric outflow.

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: 17-21 March2014
Scientific Rationale: Collisionless shocks are ubiquitous in various astrophysical, heliospheric (or solar-terrestrial), and even laboratory phenomena. The aim of this team is to formulate a common understanding regarding the latest knowledge about the initial stage of the particle acceleration (or injection) process at collisionless shocks.
Recent gamma-ray and X-ray observations of supernova remnants have provided the detailed spatial and spectral structure of high-energy particles accelerated at astrophysical shocks, enabling to discuss particle acceleration processes there. The injection problem in the diffusive shock acceleration scenario is one of the important outstanding issues. In order to understand the injection mechanism(s) at collisionless shocks, the team gathers the knowledge of the latest observations, simulations, and theory, not only on astrophysical and heliospheric shocks but also on laboratory shocks.

Superdiffusive Transport in Space Plasmas and its Influence on Energetic Particle Acceleration and Propagation

Team leaders: Gaetano Zimbardo, Università della Calabria, Italy, and Horst Fichtner, Ruhr-Universität Bochum, Germany
Session: 10-14 February 2014
Scientific Rationale: In the last few years it has been demonstrated, both by data analysis and by numerical simulations, that the transport of energetic particles in the presence of magnetic turbulence can be superdiffusive rather than normal diffusive (Gaussian). The term 'superdiffusive' refers to the mean square displacement of particle positions growing superlinearly with time, as compared to the normal linear growth. The so-called anomalous transport, which in general is comprising both subdiffusion and superdiffusion, has gained growing attention during the last two decades in many fields including laboratory plasma physics, but its serious appreciation in space physics is relatively recent.
The team gathers a number of experts on energetic particle transport, with a focus on what could be the main influence of superdiffusion on fundamental processes like diffusive shock acceleration (DSA) and solar energetic particle (SEP) propagation from the Sun to the Earth. Heliospheric, astrophysical, and laboratory plasmas are considered, and both the theoretical approach and data analysis are carried out.

The Teams below have been selected for implementation from the proposals received in response to the 2014 Call for International Teams:

SZ Clusters in the Planck Era
Team leaders: Nabila Aghanim and Marian Douspis (FR)

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 (UK) and Omer Blaes (US)

Implications for Coronal Heating and Magnetic Fields from Coronal Rain Observations and Modelling
Team leader: Patrick Antolin (JP)

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 (UK)

Field-Aligned Currents: Their Morphology, Evolution, Source Regions and Generators
Team leaders: Yulia Bogdanova (UK) and Hermann Lühr (DE)

Anisotropy and Intermittency in Solar Wind Turbulence *(ISSI - ISSI-BJ Team)*
Team leaders: Christopher Chen (UK) and Jiansen He (CN)

Solving the Exo-Cartographic Inverse Problem
Team leader: Nicolas Cowan (US)

Scenarios of Future Solar Activity for Climatemodelling
Team leader: Thierry Dudok de Wit (FR)

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

Magnetosphere-ionosphere-thermosphere Coupling: Differences and Similarities between the Two Hemispheres
Team leaders: Matthias Foerster (DE) and Ingrid Cnossen (UK)

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 (IT)

Asteroids and Self Gravitating Bodies as Granular Systems
Team leader: Daniel Hestroffer (FR)

Improving the Reliability of Solar Eruption Predictions toFacilitate the Determination of Targets-of-Opportunity for Instruments with a Limited Field-of-View
Team leaders: Paul Higgins (IRL) and Manolis Georgoulis (GR)

Adding Value to Soil Moisture Information for Climate Studies
Team leader: William Lahoz (NO)

Constraining the Dynamical Timescale and Internal Processes of the Saturn System from Astrometry
Team leader: Valéry Lainey (FR)

Large Amplitude Oscillations in Solar Prominences
Team leader: Manuel Luna (ES)

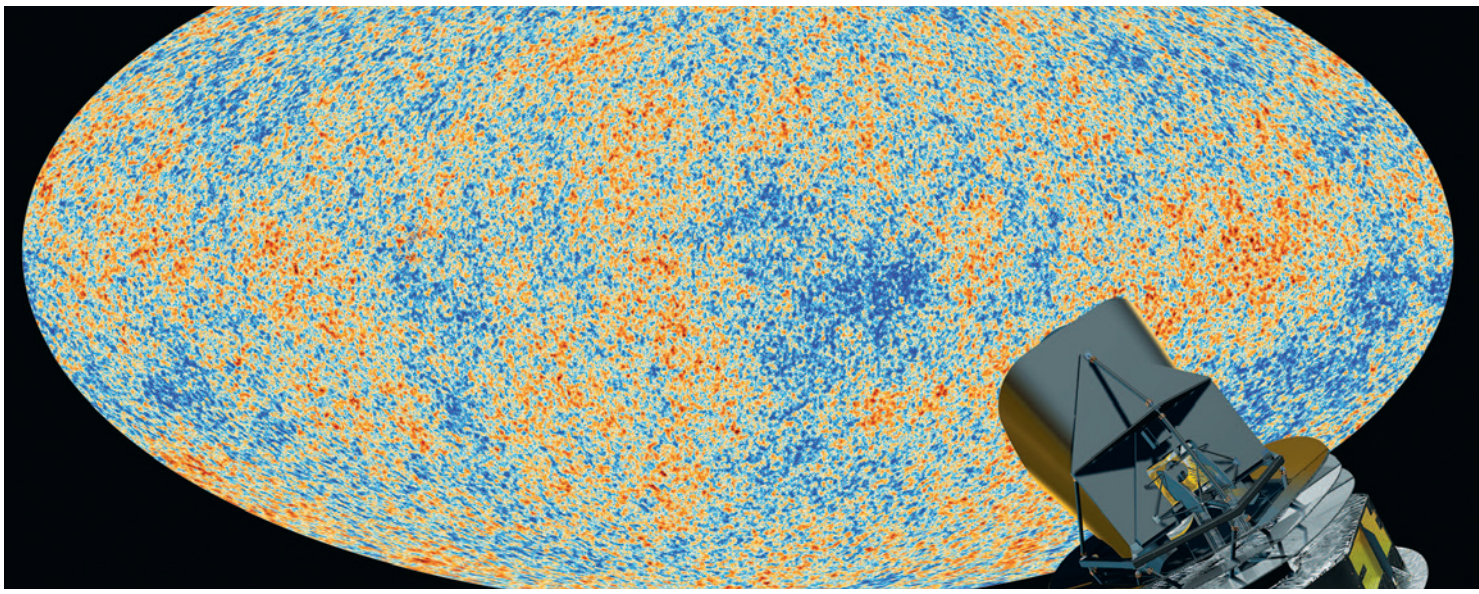
Contemporary Regional and Global Sea Level Rise: Assessment of Satellite and In-situ Observations and Climate Models
Team leader: Benoit Meyssignac (FR)

There it Spins: the Hunt for Black Hole Spins
Team leaders: Sara Elisa Motta (ES) and Tomaso Belloni (IT)

Aeronomy of Terrestrial-sized Bodies *(ISSI - ISSI-BJ Team)*
Team leader: Ingo Mueller-Wodarg (UK)

Facing the Most Pressing Challenges to Our Understanding of the Heliosheath and its Outer Boundaries
Team leaders: Merav Opher and Matthew E. Hill (US)

The Disk-magnetosphere Interaction Around Transitional Millisecond Pulsars
Team leader: Alessandro Papitto (ES)



The anisotropies of the Cosmic microwave background (CMB) as observed by Planck. The CMB is a snapshot of the oldest light in our Universe, imprinted on the sky when the Universe was just 380 000 years old. It shows tiny temperature fluctuations that correspond to regions of slightly different densities, representing the seeds of all future structure: the stars and galaxies of today. (Image Credit: ESA and the Planck Collaboration - D. Ducros)

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 (US)

Climatological Aspects of Water Vapour and Wet Tropospheric Correction Covering the Altimetry Era
Team leader: Bruno Picard (FR)

Towards a Global Unified Model of Europa's Exosphere in View of the JUICE Mission
Team leader: Christina Plainaki (IT)

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 (NL)

Coordinated Numerical Modeling of the Global Jovian and Saturnian Systems
Team leaders: Licia C. Ray and Japhet Yates (UK)

The Effect of Dense Environments on Gas in Galaxies over 10 Billion Years of Cosmic Time
Team leader: Gregory Rudnick (US)

Magnetic Waves in Solar Flares: Beyond the "Standard" Flare Model
Team leaders: Alexander Russell and Lyndsay Fletcher (UK)

Solar Heliospheric Lyman Alpha Profile Effects (SHAPE)
Team leader: Martin Snow (US)

Extension and Improvement of the Mean Sea Level Estimation in the Arctic Regions Using Space Altimetry Data
Team leaders: Pierre Thibaut (FR) and Eero Rinne (FI)

Understanding Energetic Particle Injections and their Effect on Earth's Outer Radiation Belt Electrons using Multipoint Observations
Team leaders: Drew L. Turner and Geoffrey Reeves (US)

Magnetic Helicity Estimations in Models and Observations of the Solar Magnetic Field
Team leaders: Gherardo Valori and Etienne Pariat (FR)

Improving the Analysis of Solar and Stellar Observations
Team leader: Harry P. Warren (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 acknowledgement to ISSI.

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

André Balogh, Space and Atmospheric Physics, Imperial College London, UK, working period: 6.-23.11.2013.

Edward Cliver, National Solar Observatory Sunspot, New Mexico, USA, working period: 26.5.-6.6.2014.

Len Fisk, Department of Atmospheric, Oceanic and Space Sciences College of Engineering, University of Michigan, Ann Arbor, USA, working period: 16.-27.6.2014.

Ken McCracken, IPST, University of Maryland, College Park, USA, working period: 20.4.-23.5.2014.

Götz Paschmann, Max-Planck-Institute for Extraterrestrial Physics, Garching, Germany, working period: 7.-23.3.2014.

Mario J. Pinheiro, Department of Physics, Instituto Superior Tecnico, Lisboa, Portugal, working period: 9.-28.6.2014.

Alessandro Ridolfi, Department of Physics, University of Rome "La Sapienza", Italy, working period: 9.-17.4.2014.

Paul Shearer, Department of Mathematics, University of Michigan, Ann Arbor, USA, working period: 5.-14.6.2014.

Bengt Sonnerup, Thayer School of Engineering, Dartmouth College, Hanover, USA, working period: 10.-21.3.2014.

Thomas Zurbuchen, Department of Atmospheric, Oceanic & Space Sciences College of Engineering, University of Michigan, Ann Arbor, USA, working periods: 3.10.-17.10.2013 and 5.-16.6.2014.

Edward Cliver, Emeritus Astronomer at the National Solar Observatory in Sunspot, New Mexico, answered a few questions about his work as Visiting Scientist and the collaboration with ISSI:

Why you have chosen ISSI for your short stay in Bern?

E. Cliver: Since 2010, I have been to ISSI for two workshops (cosmic ray modulation; solar cycle) and as a member of two international teams (extreme solar events; long-term solar wind reconstruction) and have very much enjoyed the supportive and collegial atmosphere at the Institute. So I immediately thought of ISSI as the place to take a mini-sabbatical for focused research via the visitor program. For several years I have been interested in the problem of the origin of the slow solar wind and the fact that Rudolf von Steiger is an expert on solar wind composition made the prospect of a visit to ISSI to explore this topic especially attractive.

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

E. Cliver: I examined the idea that there might be a floor in the solar wind magnetic field strength and that such a floor might give insight into the origin of the slow solar wind. During 2009, at the end of the recent extended solar minimum, the Sun was free of spots for ~260 days and the solar polar fields were weaker than at any time during the space age, giving us our best glimpse yet of conditions during the Maunder Minimum (a period of low sunspot activity from ~1650-1700). In the near absence during 2009 of high speed streams from low-latitude coronal holes and coronal mass ejections from active regions, Earth was bathed in slow solar wind ~70% of the time. Extrapolating to the weaker polar fields which must have existed during the Maunder Minimum indicates that the slow solar wind was even more predominant at that time as the Sun approached its minimal magnetic state. This in turn suggests that at least some of the slow solar wind originates in the weak fields of the quiet Sun rather than in coronal holes or active regions. For two weeks in Bern, I had the luxury of giving uninterrupted thought to this topic which I am continuing to pursue in Sunspot.

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.

The International Space Science Institute Beijing (ISSI-BJ) was officially inaugurated on July 16, 2013. The first Executive Director of ISSI-BJ, Maurizio Falanga, was elected by the Board of Trustees of ISSI-BJ. The institute's facilities are located in the NSSC building, in Haidian, the university district of Beijing. Since the Inauguration Ceremony, ISSI-BJ is successfully establishing an interdisciplinary and international platform for the scientific community addressing all topics of space sciences.

As part of the institute's program, ISSI-BJ organizes a series of eight 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. During the first business year ISSI-BJ successfully organized five of them: X-ray Timing and Polarization in June 2013, Space Very Long Baseline Interferometry in September 2013, Magnetosphere, Ionosphere and Thermosphere in October 2013, Solar Polar Orbit Telescope in March 2014 and Exploring the dynamic X-ray Universe in May 2014.

One of the ISSI-BJ aims is to make the forum discussions and its conclusions accessible to the broad scientific communities and the public. Therefore, the knowledge and insight gained from these forums are published in the ISSI-BJ TAIKONG Magazine. The first five forums have been published in this newly created magazine and can be found on the ISSI-BJ website www.issibj.ac.cn.

ISSI-BJ extended his activities also to an outreach program for young students as a member of the "Understanding Science" seminars at Bridge Café in Beijing. These informal seminars are organized in cooperation with the British Royal Society of Chemistry and the Institute of Physics. High-level speakers are invited to give lectures in English on scientific topics to increase awareness of today's accomplishments in space research. Around 50 people attended the first Understanding Science lecture of ISSI-BJ on May 8, 2014 and engaged in a lively discussion afterwards.

At the beginning of 2014, ISSI and ISSI-BJ released – for the first time – a joint Call for Proposals for International Teams in Space and Earth Sciences. In response to this call ISSI-BJ received ten team proposals. Six of them have been selected by the Science Committee, and they will hold a series of two one-week meetings at the institute in Beijing. Three out of these six teams will share the meetings between Bern and Beijing.

Around 40 scientists from all over the world attended the Space Very Long Baseline Interferometry Forum in September 2013.

Picture left showing the cover of first edition of the newly created ISSI-BJ magazine. TAIKONG means outer space in mandarin and encapsulates Chinese developments in Space Science.

Events

30 October 2013: Pro ISSI talk "How Space Observations and Super Computers have made Global Weather Prediction possible" by Lennart Bengtsson.

30-31 October 2013: Meeting of the Science Committee.

1 November 2013: Meeting of the Board of Trustees and ISSI Dinner.

20 March 2014: Pro ISSI talk "Surprises in the Hard X-ray Sky" by Thierry Courvoisier.

14 May 2014: Pro ISSI talk "Vulkanismus im Sonnensystem oder wie werden Planeten und Monde ihre Wärme los" by Ralf Jaumann.

26-28 May 2014: Meeting of the Science Committee.

25 June 2014: Meeting of the Board of Trustees.

ISSI in the media

Article "Solar storms could raise surface air temperature in Europe" with M. Calisto by N. Anscombe in Environmental Research Web, 15 November 2013.

TV Interview "Cosmic Front" featuring R.-M. Bonnet, R. Sagdeev and others, celebrating the Giotto Flyby of Comet Halley in 1986, by NHK Productions, 28 November 2013.

Radio Feature "Outside Source" with J. Zarnecki, BBC World Service Radio, 13 December 2013.

TV Interview "Crossover: UK expert on China's first soft landing on the moon" with J. Zarnecki, CCTV America, 14 December 2013.

TV Interview "China moon landing - the science and the politics" with J. Zarnecki, Channel 4 News, 14 December 2013.

TV Documentary "Blazing a trail in search of the secrets of comets" including Interviews with R.-M. Bonnet and N. Thomas, ESA Euronews, 20 December 2013.

Radio Feature "Wie klingt Musik im Weltall?" with R. von Steiger by T. Beyer, Swiss Radio SRF 2, 3 January 2014.

Article "No Pause in Global Sea Level rise" with A. Cazenave by Ch. Marshall and Climate Wire, Scientific American, 26 March 2014.

Interview "Zu Beginn stehen DNA-Codes oder Proteine" with R. von Steiger, interviewed by H. Liechti, Der Bund, 27 March 2014.

Interview "Das All ist voller Klänge" with R. von Steiger, Norient Magazine, 28 March 2014.

Radio Feature "Conversation with Curiosity: Wie Daten vom Mars zu Musik werden" with R. von Steiger by T. Beyer, Swiss Radio SRF 2, 28 March 2014.

Article "Wissenschaft and Politik des Klimawandels" comment by L. Bengtsson, Neue Zürcher Zeitung, 15 April 2014.

Article "Le niveau des océans ne cesse d'augmenter" with A. Cazenave, Le Figaro, 22 April 2014.

TV Documentary "Europe's 50-Year Space Odyssey" including an Interview with R.-M. Bonnet, ESA Euronews, 24 April 2014.

Interview "L'Europe en Chasse d'autres Terres" with R.-M. Bonnet, Sciences et Avenir, 806, April 2014.

Article "Sicher ist nur die Ungewissheit" comment by L. Bengtsson, Die Weltwoche, 28 May 2014.

Alpbach Summer School students and mentors. (Image Credit: Michel A. Jakob, FFG)

ISSI and the Alpbach Summer School 2013

The topic of the 2013 Summer School (the 37th of the series, with ISSI as a partner of FFG and ESA), was "Space Weather: Science, Missions and Systems". Sixty students from European countries gathered for two weeks, from 16 to 25 July 2013. ISSI support to the School was first through the participation of André Balogh and Roger-Maurice Bonnet to the Program Committee and during the School through Silvia Wenger who provided administrative assistance, André Balogh, who assisted the Head Tutor as Scientific Coordinator and participated in the Jury, which was chaired by Roger-Maurice Bonnet.

The first part of the School was devoted to introductory lectures, reviewing and summarizing what is Space Weather and why it is important to study, understand and forecast in view of the risks incurred by different application satellites and ground based systems, as well as manned spaceflight. Scientific aspects of the causes and effects of space weather were covered, in particular Solar Storms and Coronal Mass Ejections (CME), Magnetospheric and Radiation Belts dynamics. Together with technical instrumentation as well as ground segment data management related topics, these lectures provided a foundation for the usual workshops of the School, during which the students are divided into four teams and tasked to designing their own space mission, with the support and the assistance of the lecturers and tutors.

The titles of the four projects were:

- Coronal Analysis Reporting to Earth To Allow Keeping Everything Running (CARETAKER),
- Photospheric And Chromospheric and Coronal Magnetic field Analyser (PAC2MAN),
- Observatories of Solar Corona and Active Regions (OSCAR),
- Atmospheric Drag, Occultation 'N' Ionospheric Scintillation (ADONIS)

On the last day of the School, each team was allowed one hour to present its project to the audience and to the Jury composed with André Balogh, Wolfgang Baumjohann, Peter Falkner, Head Tutor, Anik de Groof, Juha-Pekka Luntama, Hugo Maree, Harald Posch, FFG, Chairman of the Program Committee, Jean-Yves Prado, and Günther Reitz. At the end of their deliberations, the Jury granted a set of so called "Oscars" to PAC2MAN for the best scientific case, as well as for the best quality of the presentation, OSCAR for the best technical case, ADONIS for proposing the most competitive mission, and CARETAKER got the Head Tutor Oscar for offering the best improvement and development case.

Roger-Maurice Bonnet speaking during the ISSI SPORT Forum at ISSI Beijing, China, in November 2013.

Presentations

Listed are activities in which ISSI staff scientists participated between 1 July 2013 and 30 June 2014. This includes presentations given, meetings attended, honors received, and chairmanships held.

12 July 2013 – R.-M. Bonnet: A Fresco of 50 years World Leadership in Space Research, Keynote Speech, 50th Birthday Celebration of Max Planck Institute for Extraterrestrial Physics, Garching, Germany.

12 July 2013 – M. Calisto: Influence of a Carrington-like event on the atmospheric chemistry, temperature and climate, Davos Atmosphere and Cryosphere Assembling DACA-13, Davos, Switzerland.

9 September 2013 – J. Zarnecki: Comets and Asteroids: Time capsules, space hazards or mineral resources, European Planetary Science Congress (EPSC) 2013, UK House of Commons, Westminster, London, UK.

18 September 2013 – R.-M. Bonnet: A European Perspective on International Cooperation in Science. Lessons Learnt, Space VLBI ISSI-BJ Forum, Beijing, China.

3 October 2013 – R.-M. Bonnet: LESIA, l'Espace en Perspective, 50th Birthday Celebration of LESIA, Meudon Observatory, France.

4 October 2013 – R.-M. Bonnet: Mars, Mars the Next Frontier, 12th Algerian Festival in Popular Astronomy, Constantine, Algeria.

5 October 2013 – R.-M. Bonnet: 50 Années d'Exploration: Nouveaux Visages de l'Univers, Mars the Next Frontier, 12th Algerian Festival in Popular Astronomy, Constantine, Algeria.

9 October 2013 – A. Cazenave: Ocean from space, ETH, Zurich, Switzerland.

24 October 2013 – R.-M. Bonnet: André Lebeau, l'Ami, Post Mortem Célébration of André Lebeau, Institut Français d'Histoire de l'Espace, Paris, France.

8 November 2013 – M. Falanga: INTEGRAL and the millisecond X-ray pulsars; a love story since 10 years, ESA/ESTEC, RSSD seminar programme, Noordwijk, the Netherlands.

12 November 2013 – A. Cazenave: The climate of the Earth, COSPAR Symposium, Bangkok, Thailand.

18 November 2013 – M. Falanga: The fundamental INTEGRAL contributions to advance the millisecond X-ray pulsars research fields and ISSI-Beijing to facilitate international collaboration, Beijing University, Beijing, China.

21 November 2013 – R.-M. Bonnet: ISSI SPORT Forum 2010 Outcome, Introduction to the ISSI-BJ SPORT Forum, Beijing, China.

25 November 2013 – R.-M. Bonnet: Summary Conclusions, ISSI-BJ SPORT Forum, Beijing, China.

25 November 2013 – M. Falanga: General Relativistic Flux Modulation from Disk Instabilities in Sgr A* and ISSI-Beijing to facilitate international collaboration, National Astronomical Observatory, CAS, Beijing, China.

27 November 2013 – R.-M. Bonnet: International Cooperation in Space Research, Keynote Speech, NSSC, Beijing, China.

2 December 2013 – R. von Steiger: Das ISSI in Bern und seine Tätigkeiten, Talk at Kiwanis Club Bern, Switzerland.

9-13 December 2013 – R. von Steiger: Solar wind abundances from Ulysses SWICS, Fall Meeting of the AGU, San Francisco, USA.

6-10 January 2014 – A. Cazenave: The Earth observed from Space, series of lectures, Institut Français and Tunis University, Tunis, Tunisia.

16 January 2014 – M. Falanga: The fundamental INTEGRAL contributions to advance the millisecond X-ray pul-

sars research fields & ISSI-Beijing to facilitate international collaboration, IHEP, CAS, Beijing, China.

29 January 2014 – R.-M. Bonnet: Past and Future Climates, Astronomical, Solar and Anthropogenic Forcing Strategies for Future Space and Modeling Research, Variability in the Sun and Climate over the SORCE Mission, SORCE Science Meeting, Cocoa Beach, Florida, USA.

11 February 2014 – R. von Steiger: Vom Urknall bis heute – die Entstehung der Erde, Talk at Naturforschende Gesellschaft Bern, Switzerland.

4 March 2014 – R.-M. Bonnet: The exciting Jupiter System, Opening Speech, VSV Planetary Exploration Symposium, Delft Technical University, the Netherlands.

4 March 2014 – A. Cazenave: Sea level and climate change, French Academy of Sciences, Paris, France.

11 March 2014 – A. Cazenave: Sea level rise, Royal Swedish Academy of Sciences, Stockholm, Sweden.

18 March 2014 – A. Cazenave: The use of space observations for climate change studies, Seminaire de prospective scientifique, Centre National d'Etudes Spatiales, La Rochelle, France.

24-27 March 2014 – N. Champollion: Effect of Snow Surface Change on L-Band Observations at Dome C, Antarctica, Meeting presentation at MicroRad conference, Pasadena, California, USA.

30-31 March 2014 – R. von Steiger: Introduction to concerts of the Sinfonietta Basel, Stadtcasino Basel, Conversation with Curiosity, based on data from the Mars rover Curiosity, Dampfzentrale Bern, Switzerland.

10 April 2014 – N. Champollion: Snow surface evolution in Antarctica, Lecture for university students, Valence, France.

7 May 2014 – R.-M. Bonnet: Einstein Probe (in) Competition, Forum "Exploring the Dynamic X-Ray Universe", ISSI Beijing, China.

7 May 2014 – M. Calisto: Influence of a Carrington-like event on the atmospheric chemistry, temperature and dynamics: revised (Poster Presentation), 5th International HEPPA Workshop in conjunction with SPARC/SOLARIS-HEPPA, Baden-Baden, Germany.

8 May 2014 – R.-M. Bonnet: Playing with Earth Climate. How long will we Survive?, Bridge Coffee "Understanding Science", ISSI Beijing, China.

Meetings

8-12 July 2013 – M. Calisto: Davos Atmosphere and Cryosphere Assembling DACA-13, Davos, Switzerland.

16 July 2013 – R. Rodrigo: What can be learnt from Mars' Missions, National Space Science Centre, Beijing, China.

24-25 July 2013 – R.-M. Bonnet: Alpbach Summer School Jury, Austria.

9-25 September 2013 – R.-M. Bonnet: Visit to NSSC and attendance to the ISSI-BJ Space VLBI Forum, NSSC, Beijing, China.

9-13 September 2013 – A. Cazenave: ESA Living Planet Symposium 2013, Edinburgh, United Kingdom.

3 October 2013 – R.-M. Bonnet: LESIA 50th Anniversary, Meudon Observatory, France.

3-6 October 2013 – R.-M. Bonnet: 12th Algerian Festival in Popular Astronomy, Constantine, Algeria.

15-18 October 2013 – M. Falanga: Conference on "INTEGRAL's journey through the high energy sky", Rome, Italy.

16-18 October 2013 – R.-M. Bonnet: Association of Universities Inc., Board of Trustees, Albuquerque, NM, USA.

24 October 2013 – R.-M. Bonnet: Hommage to André Lebeau, IFHE, Paris, France.

5 November 2013 – R.-M. Bonnet: Alpbach Summer School 2014 Program Committee, Vienna, Austria.

11-15 November 2013 – A. Cazenave: Planetary Systems of our Sun and other Stars, and the Future of Space Astronomy, The 1st COSPAR Symposium, Bangkok, Thailand.

18-30 November 2013 – R.-M. Bonnet: NSSC Visit and Attendance to the ISSI-BJ SPORT Forum, Beijing, China.

9-13 December 2013 – A. Cazenave and R. von Steiger: AGU Fall Meeting, San Francisco, USA.

10 December 2013 – R.-M. Bonnet: ESA Solar Orbiter Contamination Review, ESTEC, the Netherlands.

9-10 January 2014 – R. Rodrigo: IAA Heads of Space Agencies Summit, Chairman of the Session: "Technical Factors: Enabling Technologies/Common Requirements", Washington DC, USA.

Beside the scientific activities, the ISSI cafeteria offers the oppurtunity to have an informal chat about all themes around science. Pictured are form left to right: Johannes Geiss (Honorary Director), Vittorio De Falco (ISSI PHD Student), and Rafael Rodrigo (Executive Director).

15 January 2014 – R.-M. Bonnet: Alpbach Summer School 2014 Program Committee, Vienna, Austria.

22 January 2014 – R.-M. Bonnet: First Editorial Meeting of "Our Space Environment", Swiss Space Office, Bern, Switzerland.

28-31 January 2014 – R.-M. Bonnet: 10th SORCE Science Meeting, Cocoa Beach, Florida, USA.

13-14 February 2014 – R.-M. Bonnet: Association of Universities Inc. Board of Trustees, Arlington, VA, USA.

26 February 2014 – R.-M. Bonnet: Comité de la Recherche Spatiale, Académie des Sciences, Paris, France.

3-4 March 2014 – R.-M. Bonnet: VSV Planetary Exploration Symposium, Technical University of Delft, Delft, the Netherlands.

7 March 2014 – R.-M. Bonnet: 10th Anniversary of Mars Express Launch, ESTEC, the Netherlands.

18 March 2014 – R.-M. Bonnet: Board of Trustees of Association Française d'Astronomie, Paris, France.

25 March - 6 April 2014 – R.-M. Bonnet: Visit to NSSC, Beijing, China.

7 April 2014 – R.-M. Bonnet: Board of Trustees of Association Française d'Astronomie, Paris, France.

27 April - 2 May 2014 – A. Cazenave: European Geosciences Union, General Assembly 2014, Vienna, Austria.

1-2 May 2014 – M. Falanga: Astronomy & Astrophysics Journal Board or Directors meeting, Helsinki, Finland.

5-9 May 2014 – M. Calisto: 5th International HEPPA Workshop in conjunction with SPARC/SOLARIS-HEPPA, Baden-Baden, Germany.

4-17 May 2014 – R.-M. Bonnet: Visit to NSSC, Beijing, China.

21 May 2014 – R.-M. Bonnet: Solar Orbiter Contamination Review, ESTEC, the Netherlands.

2 June 2014 – R. von Steiger: Editorial Committee of Space Science Reviews, New York, USA.

19-20 June 2014 – R.-M. Bonnet: Association of Universities Inc. Board of Trustees, Charlottesville, Virginia, USA.

30 June - 4 July 2014 – M. Falanga: Chair of a Session on "The European Week of Astronomy and Space Science (EWASS) 2014", Geneva, Switzerland.

Chairman- and Memberships

R.-M. Bonnet:
- Administrateur de l'Association Française d'Astronomie
- Vice-President of Institut Français d'Histoire de l'Espace
- Member of the Association of Universities Inc. Board of Trustees
- President of the Alpbach Summer School Jury 2014
- Expert and Consultant to the ESA Director General and the Director of Science and Robotic Exploration for the ESA ExoMars Mission and the Contamination control of the ESA Solar Orbiter
- Co-President of the ESA Solar Contamination Review of the Solar Orbiter Mission
- Senior Advisor to the NSSC Director General for ISSI-BJ matters

A. Cazenave:
- Scientific coordinator of the 'Sea Level' project (Phase 2) of ESA (European Space Agency) 'Climate Change Initiative'
- Member of Joint Science Committee of World Climate Research Program (WRCP)
- Invited editor of PNAS (Proceedings of the National Academy of sciences)
- Chair, scientific council of MeteoFrance

-Vice-chair 'Conseil Superieur des Programmes', French Ministry of Education
- Member 'Conseil d'Administration', Centre National de la Recherche Scientifique (CNRS)
- Member of the scientific council of the Ecole Polytechnique

M. Falanga:
- Member of the Astronomy & Astrophysics Journal Board of Directors & Executive Committee, Swiss representative since 2011
- 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
- Participation in the Swiss Scientific and Economic Mission to Beijing
- Co-Investigator of the Instrument "Giada" on 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

R.von Steiger:
- Review of an FP7 Space Research Project, Brussels, December 5, 2013
- Member of Editorial Committee of Space Science Reviews

J. Zarnecki:
- Elected to the Council, Institute of Physics, UK
- Appointed Chair of the European Space Agency's Solar System & Exploration Working Group
- Appointed member of European Space Agency's Space Science Advisory Committee
- Member of European Space Agency's Human Exploration and Science Advisory Committee
- Co-Investigator of the Instrument "Giada" on the ESA Mission Rosetta for the exploration of minor bodies in the Solar System

Honors

A. Cazenave:
- Elected foreign member of the Royal Academy of Belgium, June 2014

J. Zarnecki:
- Elected Foreign Member of the Polish Academy of Arts & Sciences, 2013
- Awarded Gold Medal of the Royal Astronomical Society, 2014

Miscellaneous

R. von Steiger – Visiting Research Scientist, University of Michigan, Ann Arbor, USA (6-17 January and 24 February - 7 March 2014)

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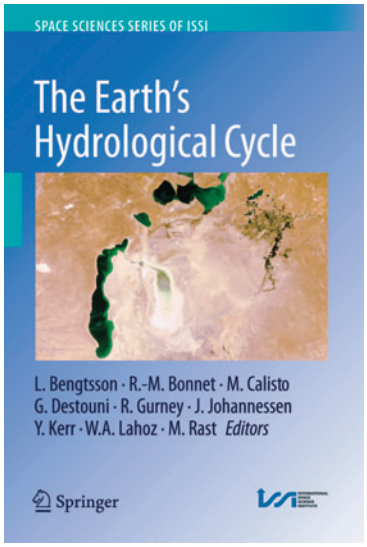

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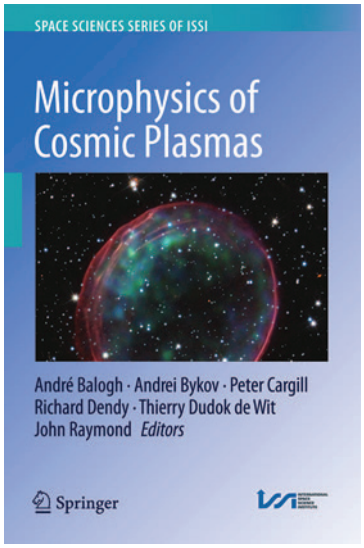

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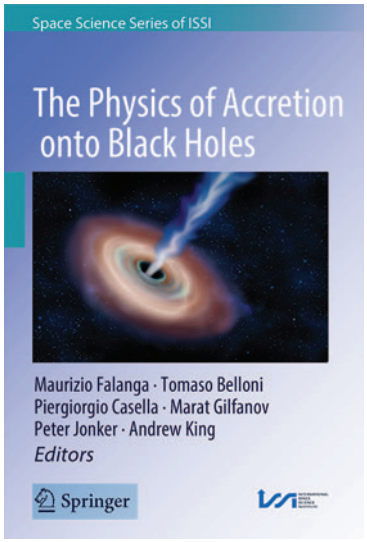

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