

2011
2012

Annual Report

Imprint

Publisher

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Printed by

Länggass Druck AG
Länggassstr. 65
3000 Bern 9
Switzerland

Cover Page

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

1. The Three Gorges Dam spans the Yangtze River in east-central China, and is the world's largest power station in terms of installed capacity, with its vast reservoir stretching for 660 km (NASA, GSFC, METI, ERSDAC, JAROS, and U.S./Japan ASTER Science Team).

2. The High Resolution Stereo Camera on ESA's Mars Express orbiter has obtained images of Hephaestus Fossae, a region on Mars dotted with craters and channel systems (ESA, DLR, FU Berlin (G. Neukum)).

3. This X-ray image shows a comet-like blob of gas about 5 million light-years long hurling through a distant galaxy cluster at nearly 1 000 kilometres per second (University of Maryland, Baltimore County (UMBC)).

4. Picture of the cosmic microwave background (CMB) radiation which thermal radiation filling the observable universe almost uniformly (WMAP Science Team, NASA).

5. The map of the surface of an exoplanet, or a planet beyond our solar system. The map, which shows temperature variations across the cloudy tops of a gas giant called HD 189733b, is made from infrared data taken by NASA's Spitzer Space Telescope (NASA, JPL Caltech, H. Knutson (Harvard-Smithsonian CfA)).

6. Snapshot from a computer simulation of the formation of large-scale structures in the Universe, showing a patch of 100 million light-years and the resulting coherent motions of galaxies flowing towards the highest mass concentration in the centre (K. Dolag and equipment VIMOS-VLT Deep Survey).

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 of 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.

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From the Chairman of the Board of Trustees

The Board of Trustees of the Foundation "International Space Science Institute" is – among other things – responsible for the strategy of the institute. Usually, during the twice-yearly routine sessions of the Board, there is no time for reflection on the long-term development or on possible future threats or opportunities. Living in "interesting times" it would be foolhardy to live a day-to-day life. That is why I asked the members of the Board to donate two additional days to ISSI for a "Séance de Réflexion". I am thankful that they complied and we gathered for an extended session in a quiet place in the outskirts of Bern on the 22nd and 23rd of September, 2011. This session has become known as the "Rütthubelbad-Session".

The afternoon of the first day was dedicated to a brainstorming session. Any idea, any input was welcome, the more innovative, original, even outlandish, the better. After dinner, we gathered again for what I called a "cold shower" meeting. The Directorate and the Science Committee gave us an overview of the constraints that the real world imposes upon us thereby limiting the creativity of the imaginable. After sleeping over the dichotomies of the two sessions, we tried to come to conclusions the next morning.

It is hardly a surprise that no radical changes were decided. An extension of the growth curve by relocating the Institute into more spacious premises and seeking additional funds was rejected. The "small is beautiful" concept should continue to prevail. The Science Committee pledged to stabilize the demand on the ISSI infrastructure by restricting the size of Teams and by raising the standards of excellence even more. Any growth should be considered only in an opportunistic way, that is to say, when promising opportunities arise that are self-financing.

Such an opportunity presented itself a few months later: Professor Wu Ji, the Director General of the National Space Science Centre of the Chinese Academy of Science came to Bern and proposed a collaboration between our two institutions. In February of 2012 the Chairman of the Board and the Executive Director travelled to Beijing in order to negotiate the details of the said cooperation. The result was a Memorandum of Understanding signed by both parties. We hope that at least partial financing to support this initiative will come from the Swiss Government.

During the coming business year, the term of our Executive Director Roger-Maurice Bonnet will end after 10 years. It will be my pleasure to describe the many achievements of Prof. Bonnet during his tenure in my next report. Today, I am pleased to announce that the Board has chosen a successor to Prof. Bonnet in the person of Professor Rafael Rodrigo. Born in Granada, Spain in 1953, Rafael Rodrigo graduated in Mathematics and obtained a PhD in Physics from the University of Granada. His scientific career began at the Institute of Astrophysics of Andalusia, of which he was Director until 2004. Rodrigo served on a number of high-level international committees particularly for the European Space Agency, where his expertise in Planetology was appreciated. Besides, he has worked with a number of research Institutions in several countries including Switzerland. During the last four years he served as President of the Spanish Research Council, the "Consejo Superior de Investigaciones Científicas". We wish him success and personal fulfillment in his new assignment.

For the Board of Trustees



Simon Aegerter

Wollerau, July 30, 2012

Over its past 17 years of existence, ISSI has constantly progressed. It has attracted more and more members of the international space research community: the number of ISSI visitors, from 46 different countries, totals a yearly figure of some 800, of which 40% are new. Indisputably, ISSI is a well-known element of the international space research landscape. As already discussed in last year's report, that growth presents a delicate challenge: Can ISSI continue growing, to what limit, and by what means? How can it avoid creating frustration among its users if it does not offer any perspective for absorbing the demand for growth? The ISSI Board in the course of a dedicated "Séance de Réflexion" addressed these questions on 22 and 23 September 2011, and concluded that ISSI should retain its "small and beautiful" characteristics while at the same time adopting the necessary measures for ensuring progress within these fixed limits.

Responding to that challenge has occupied a substantial amount of time for the ISSI Directorate. The preparation of the ISSI strategy and work plan in support of the request presented to the State Secretary for Education and Research of the Swiss government, for the period 2013-2016, has offered a unique opportunity to define ways and identify measures that would allow ISSI to continue to play its unique role. The most obvious measure is of course to raise the quality standards and the efficiency of all ISSI activities, involving more scientists and selecting more International teams and workshops within the same resources. That measure was implemented with spectacular success in the selection of International teams by the ISSI Science Committee at its 6-8 June 2012 meeting, which approved a record number of 33 teams qualified as excellent or very good, out of a total of 63 proposals. That was made possible by imposing a strict limit to the number of team participants and to the duration of their work. A similar approach would also apply to workshops, working groups and forums. The future strategy should of course continue adapting ISSI to the evolution of space research in Astronomy, Planetary and Earth sciences. The Forum approach whereby a group of selected scientists analyzes and assesses the situation of a given discipline has proven to be very efficient in that respect and has produced excellent ideas for future workshops, working groups and teams. It does offer the possibility of a direct involvement of the scientific community in the definition of the ISSI scientific program.


In the past year, the relationships with ESA have developed very positively as demonstrated by the ongoing discussions leading to the involvement of ISSI in assisting the ESA Director General Advisory Committee for Science Policy (HISPAC), in particular the fostering of internal scientific cross-disciplinarity between ESA programs, through the organization of multidisciplinary forums and workshops or working groups. As to what concerns the Earth sciences program, the present contract with ESA is approaching its end in 2013 and discussions are in progress with the ESA Director of Earth Observation (D/EOP) for ensuring the continuation of that important and very successful part of ISSI's program. This year has also been devoted to the preparation of the request for the next three years funding of the ISSI core program from the Directorate of Science and Robotic Exploration (D/SRE).

Capitalizing on the assets ISSI represents for space research organizations and institutes is an element of ISSI's future strategy. ISSI offers its help to the Swiss State Secretariat for Education and Research, for the implementation of their national and international space policy. ISSI also intends improving the coordination of its activities with the University of Bern. The joint meetings regularly organized between ISSI, the newly created Center for Space and Habitability and Oeschger Center for Climate Change Research, respectively involved in exoplanets and climate science, offer a clear demonstration of that policy.

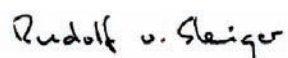
From the Directors

Meanwhile, the international reputation of ISSI remains strong. ISSI's books published by Springer in the ISSI Space Science Series as well as in Space Science reviews and in the Surveys in Geophysics are recognized as reference books with high impact factors. The Russian Academy of Sciences is offering both financial and scientific support to ISSI activities, and in February 2012, a Memorandum of Understanding has been signed between the ISSI Board and the Chinese Academy of Sciences, as detailed further down in this report, that should result in an association between ISSI and the Chinese National Space Science Center (NSSC) in Beijing. Discussions are also underway to associate ISSI with research centers and universities, in Japan and the United States.

In that context, ISSI is facing a time of delicate transitions. It enters financial negotiations with the Swiss Space Office and with ESA for the continuation of its program and at the same time three of its directors will be replaced in the course of six months. The Science Committee has expressed concerns to the Board. Indeed, as demonstrated here, the Committee has continued to show its extraordinary dedication to ISSI, ensuring the highest scientific level to ISSI's activities. This year was the last for Professor Johan Bleeker who has chaired the Committee since 2008. His leadership and sense of equity and scientific quality has been a tremendous asset for ISSI. We express our warmest acknowledgements for his help and contribution to the ISSI program. Professor Tilman Spohn from Germany succeeds him.



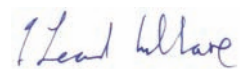
Roger-Maurice Bonnet



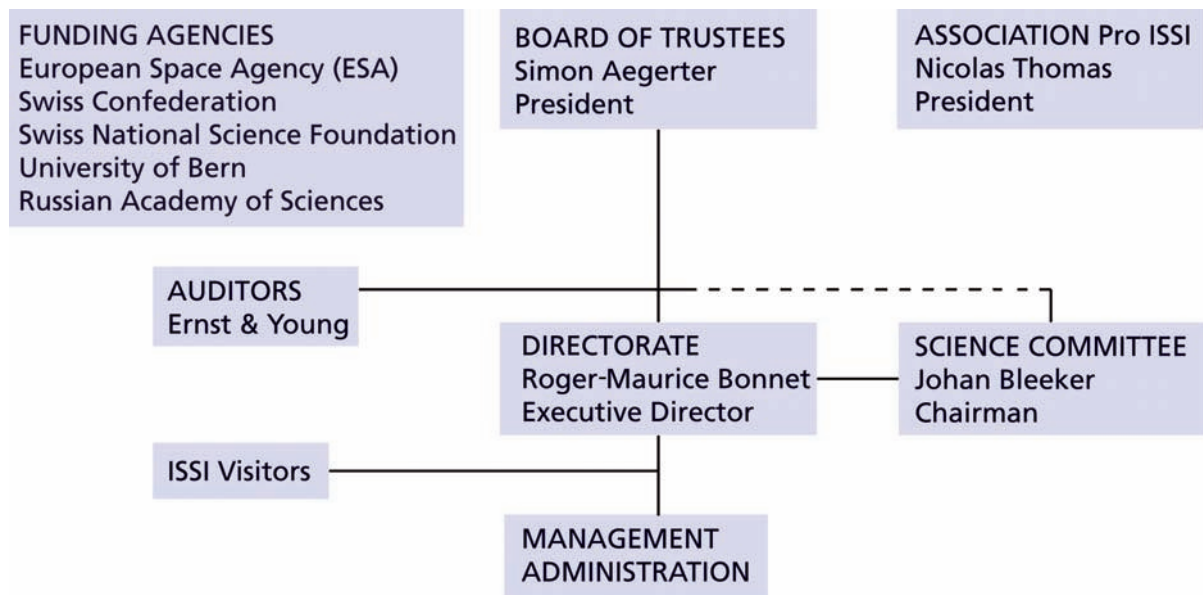
Rudolf von Steiger



Lennart Bengtsson



Len Culhane



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 is supporting ISSI with an annual financial contribution. Details can be found on page 12. ISSI received tax-exempt status from the Canton of Bern in May 1995.

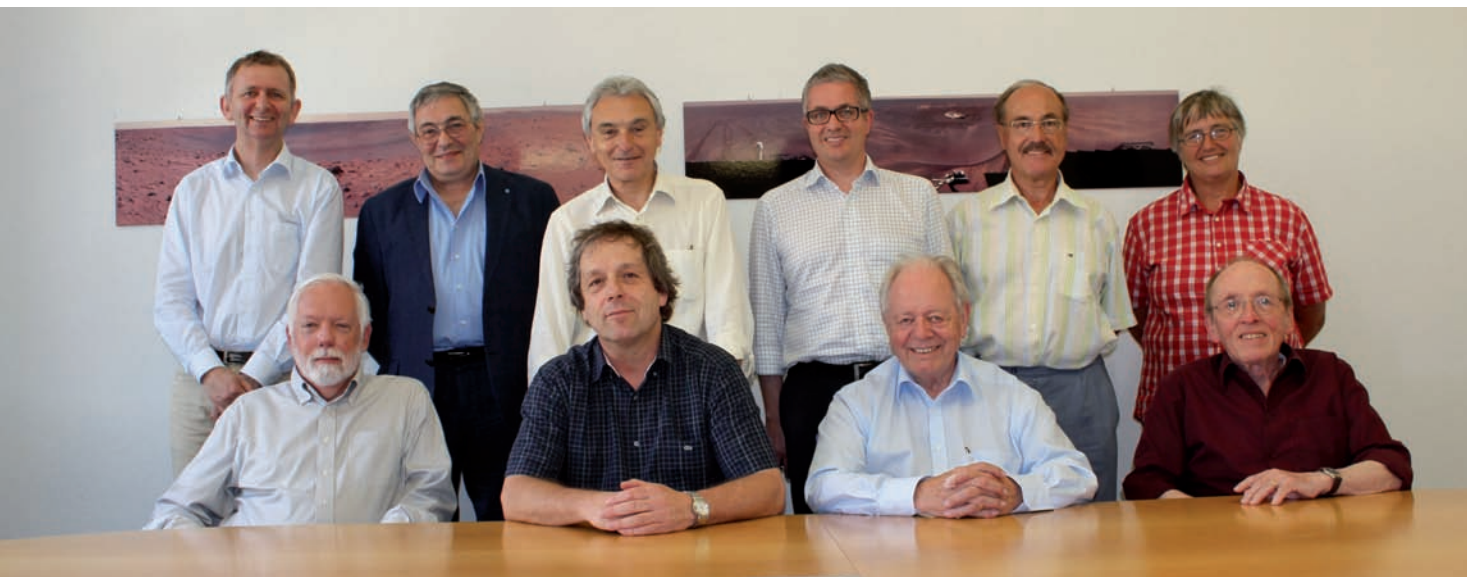
ISSI's Board of Trustees oversees the work accomplished at the Institute, exerts financial control, and appoints the Directors and members of the Science Committee. It consists of representatives of the Founder, and of the funding Institutions. Furthermore the Board of Trustees may nominate up to five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

The Science Committee, chaired by Johan Bleeker, 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 Roger-Maurice Bonnet (Executive Director), Rudolf von Steiger (University of Bern), Lennart Bengtsson (MPI for Meteorology, Germany) and Len Culhane (University College London, UK).

The Association Pro ISSI, founded in spring 1994, counts about 140 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:

Lennard A. Fisk, University of Michigan, Ann Arbor, USA
Vice Chairman: Willy Benz, University of Bern, Switzerland
Chairman: Simon Aegerter, the Cogito Foundation, Wollerau, Switzerland
Hans Balsiger, University of Bern, Switzerland

back row from left to right:

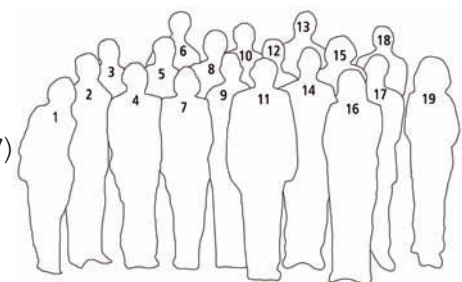
Nicolas Thomas, President of the Pro ISSI Association, Bern, Switzerland
Lev M. Zelenyi, Russian Academy of Sciences, Moscow, Russia
Sergio Volonté, Former Head of the Planning and Coordination Office in the Science and Robotic Exploration Directorate, ESA, Paris, France (retired)
Daniel Fürst, RUAG, Zurich, Switzerland
André Maeder, Observatoire de Genève Sauverny, Switzerland
Secretary of the Board: Kathrin Altwegg, University of Bern, Switzerland

missing on the picture:

Alvaro Giménez, ESA, Paris, France
Rosine Lallement, Observatoire de Paris-Meudon, France
Daniel Neuenschwander, Swiss Space Office, Bern, Switzerland
Risto Pellinen, Finnish Meteorological Institute, Helsinki, Finland



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- Tilman Spohn, German Aerospace Center (DLR), Berlin, Germany (8)
- Götz Paschmann, MPI Garching, Germany (9)*
- Georges Meylan, École Polytechnique Fédérale de Lausanne, Switzerland (10)
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- Hugh Hudson, Space Sciences Laboratory, University of California, USA (18)
- Joanna D. Haigh, Imperial College London, United Kingdom (19)



* Membership ended on 30 June 2012

The ISSI Staff



front row from left to the right:

Johannes Geiss, Honorary Director

Len Culhane, Director

Roger-Maurice Bonnet, Executive Director

Lennart Bengtsson, Director

Rudolf von Steiger, Director

back row from left to the right:

Andrea Fischer, Editorial Assistant

Marco Calisto, Post Doctoral Scientist

Saliba F. Saliba, Computer Engineer and System Administrator

Maurizio Falanga, Science Program Manager

Jennifer Zaugg, Secretary

Silvia Wenger, Assistant to the Executive Director

Irmela Schweizer, Librarian

Michel Blanc, Discipline Scientist

Pia Zacharias, Post Doctoral Scientist



Hermann Opgenoorth
Discipline Scientist

All lists show the status at the end of the seventeenth business year on 30 June 2012.



A panorama picture of ISSI's meeting point.

The ISSI facilities offer an area of 700 m² 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 (wireless included), 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 17th business year saw a major change on the server's side. ISSI bought a powerful Linux server which replaces two old servers (Windows & Linux). The new server is responsible for the following tasks: 1) Domain controller, 2) File sharing, 3) web server, 4) DHCP server. Another major addition to ISSI's infrastructure was the installation of a fixed projector on the ceiling in the conference room.

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 11.10 server)
- Seven Windows workstations five of which run Windows 7
- Seven Mac workstations running Mac OS 10.6 and 10.7
- Ten laptops (three Windows and seven Macs)
- Six printers, three of which in color
- Five projectors (four fixed on the ceiling and a mobile one)
- Two wireless access points
- One digital video camera, one still camera, three scanners

ISSI's software packages are regularly updated. These software packages provide access to the large scientific packages (such as IDL, Matlab, Grapher, Arc-View 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 us on Twitter @ISSIBern.

Financial Overview

The seventeenth financial year of ISSI ended with a surplus of 491'783.41 CHF. This unprecedented result is largely due to an unexpected extraordinary income from a currency compensation fund established by the Swiss Federal Council in the Fall of 2011 to alleviate the impact of the declining Euro. The positive result was increased further by dissolved accruals from earlier International Teams that have completed their activities under budget.

The other lines on the revenue side were all as budgeted, which is simply due to the fact that the exchange rate of the Euro has been almost constant at the budgeted value. The contributions from ESA Science, Switzerland, and Russia were similar to the previous year while the one from the ESA Earth Observation Programme has been significantly increased after successful negotiation of a new contract change notice.

On the expense side both the costs for salaries and for Workshops etc. were under budget, which is still the consequence of our "stepping on the brakes" due to the dwindling Euro. The resulting surplus will be used over the forthcoming years primarily for selecting more Teams (like the unprecedented 33 Teams selected in 2012, see p. 30) and perhaps also increasing the number of post-docs back to three.

It is important to note that ISSI also receives indirect contributions that do not appear in the table above. 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.

Operating Revenues in CHF for the 17th Business Year (1.7.2011-30.6.2012)

ESA Science Directorate	1'457'000.00
ESA Earth Observation Programme	425'160.00
Swiss Confederation	930'000.00
Russian Academy of Sciences	75'000.00
Other income ³	270'138.89

Operating Expenses in CHF for the 17th Business Year (1.7.2011-30.6.2012)

Salaries and related Costs ¹	1'226'018.26
Fixed Costs	278'224.55
Operating Costs ²	249'211.32
Investment (depreciated)	14'218.10
Workshops, Working Groups, Teams, Visiting Scientists (ISSI funded) ⁴	897'843.25
Result of the Year	491'783.41

Subtotal	3'157'298.89	3'157'298.89
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Swiss National Science Foundation (SNF)

Workshops, Working Groups, Teams, Visiting Scientists (SNF funded)	155'464.20
Grant from SNF ⁵	155'464.20

Total	3'312'763.09	3'312'763.09
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Audited by Ernst & Young, Bern

Audited by SNF

Remarks:

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

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

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

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

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

The 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 of about 140 members, meets once per year for its general assembly.

Pro ISSI Activities and the SPATIUM Series

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

The General Assembly was held on 8 November 2011 followed by a lecture by Tilman Spohn, German Aerospace Centre (DLR), Berlin, with the title: "Planets and Life". The speaker addressed the complex preconditions that a planet must fulfill to allow life to emerge.

On 22 March 2012, Georges Meylan, École Polytechnique Fédérale de Lausanne, (EPFL) gave a lecture entitled "Mirages in the Universe". Gravitational lensing creates mirages in the universe as a direct consequence of Einstein's theory of General Relativity. This phenomenon provides scientists with a powerful tool to study a variety of astrophysical questions.

On 16 May 2012 Reiner Rummel, Technische Universität München, lectured on "The Earth's Gravitational Field". Thanks to space-based instrumentation, our planet's gravitational field is well-known today revealing valuable information about its deep interior.

During the reporting period, three issues of Spatium have appeared: SPATIUM no. 27 was published in August 2011. It is entitled "Science First!" and honors ISSI's intellectual father and co-founder Johannes Geiss on the occasion of his 85th anniversary.



Impression of the Pro ISSI talk on "Leben und die Entwicklung der Planeten" by Tilman Spohn, German Aerospace Center, Germany. Tilman Spohn is member of the ISSI Science Committee.



Covers of the SPATIUM No. 27 to 29 published in the 17th ISSI Business Year.

SPATIUM no. 28, published in December 2011, provides a summary of Maurizio Falanga's Pro ISSI presentation on "How Black Are Black Holes?", while in March 2012 SPATIUM 29 appeared presenting a report on Peter Wurz's talk (see last year's annual report) on "Mysterious Mercury".

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

Scientific Activities: The 17th Year

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 17th business year a total of 648 international scientists participated in the scientific activities of ISSI:

Workshops consist of up to 50 invited scientists exchange 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 17th year two Workshops were organized, which summaries can be found on the following pages.

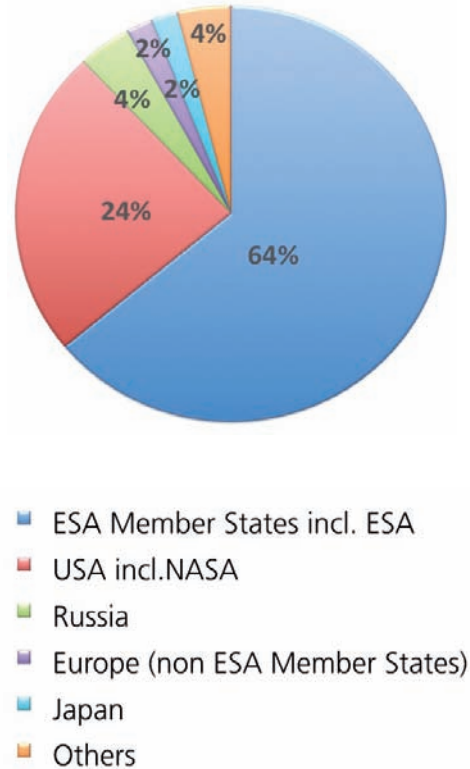
Working Groups have a smaller number of members and meet repeatedly as necessary to achieve the assigned objective. The results of the Working Groups activities are in general published as titles of ISSI Scientific Report Series by the publishing company Springer. In the course of the year no Working Groups meetings took place.

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 54 Team meetings took place in the 17th business year. Details can be found from page 21 on.

A **Forum** is an informal and free debate consisting of some 25 high-level participants on questions of political and scientific nature for about two days. A Forum does not necessarily lead to formal recommendations or decisions. In the 17th business year one Forum was held.

Visiting Scientists spend variable periods of scientific activity at ISSI. 8 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. 97 young scientists participated in the ISSI activities in the course of the 17th year.



Pie chart showing the ISSI visitors countries of origin. A total of 648 scientists worked during the seventeenth ISSI business year, 238 of them were for the first time at ISSI.

How to use ISSI tools

As a general rule participation in ISSI's activities is by invitation only. The financial support for the 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 one page maximum. The ISSI Science Committee will evaluate these suggestions and the ISSI Directorate will take a final decision.

Forums are informal and free 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. They are generally held once a year for two days.

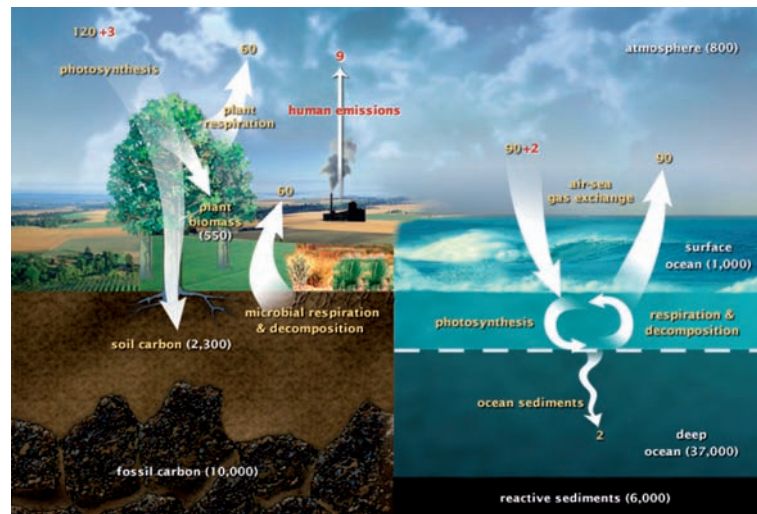
Assessing Requirements for a Carbon Model Reference Validation Framework

10-11 January 2012

Within the ISSI ESRIN Earth Science work plan for 2011 this Forum was organized to discuss the impact of the CO₂ cycle on climate change. The global carbon cycle plays a central role in regulating atmospheric carbon dioxide levels and thus Earth's climate.

The Forum offered 18 expert scientists the opportunity to consolidate current scientific knowledge in an open discussion and to address a number of significant concerns regarding future climate projection, including the poor methods of quantification for feedbacks between global climate and the carbon cycle. This is in part due to the limited understanding of the uptake of carbon through photosynthesis and the emission through respiration. These key processes might change in a future climate, but how and at what rate is uncertain. Progress in this area can only be achieved by improved process understanding, and constantly improving and validating models at the appropriate scale. The aim of the Forum was primarily to contribute to that progress by taking stock of our current understanding and monitoring capability and how this understanding could be incorporated into sophisticated carbon assimilation models.

The main topics discussed during the two days primarily concerned the modeling of the CO₂ cycle as well as observational studies. It was remarked that satellite data can help validating carbon models and it was further explained that there is a demand for a combined, simultaneous data assimilation framework of all available, important satellite and ground-based measurements into carbon models. It was also discussed that CO₂ measurements are challenging



This diagram of the fast carbon cycle shows the movement of carbon between land, atmosphere, and oceans. Yellow numbers are natural fluxes, and red are human contributions in gigatons of carbon per year. White numbers indicate stored carbon. (Image Credit: Diagram adapted from U.S. DOE, Biological and Environmental Research Information System, US Government work, public domain)

because they simultaneously carry the footprint of global surface fluxes, atmospheric chemistry and past CO₂ and that they have a relatively small variability which makes it challenging to measure in particular with remote sensing methods.

The Forum concluded with the recommendation to closely work together with weather forecasting and atmospheric modeling. Because the dynamics of the atmosphere is still a task that needs to be solved in transport models and in order to have longer time series of data, the data from earlier times should be digitized.

A follow-on of the Forum is foreseen in a working group organized by two of the Forum participants.

Workshops

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.

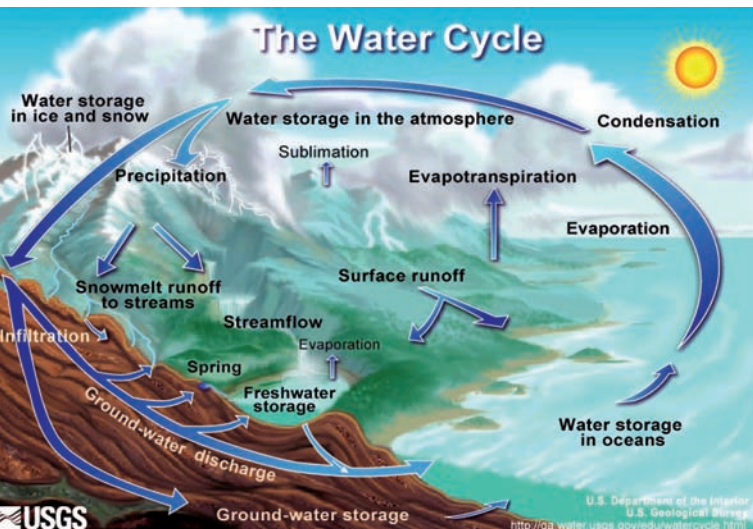
The Earth's Hydrological Cycle

6-10 February 2012

The Earth's hydrological cycle is a key component of the Earth's climate. The challenge for Earth Observation is to gather information to help understand what happens to water under global change and the impact that this change has on society. The workshop addressed this challenge by bringing together 30 world-recognized experts on various aspects of the hydrological cycle, including Earth Observation and models and their integration.

The Workshop provided information about the different important processes which led to a discussion of the importance of both modeling and experimental studies. Together, these fields can help understand the hydrological cycle of the Earth. Among the topics discussed were the implementation of the different ways how experimental data can help improve models, which then, in turn, can give more realistic results. Another topic was the regional aspect of the hydrological cycle, i.e. monsoon in India or changes in the Arctic. The next topic dealt with the key gaps in the present knowledge. During this session, the scientists discussed the limitations and the potential of regional climate models, the problem of retrieving data in remote regions to better check with models and the perspectives in modeling climate – hydrology interactions.

Currently a volume of the Space Science Series of ISSI is in preparation which will contain contributions from most of the participants. These articles will also be published as well in Surveys in Geophysics. The Workshop was convened by (in alphabetical order) Lennart Bengtsson, Roger-Maurice Bonnet, Georgia Destouni, Robert Gurney, Johnny Johannessen, Niklaus Kaempfer, Yann Kerr, William Lahoz and Michael Rast.



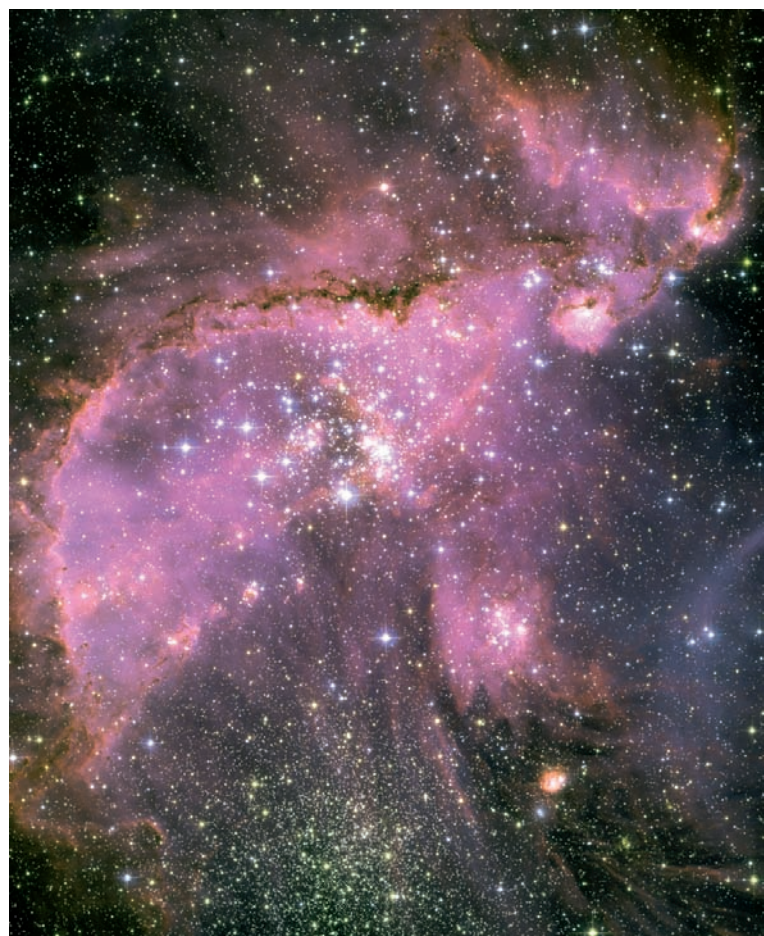
The water cycle, also known as the hydrological cycle or H₂O cycle, describes the continuous movement of water on, above and below the surface of the Earth. Although the balance of water on Earth remains fairly constant over time, individual water molecules can come and go, in and out of the atmosphere. The water moves from one reservoir to another, such as from river to ocean, or from the ocean to the atmosphere, by the physical processes of evaporation, condensation, precipitation, infiltration, runoff, and subsurface flow. (Image Credit: United States Geological Survey (USGS))

Microphysics of Cosmic Plasmas

16-20 April 2012

This was the second in the series of Workshops organized by ISSI on the theme of cosmic plasmas. The Workshop addressed the range of physical processes that underlie the observed large-scale properties, structures and dynamics of cosmic plasmas, the matter that fills interplanetary, interstellar and intergalactic space, as well as the solar atmosphere and the Earth's magnetosphere. Conveners for the Workshop were André Balogh, Andrei Bykov, Peter Cargill, Richard Dendy, Thierry Dudok de Wit and John C. Raymond. Reviews presented in the Workshop reviewed the status of understanding of microscale processes in all astrophysical collisionless plasmas. As a new departure for space plasma research, the Workshop also considered the lessons that can be learned from the extensive existing knowledge of laboratory plasmas. The Workshop's sessions covered turbulence as a phenomenological description of the properties of plasmas on all scales; a review and assessment of microprocesses (transport and instabilities) in plasmas on all scales; the latest developments in the study of magnetic reconnection, as one of the most important drivers of plasma dynamics; shock waves on all scales in cosmic plasmas; and both laboratory and astrophysical techniques of plasma description. The Workshop concluded by four summaries, given by world-leading authorities, of the different topics of the Workshop. On Wednesday 18 April, 2012 a number of participants paid a very successful visit to the Plasma Physics Research Center (CRPP), École Polytechnique Fédérale de Lausanne.

There were 38 participants in the Workshop and, in addition, four young scientists also participated within the framework of ISSI's special program. The book on the "Microphysics of Cosmic Plasmas" 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 21 substantial, multi-authored reviews of the topics covered in the Workshop.



One of the most dynamic and intricately detailed star-forming regions in space, located 210,000 light-years away in the Small Magellanic Cloud (SMC) in which young stars sculpt space with powerful outflows. (Image Credit: Hubble Space Telescope, NASA/ESA)

Forthcoming Workshops

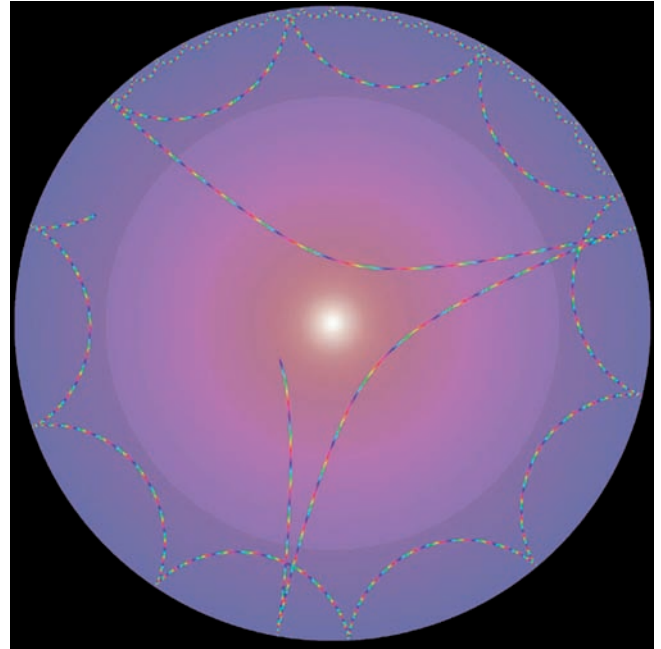
Helioseismology and Dynamics of the Solar Interior

Given the large and increasing volume of data that is available from space- and ground-based helioseismology investigations, it was judged timely to review in depth what has been achieved in solar observations, to discuss the techniques employed and to chart a course for the future of the helioseismic study of the solar interior. Following a summary of achievements in the subject to date our current understanding of the solar interior – abundances, structure, dynamics, rotation and convection – will be examined and assessed. The state of our knowledge of solar magnetism generation and its role in the Sun's cyclic behavior will be reviewed and the related issue of the sub-photosphere to solar atmosphere connection will also be discussed. The importance of long-term synoptic observations will be stressed. Observation and data analysis have a complex nature but a critical impact on progress in this field. Computational helioseismology will be discussed and the development of new data analysis and assimilation techniques evaluated. The development of new observational techniques will also be discussed while planned missions and future mission concepts will be presented. While the main aim of the present Workshop is to comprehensively review the status of helioseismology, its relationship to asteroseismology – an area of growing importance – will be examined. The Workshop will be held from 24th to 28th September, 2012.

The Physics of Accretion onto Black Holes

Accreting black holes are ideal laboratories for studying both physical properties of accretion onto compact objects and effects of General Relativity in the strong field regime. These are extreme phenomena, which are inaccessible from laboratory experiments. Since the first discovery of accreting X-ray binaries (XRB), our knowledge has advanced significantly, opening the possibility of using these systems as laboratories for fundamental physics.

The Workshop is designed to review in depth what has been achieved in the research on accretion on all scales, from galactic binaries to intermediate mass black holes to super-massive AGN, and discuss possible future directions. The main goal of the Workshop is to discuss the state of the art of the research



Internal solar oscillations comprise a large number of sound wave modes that can be detected by precision measurements of Doppler velocity at the solar surface. Their frequencies depend on conditions in the resonant cavities in which the waves propagate. Sample propagation paths are shown schematically in the figure. Careful measurements of oscillation frequencies for many modes allow evaluation of properties such as temperature, composition and motions throughout the solar interior. (Image Credit: National Optical Astronomy Observatories)

on black hole accretion and will cover the following main themes:

1. Introduction (Historical perspective)
2. Physical models for the accretion flow around black holes of all masses
3. Accretion on black holes from stellar mass to supermassive
4. Black hole fundamental parameters
5. Accretion jets outflows
6. Overview and outlook.

The Workshop will take place from 8 to 12 October 2012.

Giant Planet Magnetodiscs and Aurorae – EUROPLANET Workshop

Magnetodiscs are large current sheets surrounding Jupiter and Saturn that are filled with plasma principally originating in the natural satellites. They are also solar system analogues for astrophysical discs. Magnetodiscs are special features of the fast rotating

giant planets, a special feature of rotationally driven magnetospheres. They are driven by variability in their plasma sources and by the solar wind. Auroral signatures in the optical and radio allow a diagnostic of these dynamical processes and enable the visualization of these large plasma and field structures. The objective of this Workshop is to address outstanding issues in the structure and dynamics of magnetodiscs using a comparative approach:

- Review current understanding of magnetodiscs and auroral responses to magnetodisc dynamics.
- Characterize and understand radial plasma transport in magnetodiscs.
- Determine how magnetic reconnection works in magnetodiscs, what are the effects on plasma transport, and what are the associated auroral responses to magnetic reconnection.
- Characterize how the solar wind influences magnetodiscs and the auroral responses to solar wind-driven dynamics.
- Characterize the spectral and spatial properties of auroral emissions produced by magnetodisc dynamics – are there significant differences between solar wind- and internally-driven dynamics?
- Determine the sources of local-time asymmetries in magnetodiscs.

This Workshop will be the fourth held at ISSI in the framework of the Europlanet RI. The Europlanet Research Infrastructure is the four-year follow-on project to EuroPlaNet, a four-year Coordination Action supported by the European Union. The Workshop will be held from 26 to 30 November 2012.

Multi-scale Structure Formation and Dynamics in Cosmic Plasmas

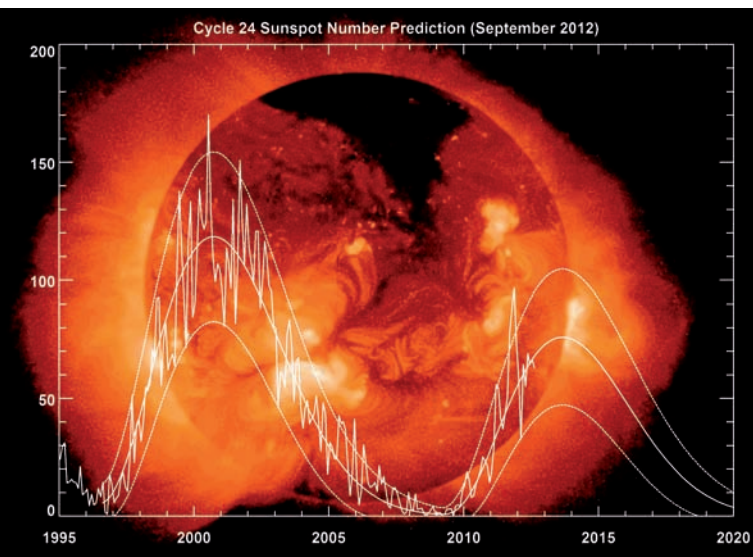
The Workshop will be the third in the series of Workshops organized by ISSI on the theme of cosmic plasmas. The initiative for the series has come from discussions held in an ISSI Forum in March 2009 on the future of magnetospheric research, with the general objective of broadening the topics covered by space plasma physics to all scales in the Universe. A great challenge of modern astrophysics is to understand the physics of structure formation at very different scales from planetary magnetospheres to the largest scale structures of the universe. Structure formation is always a highly non-linear process in-



This Hubble image shows the most detailed view so far of the entire Crab Nebula ever made. The Crab is arguably the single most interesting object, as well as one of the most studied, in all of astronomy. (Image Credit: NASA/ESA/JPL/Arizona State University)

volving energy transfers between different constituents of cosmic matter and fields. Nonlinear plasma processes play a key role in many models of cosmic structure formation and their dynamics on a very broad range of scales. The Workshop will review observations of structure formation and dynamics on all scales: in situ and remotely from space, and also ground-based, from the magnetosphere to cosmological scales. A detailed assessment will be made of the physical processes underlying the formation of structures in these different physical environments. Special attention will be paid to the interaction between scales and similarities in the processes that shape the structures on the different scales. It will cover the theory and modeling of the physical processes that lead to the amazing variety and non-trivial dynamics of structures in cosmic plasmas. The Workshop will take place from 15 to 19 April 2013.

Forthcoming Forums



Sunspot number observations are plotted against time from the end of 1995 to September 2012. The range of predicted values for cycle 24 is also indicated. The plot is superimposed on an X-ray image of the solar corona which shows the high temperature plasma contained in magnetic structures and a large polar coronal hole. (Image Credit: David Hathaway, NASA, MSFC)

Solar Activity and the Solar Cycle

ISSI will organize a Forum on Future Developments and Applications in the field of Solar Activity and Solar Cycle studies. Recently several highly significant Space missions have been dedicated to studies of the Sun, near-Earth environment and Heliosphere. Solar magnetic activity and its cyclic nature have emerged as key common factors in all of these areas. Experts in solar physics, heliospheric physics and the sun-earth interaction will assess what we understand about the physics of the cycle, the related phenomena of magnetic flux emergence and the formation and evolution of active regions. The phenomenon of stellar cyclic behavior will also be discussed. Beyond the Sun in interplanetary space, emerging magnetic flux controls solar wind formation and causes energetic events e.g. CMEs, Flares. Our understanding of the role of these phenomena in forming the Heliosphere, their interactions with the magnetic environment of Earth and their influence on Earth climate will also be assessed. The future development of the field will be examined. It is anticipated that a community discussion of this broad but interconnected range of topics will lead to the suggestion of several linked themes for future workshops. The Forum will take place on 20th and 21st November, 2012.

Future Science of Exoplanets and their Systems

The Forum on the "Future Science of Exoplanets and their Systems" is jointly organized and sponsored by ISSI and the Europlanet Research Infrastructure Network, as well as coordinated with the Center for Space and Habitability of the University of Bern. The main aims are related to debates and discussions on how one can represent observed and modeled planetary properties in the most useful and efficient way. By dealing within a multiparameter space, the most relevant observables which can be described with a minimum of complexity to understand planetary evolution should be debated and identified. The discussions will address open or not well understood scientific questions such as: What is driving planetary evolution? What is the relevance of planet formation and a system's impact history to the evolution of Earth-like habitats and planets in general? Is there a typical architecture of planets? What were the lessons learned since the early times of solar system research until today when better data become available? What can be used from these approaches with today's knowledge and theory? Because these questions are strongly connected and linked to important environments such as disk properties, the radiation and plasma outflow of a planet's host star, systems in binaries or clusters, etc., discussions on the most important environmental aspects related to available, or data which will be gathered during the near future, will be carried out.

The outcome of this two-day ISSI Forum should also be a written report, which will be finalized and published after the meeting. The debates and discussions between observers and theoreticians from astronomy, astrophysics, and planetary science will stimulate ideas and recommendations to the interested scientific community but may also lead to suggestions of several themes for future ISSI Workshops. The conveners of the Forum are Michel Blanc, Helmut Lammer, Willy Benz, Stephane Udry, Vincent Coudé du Foresto, Manuel Güdel, Heike Rauer, Malcolm Fridlund and Maurizio Falanga. The Forum will be held on December 5 and 6, 2012.

Listed are Teams that had a meeting at ISSI in the period of the 17th business year. A rationale is given only for the new selected teams for the others see the previous Annual Reports.

Teams selected in 2009

Comparative Study of Induced Magnetospheres

Team leader: Cesar Bertucci, Institute for Astronomy and Space Physics - IAFE, Ciudad Universitaria, Buenos Aires, Argentina
Session: 7-11 November 2011

Space-Borne Monitoring of Polar Sea Ice and Monitoring of Antarctic Sea Ice during IPY

Team leader: Petra Heil, AAd & ACE CRC, Australia
Session: 29 May - 1 June 2012

MOlecules and DUst at LOw metallicity: MODULO

Team leader: Leslie K. Hunt, INAF-Osservatorio di Arcetri, Firenze, Italy
Session: 16-18 January 2012

Theory and Model for the New Generation of the Lunar Laser Ranging Data

Team leader: Sergei Kopeikin, University of Missouri-Columbia, USA
Session: 22-23 March 2012

Solar Prominence Formation and Equilibrium: New Data, New Models

Team leader: Nicolas Labrosse, University of Glasgow, UK
Session: 5-8 September 2011

Land Data Assimilation: Making Sense of Hydrological Cycle Observations

Team leader: William Lahoz, Norwegian Institute for Air Research, Norway
Session: 27-29 June 2012

The Rapid Temporal Evolution of the Observed Magnetic Field and the Associated Processes in the Earth's Liquid Outer Core

Team leader: Vincent Lesur, GFZ German Research Centre for Geosciences, Potsdam, Germany
Session: 7-9 September 2011 (Editorial Meeting)

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.

Phobos and Deimos – After Mars Express, Before Phobos Grunt

Team leader: Jürgen Oberst, German Aerospace Center, Berlin, Germany
Session: 10-13 April 2012

Exploiting the Multi-Wavelength Lensing Survey

Team leader: Daniel Schaerer, University of Geneva, Switzerland
Session: 29 May - 1 June 2012

Geospace Coupling to Polar Atmosphere

Team leader: Annika Seppälä, British Antarctic Survey, Cambridge, UK
Session: 17-21 October 2011

Defining the Life-Cycle of Dwarf Galaxy Evolution: the Local Universe as a Template

Team leader: Eline Tolstoy, University of Groningen, the Netherlands
Session: 12-16 September 2011

Dispersive Cascade and Dissipation in Collisionless Space Plasma Turbulence – Observations and Simulations

Team leader: Emiliya Yordanova, Swedish Institute for Space Physics, Sweden
Sessions: 11-14 July 2011 and 7-9 November 2011

International Teams



Members of team led by Alexandre Marcowith working on the topic: Collisionless Shock Physics: From Non-Relativistic to Relativistic Shocks.

Teams selected in 2010

Mapping Neutron Stars with Type I X-ray Bursts

Team leader: Andrew Cumming, Mc Gill University, Canada

Session: 12-16 March 2012

Astrophysics and Cosmology with Galaxy Clusters: the X-ray and Lensing View

Team leader: Stefano Ettori, INAF/OA Bologna, Italy

Session: 26-30 March 2012

Magnetic Flux Emergence in the Solar Atmosphere: Comparing Observational and Model Conditions Leading to Active Region Formation and to the Interaction of the Newly Emerged Flux with the Ambient Magnetic Field

Team leaders: Klaus Galsgaard, University of Copenhagen, Denmark and Francesca Zuccarello, University of Catania, Italy

Sessions: 7-9 December 2011 and 5-8 June 2012

Filamentary Structure and Dynamics of Solar Magnetic Fields

Team leader: Irina N. Kitiashvili, Stanford University, USA

Session: 21-25 November 2011

Collisionless Shock Physics: From Non-Relativistic to Relativistic Shocks

Team leader: Alexandre Marcowith, University of Montpellier II, France.

Session: 23-26 April 2012

Plasma Coupling in the Auroral Magnetosphere-Ionosphere System (POLARIS)

Team leaders: Octav Marghиту, Institute for Space Sciences, Bucharest, Romania and Joachim Vogt, Jacobs University Bremen, Germany

Sessions: 8-12 August 2011 and 20-24 February 2012

Numerical and Laboratory Explorations of the Response of Solid Celestial Bodies and their Granular Surfaces to Various Kinds of Stresses Under Variable Gravity

Team leaders: Patrick Michel, University of Nice, CNRS, France and Akiko M. Nakamura, Kobe University, Japan

Sessions: 26-29 September 2011 and 16-20 June 2012

Study of Cosmic Ray Influence upon Atmospheric Processes

Team leader: Irina A. Mironova, St. Petersburg State University, Russia

Sessions: 19-23 September 2011 and 11-15 June 2012

Study of Gamma-ray Loud Binary Systems

Team leader: Andrii Neronov, University of Geneva, Switzerland

Session: 27 February - 2 March 2012

Utilizing the Smallest Martian Craters to Analyze Surface Ages and Geological Evolution

Team leaders: Olga Popova, Russian Academy of Sciences, Moscow, Russia and William Hartmann, Planetary Science Institute, Tucson, USA

Session: 21-25 May 2012

Remote Observation of Aerosol Cloud-Precipitation Climate Interactions

Team leader: Anni Reissell, University of Helsinki, Finland

Session: 27-29 February 2012

Physics of the Accretion Column of X-ray Pulsars

Team leader: Gabriele Schönherr, Astrophysical Institute Potsdam, Germany

Session: 12-16 March 2012

Plasma Entry and Transport in the Plasma Sheet

Team leader: Simon Wing, The Johns Hopkins University Applied Physics Laboratory, USA

Session: 8-12 August 2011

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: 27 February - 1 March 2012

Scientific Rationale: The problem of what heats the closed structures in the solar corona is often framed in terms of mechanisms that dissipate electric currents in a steady, or quasi-steady manner, and those which are highly impulsive. From the early 1990s predictions were made for models of different dissipation processes about the observables that could be one day measured when space-based instrumentation became adequate. Once feasible, such a comparison between theory and observations could then be used to distinguish between competing theories and eliminate some. New imaging and spectroscopic data from the Solar Dynamics Observatory (SDO) and Hinode missions make such full comparisons possible. Initial results suggest that major constraints can be imposed on the heating time scale, but the early work has failed to produce a consistent view. The aim of the team is to use SDO and Hinode data to determine the timescale of the heating processes. Different heating scenarios are explored, including the most recent results from MHD codes and ideas on the role of spicules.

Heating of the Magnetized Chromosphere: Confronting Models with Observations

Team leaders: Bart De Pontieu, Lockheed Martin Solar and Astrophysics Laboratory, Palo Alto, USA and Scott McIntosh, National Center for Atmospheric Research, Boulder, USA

Session: 21-24 February 2012

Scientific Rationale: The solar chromosphere forms a crucial interface region between the solar photosphere and the heliosphere. It requires over 30 times more energy than the corona and heliosphere combined. Despite its importance for understanding the outer solar atmosphere, the chromosphere is poorly understood. The team exploits the advent of novel and powerful instrumentation that captures full

spectral information at high-resolution and massively parallelized numerical simulations that incorporate non-equilibrium ionization and non-local radiative transfer to better understand the physics of the chromosphere that is associated with strong magnetic fields concentrated in the network (and active region/plage) regions. One of the aims is to critically assess and test the assumptions underlying the variety of theoretical models for what heats the magnetic chromosphere by confronting them with the highest resolution observations and to make major advances in understanding the heating of the magnetized chromosphere, and thus the understanding of the outer solar atmosphere.

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, Humboldt-Universität zu Berlin, Germany

Sessions: 24-26 October 2011 and 7-11 May 2012

Scientific Rationale: The team brings together an interdisciplinary group of researchers with the aim to determine the impact flux of the Earth-Moon system. Special attention will be given to the initial 1 billion years (Ga) of Earth-Moon history during which the major lunar basins were excavated. The Team consists of 15 members with research interests ranging from sample laboratory analyses (petrology, geochemistry and geochronology), to photogeology, to modeling of planetesimals and impact crater formation and evolution in order to bring together interdisciplinary expertise to elucidate the bombardment history in the Earth's vicinity. The members integrate old and new, laboratory and remote sensing data with the objective to synthesize a comprehensive impact history and evolution of the Earth-Moon system from ~4.5 Ga to the present day.

Multi-point Studies of the Auroral Acceleration Region using Cluster

Team leader: Colin Forsyth, UCL Mullard Space Science Laboratory, United Kingdom

Session: 13-17 February 2012

Scientific Rationale: The team brings together experts on the auroral acceleration processes and multi-spacecraft studies of space plasmas in order to exploit this exciting new dataset in space plasma physics. The team attempts to address questions

International Teams



This illustration shows the relative sizes of the Sun and the Earth by placing them impossibly close together. (Image Credit: NASA/JPL-CALtech/IR.Hurt (SSC))

such as: What is the in-situ analogue of narrow-band fine structure in auroral radio emission (auroral kilometric radiation-AKR)? What is the electric potential structure of the auroral acceleration region (AAR) and how does it vary? How do charged particle distributions vary along the AAR? How does the structure in the AAR vary in space? These questions will initially be addressed by a number of case studies of optimum events identified in the data.

Flow-driven Instabilities of the Sun-Earth System

Team leader: Claire Foullon, University of Warwick, United Kingdom

Session: 14-16 May 2012

Scientific Rationale: The team identifies and opens new vistas for advancing the knowledge of flow-driven instabilities in space, solar and astrophysical plasma environments. By combining observational and theoretical characterizations and by sensibly comparing solar and terrestrial phenomena, the team clarifies and exploits similarities and, ultimately, gain a cross-fertilization between the fields. The tasks are: (1) to review flow-driven instabilities near the Earth, in the solar wind and in the solar corona, identifying the fundamental similarities, and (2) to carry out specialized studies, which include e.g., the mechanisms controlling boundary layer formation, the cascade of magnetohydrodynamic (MHD) waves into high frequency waves and post-eruptive wave phenomena. The aim is to clarify the efficiency of the flow-driven instabilities in these processes, by comparing their role in the dynamics of various structures of the Sun-Earth system with recent and future ob-

servations of waves in flowing plasmas, as well as the use of plasma theory and numerical simulations. This requires direct comparisons of the onset conditions, as well as the spatial and temporal evolution characterizations of the waves occurring near flow-shear boundaries or driven by reconnection outflows.

Zonal Jets and Eddies – Planetary Science and Satellite Oceanography at the Crossroads

Team leader: Boris Galperin, University of South Florida, USA

Session: 5-9 March 2012

Scientific Rationale: Zonal jets play a prominent role in large-scale circulations of planetary atmospheres and oceans. Their presence has been established on giant planets and in the terrestrial oceans and atmosphere. They are familiar as the “sub-tropical jet stream” in the Earth’s atmosphere and as zonal (east-west) bands on the Jovian disk formed by the clouds. Powerful oceanic boundary currents such as the Gulf Stream and Kuroshio, as well as the Antarctic Circumpolar Current (ACC) and the recently discovered ubiquitous narrow oceanic jets detectable both on the surface and at great depth may all be held together by similar processes. The recent progress in our understanding of the physics of zonal jets has been stimulated by (a) the acquisition of new planetary data, (b) collection of the ocean data using satellite altimetry and floats, (c) new laboratory data, (d) high-resolution computer simulations, and (e) progress in understanding of the interaction between anisotropic turbulence and waves. The purpose is to facilitate further progress by assessing, summarizing and diffusing this information between different areas of science.

Present and Past Activity of the Galactic Center Super-massive Black Hole and its Impact on the Central Molecular Zone of the Galaxy

Team leader: Andrea Goldwurm, Service d’Astrophysique / IRFU / DSM / CEA - Saclay, France

Session: 21-25 May 2012

Scientific Rationale: The aim is to investigate the present and recent past behavior of the supermassive black hole at the center of our galaxy. On one side the team intends to pursue the effort of understanding the origin and mechanisms of its flaring activity, observed in X-rays and infrared wavelengths. On the other the team re-evaluates the hypothesis,

supported by observations of the X-ray emission from the surrounding molecular clouds, that this peculiar object underwent a phase of high activity in X and hard X-rays few hundred years back. The role of the black hole in accelerating the particles seen to populate the central region of the Galaxy is also explored and the link with its past X-ray activity and other specific phenomena observed in the galactic center region is studied.

Atmosphere-Ionosphere Coupling during Stratospheric Sudden Warmings

Team leader: Larisa Goncharenko, MIT Haystack Observatory, USA

Session: 7-11 November 2011

Scientific Rationale: The dynamic coupling of the atmosphere-ionosphere system is a complex interdisciplinary problem. The team studies dynamical coupling processes by focusing on sudden stratospheric warmings and bringing together experts specializing in the middle and upper atmosphere. The aim is to analyze data from different ground-based and satellite-based observations, including global maps of tropospheric and stratospheric water vapor, stratospheric ozone, stratospheric and mesospheric temperatures, ionospheric plasma density, and electrodynamics. These global maps are analyzed in conjunction with specialized datasets collected by microwave radiometers at altitudes 30-70 km, medium frequency and meteor radars at altitudes 70-100 km, and incoherent scatter radars at altitudes 100-800 km. The interpretation of the observations and the elucidation of the impact of the associated processes on the ionosphere will be provided by focused modeling efforts.

The Formation of Star Clusters

Team leader: Simon Goodwin, Department of Physics and Astronomy, University of Sheffield, United Kingdom

Session: 10-13 April 2012

Scientific Rationale: The study of star formation is crucial to the understanding of many areas of astrophysics. Stars are the fundamental visible component of the Universe, planets form as the by-products of star formation, and star formation is a crucial part of galaxy formation and evolution. Stars do not form alone. The team brings together experts in nearby small groups of tens or hundreds of stars, to specialists in massive extra-galactic star clusters with mil-



Using data from the VISTA infrared survey telescope at ESO's Paranal Observatory, an international team of astronomers has discovered 96 new open clusters hidden by the dust in the Milky Way. Thirty of these clusters are shown in this mosaic. This is the first time so many faint and small clusters have been found at once. The images are made using infrared light in the following bands: J (shown in blue), H (shown in green), and Ks (shown in red). (Image Credit: ESO/J. Borissova)

lions of members. The aim is to investigate how these extremes can be reconciled – are they two ends of a continuous spectrum of star formation, or are they fundamentally different objects?

Address the Physics of the Heliopause

Team leaders: Randy Jokipii, University of Arizona, USA and Edward C. Stone, California Institute of Technology, USA

Session: 17-20 April 2012

Scientific Rationale: The team studies the physics of the heliopause in the context of the Voyager observations, with the goal of maximizing the science return from the mission. The team consists of the Principal Investigators or their representatives from each of the functioning instruments on Voyager and a broad selection of theorists and modelers. The two Voyager spacecraft are exploring a totally uncharted region of space and will make the first crossings of the heliopause and enter interstellar space. The team is timely because of the likelihood that the Voyagers

International Teams

will soon see (or may already be) seeing phenomena associated with the heliopause. Because the phenomena are new it is desirable to have a diverse team trying to understand and predicting the physical processes which occur and how these be observed with the Voyager instruments.

Characterizing Super-Earths and Life Advance through Linking 1D/3D Atm. Models and their Resulting Observables

Team leader: Lisa Kaltenegger, Harvard Smithsonian Center for Astrophysics, USA

Session: 10-12 September 2012 (BY 18)

Scientific Rationale: The team compares and links established 1D atmospheric climate and photochemistry models with basic 3D atmospheric dynamic model for the first time and translate the results into observables for future space missions. The results provided by the project will have important implications for present and future space missions, like Kepler, EChO, and a Darwin/TPF mission. In order to use more efficient current telescopes, the goal is to discuss physical models of such planetary environment systems. This may also help to design future instruments to be able to undertake comparative exo-planetology and potentially remotely detect life on extrasolar worlds.

Aerosol Remote Sensing from Space

Team leader: Alexander Kokhanovsky, Bremen University, Germany

Session: 15-21 July 2012 (BY 18)

Scientific Rationale: The global distribution of aerosol concentration, size, and chemical composition around the world and, from there, the influence of aerosols on climate and air quality remain key unanswered questions in atmospheric science. Many instruments have only spectral capability, and, therefore, they cannot provide accurate retrievals in many cases. That is primarily why instruments capable of measuring polarization of reflected sunlight have been launched. However, the corresponding retrieval algorithms rely on quite complex radiative transfer codes, and currently are mostly based on look-up-table approaches. This technique has an advantage of fast retrievals but the method is not flexible with respect to new insights about a priori assumptions. It is therefore important to perform the corresponding retrievals relying directly on radiative transfer calculations during the inversion process. The team



The Amazon rainforest is disappearing rapidly. This photo was taken by ESA astronaut André Kuipers and released during Earth Hour on Saturday 31 March 2012. Earth Hour is a world effort to raise awareness about the need to take action on climate change. World Wide Fund for Nature ambassador André Kuipers and ESA supported the initiative. (Image Credit: ESA/NASA)

combines complimentary expertise in radiative transfer (both 1D and 3D), inverse problem solution, and aerosol remote sensing to address both of the stated problems.

An Assessment of the Accuracies and Uncertainties in the Total Solar Irradiance Climate Data Record

Team leader: Greg Kopp, University of Colorado, USA

Session: 6-8 March 2012

Scientific Rationale: Total solar irradiance measured from space for the last 34 years provides the best data record of the net energy driving Earth's climate. Calibration differences between instruments contributing to this record make estimating uncertainties difficult; yet such uncertainties are required for assessing solar influences on climate. With improved ground calibrations, recent tests of instruments representing those on-orbit, and the availability of investigators responsible for the historical and newer flight instruments, now is an opportune time to assess this important record's accuracies. The team brings together the international TSI instrument representatives to 1) assess instrumental accuracies and uncertainties, and 2) produce and publish a solar irradiance composite having time-dependent uncertainties needed for climate studies.

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: 21-24 May 2012

Scientific Rationale: The heliosphere, created from the interaction of the magnetized environments of the solar wind and the interstellar medium, presents the outermost shield of the Earth against cosmic rays. The team uses a combination of Interstellar Boundary Explorer (IBEX) and Solar Wind Anisotropies (SWAN) results to study the 3D global heliospheric interaction with the interstellar medium, and the variability of the heliospheric structure due to the temporal variations of solar activity.

Characterizing Stellar and Exoplanetary Environments via Observations and Advanced Modeling Techniques

Team leader: Helmut Lammer, Austrian Academy of Sciences, Graz, Austria

Session: 19-21 March 2012

Scientific Rationale: Recent observations with the Hubble (HST) and Spitzer Space Telescopes and theoretical studies of transiting exoplanets indicate that obtained spectra related to the upper atmospheres can be used to infer properties such as the thermosphere structure, the exosphere-magnetosphere-stellar plasma environment (e.g., superthermal ions, energetic neutral atoms ENAs), outflow of planetary gas including hydrogen atoms and heavy species such as carbon, oxygen and metals. The team investigates the physical processes by applying advanced numerical modeling techniques (Monte Carlo, test-particle, gas dynamic, MHD, hydrodynamic, radiation transfer, empirical, and thermal balance models) together with astrophysical observations of the radiation environment of exoplanet host stars (UV, X-rays, IR, etc.) to understand the exoplanet upper atmosphere structures and exoplanet plasmamagnetosphere environment.

Resolving Current Systems in Geospace

Team leaders: Mike Liemohn, University of Michigan, USA and Natalia Ganushkina, Finnish Meteorological Institute, Finland

Session: 23-27 January 2012

Scientific Rationale: Electric currents flowing through near-Earth space ($R \leq 12$ RE) can support a highly distorted magnetic field topology, changing particle drift paths and therefore having a nonlinear feedback on the currents themselves. A number of current systems exist in the magnetosphere, most notably the dayside magnetopause Chapman-Ferraro currents, high latitude "region 1" field-aligned Birkeland currents, mid-latitude "region 2" field-aligned currents connected to the partial ring current, magnetotail currents, and the symmetric ring current. In the near-Earth night-side, however, several of these current systems flow in close proximity to each other and it is very difficult to identify a local measurement as belonging to a specific system. Such identification is important, however, because how the current closes and how these loops change in space and time governs the magnetic topology of the magnetosphere and therefore controls the physical processes of geospace. There is confusion among magnetospheric physicists about how to even define these currents, let alone which one dominates at what time during geomagnetic activity.

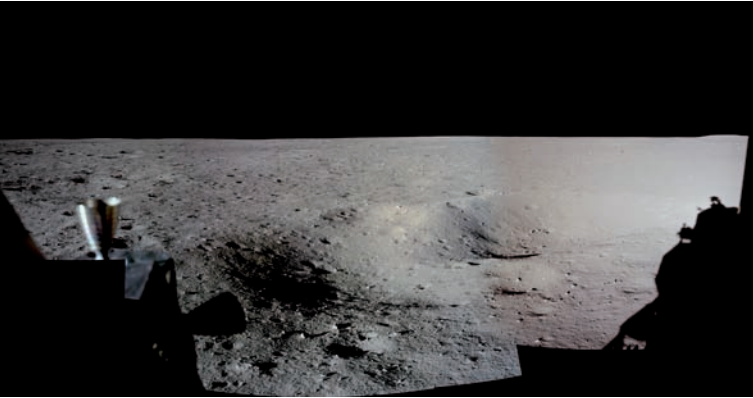
Interaction of Satellites with their Space Environment

Team leader: Richard Marchand, University of Alberta, Canada

Session: 12-16 December 2011

Scientific Rationale: Space technology is a critical aspect of our every day lives, our well being and the security of our societies. In order to make optimal use of space-enabled technology we must develop a good understanding of the interaction between space-based systems and their environment. The challenge is considerable and, despite years of progress, several fundamental questions remain. The goal is to study some of these key questions through a broad and interdisciplinary collaboration. The team achieves this through a number of case studies to elucidate questions identified as of high priority, and with a direct impact on space missions. By combining the resources and the different expertise, the team aims to advance knowledge and understanding in the targeted areas, in ways that would otherwise not be possible.

International Teams



Assembled from high-resolution scans of the original film frames, this one sweeps across the magnificent desolation of the Apollo 11 landing site on the Moon's Sea of Tranquility. Taken by Neil Armstrong looking out his window of the Eagle Lunar Module. (Image Credit: Neil Armstrong, Apollo 11, NASA - Panorama by Syd Buxton)

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: 26-30 March 2012

Scientific Rationale: Time series of measurements intended for use in Climate Research are referred to as "Climate Data Records" (CDRs), and the generation of CDRs of Sea-Surface Temperature (SST) is both of great importance and also tractable, at least in principle. In practice a pathway exists if the uncertainties in SSTs retrieved from satellite measurements are determined using accurate ship-based radiometers with calibration traceable to National Metrology Institute (NMI) standards, such those maintained by the National Physical Laboratory (NPL) in the UK and the National Institute of Standards and Technology (NIST) in the USA. The meetings bring together scientists active in the field of satellite remote sensing of SST and ship-based radiometry with those from NMIs to establish the procedures for the consistent generation of CDRs of SSTs.

Lunar Volatiles

Team leaders: Igor Mitrofanov, Space Research Institute (IKI), Moscow, Russia and William Boynton, University of Arizona, USA

Session: 25-29 June 2012

Scientific Rationale: This research project addresses the recent findings and current development of a

new field of lunar science, concerning the origin, transport and accumulation of volatiles at lunar poles. The first direct detection of polar enhancement of H₂O and/or OH in the regolith was performed by means of the M³ hyper-spectral IR mapping spectrometer onboard the ISRO Chandrayaan-1 mission. The latest proof for the presence of localized areas with a relatively high content of water and other volatiles at the lunar poles has been recently provided by the remote sensing measurements of NASA's LRO and LCROSS missions: the instruments onboard LRO and LCROSS measured direct signatures of water, H₂ and another volatiles in the plume material ejected by the LCROSS artificial impact event. These discoveries highlight the exploration of a New Moon at the poles, which is very much different from the Moon studied by Apollo and Lunas.

Advancing Our Understanding of Solar Wind Fractionation

Team leader: Dan Reisenfeld, University of Montana, USA

Session: 30 April - 3 May 2012

Scientific Rationale: Understanding the mechanisms that fractionate the solar wind composition from the photospheric composition is a key step toward understanding the acceleration of the solar wind, as well as providing improved solar abundances, which are key inputs for understanding solar-system formation processes. Over the past 5 years, new composition data has emerged which may allow us to develop a deeper understanding of solar wind fractionation. A rich new dataset is available from the Genesis returned solar wind sample analysis program, providing elemental and isotopic abundances of unprecedented accuracy. In addition, recent findings from ACE, WIND and Ulysses are very informing. The objective of the team is to advance our understanding of solar wind fractionation in light of this new work.

Deriving Physical Parameters of Atmosphereless Bodies in the Solar System by Modeling their Thermal Emission

Team leader: Hans Rickman, University of Uppsala, Sweden

Sessions: 26-28 October 2011 and 2-4 May 2012

Scientific Rationale: This is a comprehensive study of

state-of-the-art thermophysical models (TPMs) as applied to a wide variety of atmosphereless Solar System bodies. The recent availability of new thermal data of unprecedented quality naturally demands more sophisticated TPMs in order to retrieve correct information on the nature of the surfaces and structure of the objects. These data are provided by currently active spacecraft in the form of spatially resolved IR spectroscopy, and a wealth of disk-integrated IR observations from orbiting observatories and ground based telescopes. The team studies the capabilities and limitations of TPMs in order to provide advice on their use for many different types of objects and thermal observations. To this end, numerical modeling studies are supplemented by laboratory emissivity measurements.

Extreme Solar Flares as Drivers of Space Weather: From Science towards Reliable Statistics

Team leaders: Karel Schrijver, Lockheed Martin Advanced Technology Center, USA and Jürg Beer, EAWAG, Switzerland

Sessions: 30 August - 2 September 2011 and 2-5 April 2012

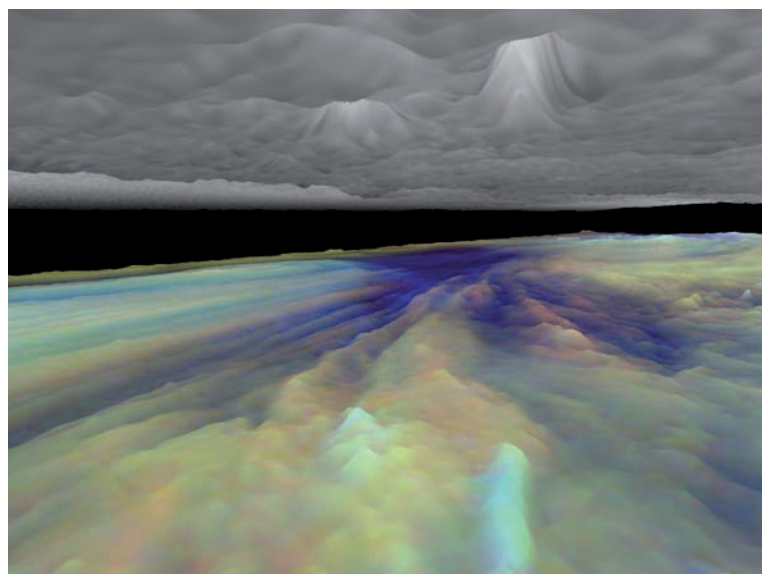
Scientific Rationale: The most energetic space weather events are most dangerous to our society. We can learn about these rare events not only by direct observations but also by indirect means: Ice cores appear to contain information on extreme geospace weather in Earth's past, while observations of stars like the Sun provide a statistical sample of a multitude of Sun-like stars. The team assembles scientists for the analysis of records in ice and rock, solar and stellar observations, and of the processes that link solar events to their observables (1) to estimate the probabilities of the occurrence of space weather events of different magnitudes, and (2) to assess possible future measurements and techniques to improve the knowledge.

Comparative Jovian Aeronomy

Team leader: Tom Stallard, University of Leicester, United Kingdom

Session: 10-14 September 2012 (BY 18)

Scientific Rationale: The team discusses the aeronomy at Jupiter, investigating the energy crisis within the upper atmosphere, magnetosphere-atmospheric coupling and the extent of variability within the ionosphere. It will also relate Jupiter's aeronomy to that of other Gas Giants, in particular results from the on-



Every day is a cloudy day on Jupiter, the Solar System's reigning gas giant. This visualization presents a simplified model view from between Jovian cloud decks based on imaging and spectral data recorded by the Galileo spacecraft. The separation between the cloud layers and the height variations have been exaggerated. The upper cloud layer is haze a few tens of miles thick. Heights in the lower cloud layers have been color coded; light bluish clouds are high and thin, reddish clouds are low, and white clouds are high and thick. (Image Credit: Galileo Project, JPL, NASA)

going Cassini mission at Saturn. In addition to these scientific returns, these discussions will also be used to plan the instrumentation and science requirements for several upcoming space missions.

Long-term Reconstruction of Solar and Solar Wind Parameters

Team leader: Leif Svalgaard, Stanford University, USA
Session: 7-11 May 2012

Scientific Rationale: There are long term changes in the interplanetary magnetic field (IMF) as a consequence of magneto-hydrodynamic processes on the Sun. Reasonable agreement has been achieved between IMF strength (and open flux) estimates based on geomagnetic data and the inversion of the paleoc cosmic radiation data for the last ~100 years. The aim is to extend and substantiate the geomagnetic-based reconstruction of solar wind parameters from ~1840-2010 and to resolve the remaining discrepancies among the geomagnetic-, cosmic-ray-, and sunspot-based reconstructions, and to explore the open questions.

International Teams approved in 2012

The Teams below have been selected for implementation from the proposals received in response to the 2012 Call for International Teams:

Atmospheric Gravity Waves in Global Climate Prediction and Weather Forecasting Applications
Team leader: Joan Alexander (US)

Planetary Population Synthesis: Interpreting Present and Future Space Data
Team leaders: Yann Alibert (CH) and Douglas Lin (US)

Self-Organized Criticality and Turbulence
Team leader: Markus Aschwanden (US)

Thermonuclear Bursts: Probing Neutron Stars and their Accretion Environment
Team leader: Andrew Cumming (CA)

Nonlinear Force-Free Modeling of the Solar Corona: Towards a New Generation of Methods
Team leaders: Marc DeRosa (US) and Michael S. Wheatland (AUS)

Polar Cap Arcs: Understanding Magnetosphere-Ionosphere Coupling and Magnetospheric Topology during Periods of Northward IMF
Team leaders: Robert Fear (UK) and Romain Maggiolo (US)

Kinetic Plasma Processes at Airless Bodies
Team leader: Matthew O. Fillingim (US)

Rapid Dynamics in the Earth's Core: Assimilation of Satellite Observations into MHD models
Team leader: Christopher Finlay (CH)

Observations and Modeling of Flare Chromospheres
Team leader: Lyndsay Fletcher (UK)

First Principles Physics for Charged Particle Transport in Strong Space and Astrophysical Magnetic Turbulence
Team leader: Federico Fraschetti (US)

Coronal Magnetometry: Building Tools for Discovery
Team leader: Sarah E. Gibson (US)

Towards an Integrated Retrieval of Antarctic Sea Ice Volume
Team leaders: Petra Heil (AU) and Stefan Kern (DE)

Characterizing Diurnal Variations of Ozone for Improving Ozone Trend Estimates
Team leader: Klemens Hocke (CH)

The Evolution of the First Stars in Dwarf Galaxies
Team leader: Pascale Jablonka (CH)

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 (BG)

X-ray and Radio Diagnostics of Energetic Electrons in Solar Flares
Team leader: Eduard P. Kontar (UK)

Heavy Ions: Their Dynamical Impact on the Magnetosphere
Team leader: Elena Kronberg (DE)

The Induced Magnetosphere of Mars: Physical Processes and Consequences
Team leader: Mark Lester (UK)

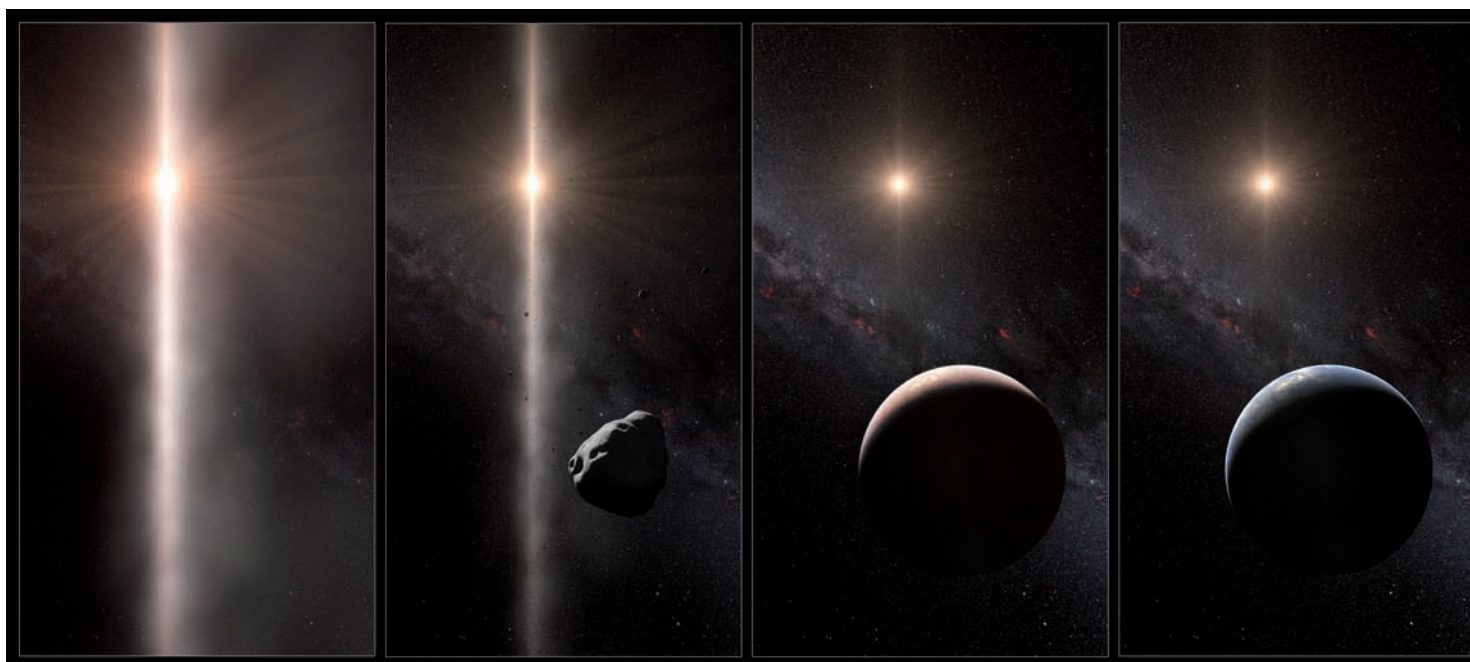
Quantifying Hemispheric Differences in Particle Forcing Effects on Stratospheric Ozone
Team leader: Daniel Marsh (US)

Unified View of Stellar Winds in Massive X-ray Binaries
Team leader: Silvia Martinez Nunez (ES)

MHD Oscillations in the Solar Corona and Earth's Magnetosphere: Towards Consolidated Understanding
Team leaders: Valery Nakariakov (UK) and Slava Pilipenko (RU)

Study of Gamma-ray Loud Binary Systems
Team leader: Andrii Neronov (CH)

Large-scale Vortices and Zonal Winds in Planetary Atmospheres/ionospheres: Theory versus Observations
Team leader: Oleg Pokhotelov (RU)



This artist's impression shows four stages of the development of the inner Solar System over a period of nearly five billion years. The left panel shows the earliest stage where the debris disc around the Sun was composed of gas and tiny particles, typically less than one millimetre across. At the second stage the particles have formed large clumps, roughly 100 kilometres across and, similar to the asteroid Lutetia. These bodies in turn formed the rocky planets including the Earth. Over the subsequent four billion years the surface of the Earth developed to what we know now under the influence of meteor bombardment that delivered volatile materials including water, and the evolution of life on its surface. (Image Credit: ESO/L. Calçada and N. Risinger)

Dusty Plasma Effects in the System Earth–Moon

Team leader: Sergey Popel (RU)

Understanding Solar Jets and their Role in Atmospheric Structure and Dynamics

Team leader: Nour-Eddine Raouafi (US)

Particle Acceleration at Plasma Jet Fronts in the Earth's Magnetosphere

Team leader: Alessandro Retino (FR)

Solar Wind Charge Exchange Soft X ray Imaging in the Solar System

Team leaders: David Sibeck and Michael R. Collier (US)

Stratospheric Sulfur and its Role in Climate (SSiRC) Workshops

Team leader: Larry W. Thomason (US)

Vesta, the Key to the Origins of the Solar System

Team leader: Diego Turrini (I)

Towards a Full Integration of Earth Observation Products and Concepts in Land Surface Models

Team leader: Peter M van Bodegom (NL)

Dawn-Dusk Asymmetries in the Coupled Solar Wind-Magnetosphere-Ionosphere System

Team leaders: A. Walsh (UK) and S. Haaland (NO)

Magnetic Activity of M-type Dwarf Stars and the Influence on Habitable Extra-Solar Planets

Team leader: Sven Wedemeyer-Böhm (NO)

Magnetosphere and Ionosphere as a Coupled System: Theory and Observations

Team leader: Andrew Wright (UK)

Visiting Scientists

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.

Following scientists worked at ISSI in the course of the seventeenth business year:

Michael Balikhin, Department of Automatic Control and Systems Engineering, University of Sheffield, working period: 18.-29.1.2012.

André Balogh, Space and Atmospheric Physics, Imperial College London, UK, working period: 4.-11.11.2011.

Ken McCracken, IPST, University of Maryland, College Park, USA, working period: 29.8.-30.9.2011.

Fulvio Melia, Department of Physics and Astronomy, University of Arizona, USA, working period: 22.-27.6.2012.

Götz Paschmann, Max Planck Institute for Extraterrestrial Physics, Garching, Germany, working periods: 29.10.-6.11.2011 and 2-10.6.2012.

Daniel Reisenfeld, University of Montana, Missoula, USA, working period: 30.4.-25.5.2012.

Jean-Pierre Rozelot, OCA-GEMINI, Grasse, France, working period: 16.-28.10.2011.

Thomas Zurbuchen, Department of Atmospheric, Oceanic & Space Sciences College of Engineering, University of Michigan, Ann Arbor, USA, working period: 22.-30.9.2011.



Dan Reisenfeld of the University of Montana, USA, took the opportunity to work at ISSI for a few weeks.

To present the work of Dan Reisenfeld – one of the eight Visiting Scientists – he answered a few questions about the time spent at ISSI:

How has your collaboration started with ISSI?

D. Reisenfeld: I first heard of ISSI in 2001 while attending a conference at the University of Bern on composition in the universe. My collaboration with ISSI began around 2010, when I approached Rudolf von Steiger regarding the idea of ISSI hosting a workshop on advances in our understanding of solar wind fractionation. He suggested the idea of putting together an ISSI team at that time. As a result of our discussions, I submitted a proposal for an ISSI team on solar wind fractionation for the 2011 call, which was then selected.

On which projects you worked during your stay at ISSI?

D. Reisenfeld: In addition to leading the team on Solar Wind Fractionation on first week of May, I also participated as a team member on the team lead by Dimitra Koutroumpa on the outer heliosphere the week of May 21. For the two weeks in between, I worked on completing a manuscript on the state of the solar wind during the Genesis mission sample collection period. Furthermore I had a number of quite helpful discussions with Ruedi von Steiger regarding this study.

From your point of view what are the key words for the International Space Science Institute?

D. Reisenfeld: If you are asking for phrases that describe the essence of ISSI, they might be: collaborative, excellent working environment, welcoming, international, interdisciplinary, a place to synthesize ideas.

Events

26 September 2011: "Ejection of Cool Plasma into the Hot Corona", Seminar by Pia Zacharias, ISSI Post-Doc.

27 October 2011: "Creation, Application and Contribution – A three-phase roadmap of Chinese Space Activities", Seminar by Prof. Wu Ji.

3 November 2011: Meeting of the Science Committee.

4 November 2011: Meeting of the Board of Trustees and the ISSI Board Dinner.

8 November 2011: Pro ISSI talk "Leben und die Entwicklung der Planeten" by Tilman Spohn.

7 February 2012: Evening Lecture "The Application of GRACE Time-Dependent Gravity Measurements to the Understanding of Land Surface Hydrology and Global Sea Level" by W.R. Peltier.

22 March 2012: Pro ISSI talk "Mirages in the Universe" by Georges Meylan.

16 May 2012: Pro ISSI talk "The Earth's gravitational field" by Reiner Rummel.

6-8 June 2012: Meeting of the Science Committee.

29 June 2012: Meeting of the Board of Trustees.



Dr. Simon Aegerter (left), Chairman of the ISSI Board of Trustees, and Prof. Wu Ji, Director General of the National Space Science Center (NSSC), signing the Memorandum of Understanding between ISSI and NSSC.

ISSI's Cooperation with China

In October 2011, Professor Wu Ji, Director General of the National Space Science Center (NSSC) of the Chinese Academy of Sciences visited ISSI and discussed with the ISSI Board Chairman and the Executive Director, a possible association between the two organizations. That meeting was followed by a second one held in February 2012 in the offices of NSSC – Beijing, which led to the signature on 14 February of a Draft Memorandum of Understanding. It was agreed to initiate the setting up of an Institute hosted by NSSC in Beijing similar to ISSI and using most of the ISSI operation tools. At its meeting on 29 June 2012, the ISSI Board approved the Memorandum of Understanding, and agreed to start a small number of activities, growing from there based on the success of the venture. On the political side, the concept was also discussed in Beijing between the Swiss State Secretary for Education and Research, Mr. Dell'Ambrogio, and the Vice-Minister of the Chinese Ministry of Industry and Information Technology, Mr. Chen Quifa, on the occasion of a visit in March. The process will be followed in the near future by more detailed discussions between ISSI and NSSC for implementation of the MOU, i.e. organization of joint workshops, exchanges of scientists etc. Both parties would benefit from such a cooperative venture leading to a gradual integration of the Chinese scientific community in the ISSI activities and a better knowledge by the ISSI community of the Chinese Space program.

Events and ISSI in the media at a glance



Infrared image of the Rosette molecular cloud. Herschel collects the infrared light given out by dust and this image is a three-colour composite made of wavelengths at 70 microns (blue), 160 microns (green) and 250 microns (red). The bright smudges are dusty cocoons containing massive protostars. The small spots near the centre of the image are lower mass protostars. (Image Credit: ESA/PACS & SPIRE Consortium/HOBYS Key Programme Consortia)

ISSI and the Alpbach Summer School 2011

The 35th Summer School, with ISSI as a partner of FFG and ESA in supporting the Summer School, was held on 19 to 28 July 2011 with the topic "Star Formation across the Universe". Following past years' practice, 60 students from European countries gathered for two weeks to learn how to design a scientific space missions. The students were brought up to date by lecturers on both the scientific questions concerning star formation and how to make space-based astronomical observations and on the space technologies needed to design a successful mission. The 60 students were grouped into four teams of 15 students, named the Blue, Green, Orange and Red teams who then, in the few days available to them, were asked to design and present a space mission that would further our knowledge of star formation processes and regions. As in previous years, the student teams worked very hard and successfully to design space missions which were both innovative and scientifically challenging. The missions proposed by the students covered the observation of starburst galaxies (Green Team), high-resolution far-infrared

interferometric observations of star-forming regions (Red Team), making astrometric observations in the far-infrared to complement the observations of ESA's Gaia mission (Blue Team) and observation of pre-main sequence stars in the ultraviolet wavelength range at high spectral resolution (Orange Team). The Jury, chaired by André Balogh substituting for Roger-Maurice Bonnet, had a very difficult task to identify the most successful proposals in the different categories of scientific merit, technical excellence, competitiveness and quality of the presentation. In the end, all mission proposals were declared excellent in different ways; the real winners were all the students for whom Alpbach again proved to be an exhilarating and formative experience. On behalf of ISSI, Silvia Wenger provided administrative assistance to the Summer school organizers.

ISSI in the media

Article "Certains micro-organismes traversent les océans", Radio Television Suisse Online: www.rts.ch/info/sciences-tech/3349449-certains-micro-organismes-traversent-les-océans.html, 24 August 2011.

Article "Les microbes survolent l'océan", 20 Minutes, 25 August 2011.

Interview "Von Weltraumtourismus halte ich wenig" with Johannes Geiss by R. Bossart, Neue Luzerner Zeitung, 8 October 2011.

Article "Ein Mondbaum für das Verkehrshaus" by Alois Feusi, Neue Zürcher Zeitung, 11 October 2011.

Interview "Pour aller sur Mars, apprendre à vivre sur Terre" with R.-M. Bonnet, Ciel et Espace, Numéro spécial 500, December 2011.

Article "Scepticisme sur une mission russe vers la Lune", Le Temps, 7 February 2012.

Interview "Dans la Lune, les Russes?" with R.-M. Bonnet by E. Grynszpon, Le Temps, 10 February 2012.

Press conference at Chinese Academy of Sciences with R.-M. Bonnet "Surviving 1,000 Centuries" translated in Chinese, Lifework 3-12-2012, p. 151, 14 February 2012.

Article "De l'Espace pour la Terre?" by R.-M. Bonnet, J. Achache, J.-L. Fellous, D. Vidal-Majar, Libération.fr, 13 June 2012.

Presentations

28 June-7 July 2011 – R. von Steiger: Unusual evolution of solar wind parameters over the past solar cycle, Invited talk at the 2011 Assembly of the IUGG, Melbourne, Australia.

1 and 2 September 2011 – H. Opgenoorth: The Mars Magnetosphere in a Variable Solar wind, Chair of SOC, panel member, ILWS workshop, Towards the new Solar Maximum, 28 August - 2 September 2011, Beijing, China.

13 September 2011 – P. Zacharias: Ejection of cool plasma into the corona, European Solar Physics Meeting 13, Rhodes, Greece.

20 September 2011 – M. Falanga: The ephemerides and orbital decay of ten eclipsing HMXB, INTEGRAL conference, Chia Laguna, Italy.

23 September 2011 – H. Opgenoorth: Responses of the Mars magnetosphere and ionosphere to Solar wind variations, Cluster Workshop, ECLAT team meeting, 19-23 September 2011, Brugge, Belgium.

26 September 2011 – P. Zacharias: Ejection of cool plasma into the hot corona, ISSI Seminar, Bern, Switzerland.

28 September 2011 – R. von Steiger: HUGO in the sky, University of Bern Researcher's night (with Daniel Schümperli and Lukas Frey), Bern, Switzerland.

6 October 2011 – H. Opgenoorth: Magnetospheric and Ionospheric Response to Solar Wind Variability at Mars, EPSC and DPS, 2-7 October 2011, Nantes, France.

13 October 2011 – J.L. Culhane: Active region plasma outflows and their contribution to the solar wind, Fifth Hinode Meeting, Cambridge, Massachusetts, USA.

14 October 2011 – M. Falanga: Wie schwarz sind schwarze Löcher?, Astronomische Gesellschaft Urania Zürich, Switzerland.

10 November 2011 – L. Bengtsson: The Atmospheric water cycle: How will it change in a warmer climate?, Max Planck Institute for Meteorology, Hamburg, Germany.

18 November 2011 – L. Bengtsson: The Hydrological Cycle and Climate Change: What are the consequences for the Arctic?, Nansen Institute, Bergen, Norway.

22 November 2011 – R.-M. Bonnet: "De la Fusion Nucléaire au Réchauffement Climatique", Thales, Research and Technology, France.

Listed are activities in which ISSI staff scientists participated between 1 July 2011 and 30 June 2012. This includes presentations given, meetings attended, honors received, and chairmanships held.

25 November 2011 – P. Zacharias: 3d magnetohydrodynamic models of the solar corona - mass flows and plasma ejections, Team Meeting of I.N. Kitiashvili, ISSI, Bern, Switzerland.

5-9 December 2011 – R. von Steiger: Variability of the solar wind, Fall Meeting of the AGU, San Francisco, USA.

23 January 2012 – L. Bengtsson: Diagnosis of the general circulation of the atmosphere – In memory of Aksel Wiin-Nielsen, American Meteorological Society, MS New Orleans, USA.

31 January 2012 – H. Opgenoorth: Space plasma physics around Mars, Swedish Space Plasma Phys. Meeting, 30-31 January 2012, Kiruna, Sweden.

2 February 2012 – L. Bengtsson: Den globala vattencykeln i ett varmare klimat, Vad kan detta innebära för Sverige?, Uppsala University, Sweden.

6 February 2012 – L. Bengtsson: The Atmospheric water cycle, How will it change in a warmer climate?, Workshop "The Earth's Hydrological Cycle", ISSI, Bern, Switzerland.

8 February 2012 – M. Falanga: ISSI-EPN Workshop Books: A Legacy for Planetary Sciences, Conference on Euro-planet-RI Towards Sustainability, Vienna, Austria.

14 February 2012 – R.-M. Bonnet: The Future of Humanity, Chinese Academy of Sciences, Beijing, China.

15 February 2012 – R.-M. Bonnet: The Sun: From Nuclear Fusion to Climate Change, The Royal Swedish Academy of Sciences, Stockholm, Sweden.

6 March 2012 – P. Zacharias: Unbiased view on existing TSI records, Team Meeting of G. Kopp, ISSI, Bern, Switzerland.

14 March 2012 – P. Zacharias: Ejection of cool plasma into the corona - Comparison between models and observations (Poster), SDO/IRIS/Hinode Workshop, Monterey, United States.

20 March 2012 – L. Bengtsson: Vad händer med jordens klimat?, Public Debate on Climate Change, Uppsala Sweden.

Staff Activities

21 March 2012 – L. Bengtsson: Den globala energiproduktionen och dess konsekvenser för jordens klimat, on behalf of the Royal Swedish Academy of Sciences, Falun, Sweden.

22 March 2012 – M. Falanga: Millisecond pulsars as Particle Accelerators, Workshop on "Positrons in Astrophysics", Mürren, Switzerland.

23 April 2012 – H. Opgenoorth: Magnetospheric and Ionospheric Response to Solar Wind Variability at Mars, Flare Effects in Mars's Ionosphere Observed by Mars Express Topside Sounding, The configuration of the induced Martian magnetosphere and ionosphere during quiet solar wind conditions (Poster), Anomalous structures observed in the nightside Martian ionosphere with the Mars Express topside radar sounder (Poster), Session convener, EGU, 22-27 April 2012, Vienna, Austria.

26 April 2012 – R.-M. Bonnet: Intervention "La Terre vue de l'Espace", Institut des Hautes Etudes pour la Science et la Technologie (IHEST), Paris, France.

26 April 2012 – J.L. Culhane: UK Space Science Milestones - the Sun, Ariel I, 50 Years of the UK in Space, Science Museum, London, UK.

30 April - 3 May 2012 – R. von Steiger: In-situ composition measurements and their challenges, Composition measurements over three Ulysses orbits, talks at the Team Meeting of D. Reisenfeld, ISSI, Bern, Switzerland.

3 May 2012 – L. Bengtsson: Renewable energies are unlikely to satisfy expected global demands with risks for irreversible changes of the Earth's climate, Royal Swedish Academy of Sciences, Stockholm, Sweden.

11 May 2012 – H. Opgenoorth: New methods for Mars - Express MARSIS data analysis, Overview of Aspera and Marsis results during the April May Earth Mars conjunction campaign, Solar wind effects at Mars during the first Earth Mars conjunction campaign in early 2010, 4th Mars Upper Atmosphere Network MUAN 9-11 May 2012, Uppsala, Sweden.

14 May 2012 – L. Bengtsson: Some further thoughts on geo-engineering, Max Planck Institute for Atmospheric Chemistry, Mainz, Germany.

22 May 2012 – L. Bengtsson: What is the climate system able to do "on its own"?, Bolin Symposium, Royal Swedish Academy of Sciences, Stockholm, Sweden.

22 May 2012 – R.-M. Bonnet: Séminaire De la Fusion Nucléaire au Changement Climatique: Le Soleil, Centre Spa-



Seminar on "Ejection of cool plasma into the hot corona" presented by Pia Zacharias at ISSI's premises.

tial de Liège, Université de Liège, Brussels, Belgium.

30 May 2012 – L. Bengtsson: The atmospheric water cycle: How will it change in a warmer climate?, South Korean Academy of Sciences, Seoul, South Korea.

14 June 2012 – R. von Steiger: HUGO in the sky, Espace Jean Tiguely-Niki de Saint Phalle, (with Daniel Schümperli and Lukas Frey), Fribourg, Switzerland.

21 June 2012 – M. Calisto: Influence of Galactic Cosmic Rays on the atmospheric composition and temperature, Swiss Physical Society Meeting, ETH Hönggerberg, Switzerland.

29 June 2012 – L. Bengtsson: The scientific contributions by Professor Aksel Wiin-Nielsen, Understanding atmospheric circulation and predicting the weather, World Meteorological Organization, Geneva, Switzerland.

Meetings

4-5 July 2011 – J.L. Culhane: UK Space Agency First National Space Conference, Warwick University, UK.

26-28 July 2011 – J.L. Culhane: From Atoms to Stars, Oxford University, Oxford, UK.

12-16 September 2011 – P. Zacharias: European Solar Physics Meeting 13, Rhodes, Greece.

19-23 September 2011 – M. Falanga: The Extreme and Variable High Energy Sky, Workshop, Chia Laguna, Italy.

3-5 October 2011 – M. Falanga: Europlanet Annual General Assembly and Board meeting, Nantes, France.

10-14 October 2011 – J.L. Culhane: Fifth Hinode Science Meeting, Cambridge, Massachusetts, USA.

21 October 2011 – SSAA General Assembly, Versoix, Switzerland.

16-22 October 2011 – R.-M. Bonnet: Board of Trustees Meeting Associated Universities Inc., Santiago, Chile.

11 November 2011 – R.-M. Bonnet: Programme Committee Meeting Summer School Alpbach 2012, Vienna, Austria.

21-25 November 2011 – P. Zacharias: "Filamentary Structure and Dynamics of Solar Magnetic Fields", ISSI Team Meeting led by I.N. Kitiashvili, ISSI, Bern, Switzerland.

28 November - 2 December 2011 – P. Zacharias: Visit to MPS, Katlenburg-Lindau, Germany.

13 December 2011 – J. L. Culhane: Opening of Centre for Space and Habitability, University of Bern, Switzerland.

13 January 2012 – J.L. Culhane: A comparison of solar eruption models from local and global perspectives: observation and theory, Royal Astronomical Society Discussion Meeting, London, UK, organized by J.L. Culhane (ISSI/MSSL), A. Hood (St. Andrews), B. Kliem (MSSL/Potsdam).

18-19 January 2012 – M. Falanga: INTEGRAL Users Group meeting, ESA/ESTEC, The Netherlands.

25 January 2012 – M. Falanga, A. Fischer, and R. von Steiger: Outreach Meeting, ESO Garching, Germany.

26 January 2012 – M. Falanga: Alpbach Summer School Program Committee Meeting, FFG, Vienna, Austria.

27-28 January 2012 – M. Falanga: Conference on Europlanet-RI Towards Sustainability, Vienna, Austria.

6-10 February 2012 – P. Zacharias: Workshop on Earth's Hydrological Cycle, ISSI, Bern, Switzerland.

11-15 February 2012 – R.-M. Bonnet: Discussion of the cooperation opportunities between ISSI and NSSC, Beijing, China.

20-24 February 2012 – P. Zacharias: Heating of the Magnetized Chromosphere: Confronting Models with Observations, ISSI Team Meeting led by B. De Pontieu and S. McIntosh, ISSI, Bern, Switzerland.

21-23 February 2012 – J.L. Culhane: Annual Meeting of the Virtual Atomic and Molecular Data Centre FP7 consortium, Vienna, Austria.

22-24 February 2012 – R.-M. Bonnet: Board of Trustees Meeting Associated Universities Inc., Washington DC, USA.

27 February - 1 March 2012 – P. Zacharias: Coronal Heating - Using Observables (flows and emission measure) to Settle the Question of Steady vs. Impulsive Heating, ISSI Team Meeting led by S. Bradshaw and H. Mason, ISSI, Bern, Switzerland.

12-16 March 2012 – R.-M. Bonnet: COSPAR Bureau Meetings, Chair Revision By Laws, Paris, France.

12-14 March 2012 – R. von Steiger: Cospar Science Advisory Committee and Cospar 2012 Program Committee, Paris, France.

16-17 April 2011 – J.L. Culhane: Hinode EUV Imaging Spectrometer (EIS) Science Team Meeting, Mullard Space Science Laboratory, Holmbury St Mary, UK.

18-20 April 2012 – J.L. Culhane: Spectroscopy of the Dynamic Sun, University College London, London, UK.

24 April 2012 – R. von Steiger: Editorial Committee of Space Science Reviews, Vienna, Austria.

26-27 April 2012 – J.L. Culhane: Ariel I: 50 Years of the UK in Space, Science Museum, London, UK.

6-8 March 2012 – P. Zacharias: An Assessment of the Accuracies and Uncertainties in the Total Solar Irradiance Climate Data Record, ISSI Team Meeting led by G. Kopp, ISSI, Bern, Switzerland.

12-16 March 2012 – P. Zacharias: SDO/IRIS/Hinode Workshop, Monterey, United States.

20-23 March 2012 – M. Falanga: Workshop on Positrons in Astrophysics, Müren, Switzerland.

16-20 April 2012 – P. Zacharias: Workshop on Microphysics of Cosmic Plasmas, ISSI, Bern, Switzerland.

7-11 May 2012 – P. Zacharias: Long-term Reconstruction of Solar and Solar Wind Parameters, ISSI Team Meeting led by L. Svalgaard, ISSI, Bern, Switzerland.

13-16 June 2012 – R.-M. Bonnet: Board of Trustees Meeting Associated Universities Inc., Ithaca, USA.

20-22 June 2012 – M. Falanga: INTEGRAL Users Group Meeting, ESA/ESTEC, The Netherlands.

Staff Activities



Panel Discussion on "Mission Apollo 16" at the Verkehrshaus Luzern with (from left to right) Charlie Duke (NASA Apollo-16 Astronaut), Lukas Viglietti (Swiss Apollo Association and organizer), Johannes Geiss (ISSI), and Claude Nicollier (Shuttle Astronaut ESA and EPFL Lausanne).

Honors

8 July 2011 - R.-M. Bonnet: Reception Speech of Struve Award "From F.J.W. Struve to James Webb", JENAM 2011, Saint Petersburg, Russia.

16 March 2012 - R.-M. Bonnet: The 2012 COSPAR International Cooperation Medal (presented at the 39th COSPAR Scientific Assembly in Mysore, India (July 2012)).

Chairman- and Memberships

L. Bengtsson:
Chairman of the Scientific Advisory Committee of the Nansen Centre (NERSC), Bergen, Sweden.
Chairman of the Italian Climate Program Advisory Committee.
Member of the Bert Bolin Centre for Climate Research.
Member of the Energy Committee of the Royal Swedish Academy of Sciences.

R.-M. Bonnet:
Chair Revision by laws COSPAR, Paris, France.
Vice-President, Institut Français d'Histoire de l'Espace, France.

J.L. Culhane:
Fellow of the UK Royal Society.
Chairman of the UK Space Action Network.
Member of the UK Space Agency Science Programme Advisory Committee.
Member of the Editorial Board of Space Policy.

M. Falanga:
Member of the Astronomy & Astrophysics Journal Board of Directors, Swiss representative from 2011-2013.
Member of the Alpach Summer School Program Committee, Swiss representative 2011-2012.
Member of INTEGRAL Users Group (IUG) from 2010-2012, ESA.
Member of the Editorial Board for Advances in Astronomy Journal.
Member of the LOFT Science Working Group "Dense Matter".
Member of the science organizing Committee conference on "An INTEGRAL view of the high-energy sky (the first 10 years)", Paris, France, October 15-19, 2012.

H. Opgenoorth:
Elected Honorary Fellow of the Royal Astronomical Society, UK, January 2012.
Appointed: Member of the European Space Science Committee of the ESF spring 2012 to spring 2015.
Member Editorial Board, J.AtM.Sol.Terr.Phys. (JASTP) and Space Weather, the international Journal of Research and Applications.
Convener of meetings and campaigns for the Mars Upper Atmosphere Network (MUAN).
Secretary, Planetary Space Plasma Physics, European Geophysical Union, EGU.

R. von Steiger:
Expert of the FP7 SPACE call of the EC, Brussels, Belgium, February 6-10, 2012.

Miscellaneous

J. Geiss: Mission Apollo 16, Panel Discussion with Charles Duke, Johannes Geiss, Claude Nicollier and Lukas Viglietti (Moderator), Swiss Apollo Association (SAA), Verkehrshaus Luzern, Switzerland, 8 and 9 October 2011.

Ågren, K., D.J. Andrews, S. Buchert, A.J. Coates, S.W.H. Cowley, M.K. Dougherty, N.J. T Edberg, P. Garnier, G.R. Lewis, R. Modolo, H. Opgenoorth, G. Provan, L. Rosenqvist, D.L. Talboys, J.-E. Wahlund, A. Wellbrock, Detection of currents and associated electric fields in Titan's ionosphere from Cassini data, *J. Geophys. Res.*, 116, A04313, doi:10.1029/2010JA016100, 2011.

Beer, J., K. McCracken, and R. von Steiger, *Cosmogenic Radionuclides – Theory and Applications in the Terrestrial and Space Environments*, Springer Heidelberg Dordrecht London New York, ISBN 978-3-642-14650-3, 2012.

Bengtsson, L., K.I. Hodges, S. Koumoutsaris, M. Zahn, N. Keenlyside, The changing atmospheric water cycle in Polar Regions in a warmer climate, *Tellus Series A-Dynamic Meteorology and Oceanography*, 63A, 907–920, 2011.

Bengtsson, L., K.I. Hodges, On the evaluation of temperature trends in the tropical troposphere, *Clim. Dyn.*, 36, 419-430, 2011.

Bengtsson, L., Foreword: International Space Science Institute (ISSI): Workshop on Observing and Modeling Earth's Energy Flows, *Surv. Geophys.*, 33, 333–336, 2012.

Bengtsson, L., P. Hardaker, Jean Labrousse Obituary, *Weather*, 66, 10, 283, 2011.

Bernardini, F., D. de Martino, M. Falanga, K. Mukai, G. Matt, J.-M. Bonnet-Bidaud, N. Masetti, M. Mouchet, Characterization of new hard X-ray cataclysmic variables, *Astron. Astrophys.*, 542, 22, 2012.

Bini, D., M. Falanga, A. Geralico, L. Stella, The signal from an emitting source moving in a Schwarzschild spacetime under the influence of a radiation field, *Class. Quantum Grav.*, 29, 065014, 2012.

Bonnet, R.-M., Preface in "L'Exploration Spatiale. Au Carrefour de la science et de la politique", by A. Ammar-Israël and J.L. Fellous, CNRS Editions, ISBN 978-2-271-07081-4, 2011.

Bonnet, R.-M., From F.J.W. Struve to James Webb, Reception speech of Struve Award, 5 July 2011, *EAS Newsletter*, Issue 42, 10, December 2011.

Bonnet, R.-M., Preface in "Thermodynamique de l'évolution", F. Roddier, ISBN 978-2-917141-32-8, Editions Pa-
role, 2012.

Bonnet-Bidaud, J.M., D. de Martino, M. Mouchet, M. Falanga, T. Belloni, N. Masetti, K. Mukai, G. Matt, The pe-

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cular source XSS J12270-4859: a LMXB detected by FERMI?, *Proc. The Golden Age of Cataclysmic Variables (Palermo 2011)*, in *Mem. Soc. Astron.*, 2011.

Bozzo, E., L. Pavan, C. Ferrigno, M. Falanga, S. Campana, S. Paltani, L. Stella, R. Walter, XMM-Newton observations of four high mass X-ray binaries and IGR J17348-2045, *Astron. Astrophys.*, in press, 2012.

Bozzo, E., A. Giunta, G. Cusumano, C. Ferrigno, R. Walter, S. Campana, M. Falanga, G. Israel, L. Stella, XMM-Newton observations of IGR J18410-0535: the ingestion of a clump by a supergiant fast X-ray transient, *Astron. Astrophys.*, 531, 130, 2011.

Calisto, M., P.T. Verronen, E. Rozanov, T. Peter, Influence of a Carrington-like event on the atmospheric chemistry, temperature and dynamics, *Atmos. Chem. Phys. Discuss.*, 12, 14747-14769, 2012.

Champion, A.J., K.I. Hodges, L.O. Bengtsson, N.S. Keenlyside, M. Esch, Impact of increasing resolution and a warmer climate on extreme weather from Northern Hemisphere extratropical cyclones, *Tellus Series A-Dynamic Meteorology and Oceanography*, 63, 5, 893-906, 2011.

D'Avanzo, P., S. Campana, T. Muñoz-Darias, T. Belloni, E. Bozzo, M. Falanga, L. Stella, *Astron. Astrophys.*, 534, 92, 2011.

Edberg, N.J.T., H. Nilsson, Y. Futaana, G. Stenberg, M. Lester, S.W.H. Cowley, J.G. Luhmann, T.R. McNulty, H.J. Opgenoorth, A. Fedorov, S. Barabash, T.L. Zhang, Atmospheric erosion of Venus during stormy space weather, *J. Geophys. Res.* 116, A09308, doi:10.1029/2011JA016749, 2011.

Falanga, M., L. Kuiper, J. Poutanen, D.K. Galloway, E.W. Bonning, E. Bozzo, A. Goldwurm, W. Hermsen, L. Stella, Spectral and timing properties of the accreting X-ray millisecond pulsar IGR J17498-2921, *Astron. Astrophys.*, in press, 2012.

Ferrigno, C., M. Falanga, E. Bozzo, P.A. Becker, D. Klochkov, A. Santangelo, 4U 0115+63: phase lags and cyclotron resonant scattering, *Astron. Astrophys.*, 532, A76, 2011.

Staff Publications

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Koumoutsaris, S., I. Bey, Can a global model reproduce observed trends in summertime surface ozone levels?, *Atmos. Chem. Phys. Discuss.*, 12, 2025-2056, doi:10.5194/acpd-12-2025-2012, 2012.

Koumoutsaris, S., What can we learn about climate feedbacks from short-term climate variations, *Tellus*, submitted, 2012.

Kortha, H., B.J. Anderson, T.H. Zurbuchen, J.A. Slavin, S. Perri et al., The interplanetary magnetic field environment at Mercury's orbit, *Planet. Space Sci.*, 59, 15, 2075-2085, 2011.

Lepri, S.T., J.M. Laming, C.E. Rakowski, and R. von Steiger, Spatially dependent heating and ionization in an ICME observed by both Ulysses and ACE, *Astrophys. J.*, submitted, 2012.

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Schmelz, J.T., D.V. Reames, R. von Steiger, and S. Basu, The composition of the solar corona, solar wind, and solar energetic particles, *Astrophys. J.*, 755:33, doi:10.1088/

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Zacharias, P., H. Peter, S. Bingert, Ejection of cool plasma into the hot corona, *Astron. Astrophys.*, 532, A112, 2011.

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Bello González, N., F. Kneer, R. Schlichenmaier, Shear and vortex motions in a forming sunspot – Twist relaxation in magnetic flux ropes, *Astron. Astrophys.*, 538, A62, 2012.

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Bykov, A.M., R.A. Treumann, Fundamentals of collisionless shocks for astrophysical application, 2. Relativistic shocks, *Astron. Astrophys. Rev.*, 19, 42, doi 10.1007/s00159-011-0042-8, 2011.

Bykov, A.M., G.G. Pavlov, A.V. Artemyev, Yu. A. Uvarov, Twinkling pulsar wind nebulae in the synchrotron cut-off regime and the γ -ray flares in the Crab Nebula, *MNRAS*, 421, 1, L67-L71, 2012.

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Cowee, M.M., S.P. Gary, Electromagnetic ion cyclotron wave generation by planetary pickup ions: One-dimensional hybrid simulations at sub-Alfvénic pickup velocities, *J. Geophys. Res.*, 117, A06215, doi:10.1029/2012JA017568, 2012.

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Dunlop, M.W., Q.-H. Zhang, Y.V. Bogdanova, M. Lockwood, Z. Pu, H. Hasegawa, J. Wang, M.G.G.T. Taylor, J. Berchem, B. Lavraud, J. Eastwood, M. Volwerk, C. Shen, J.-K. Shi, D. Constantinescu, H. Frey, A.N. Fazakerley, D. Sibeck, P. Escoubet, J.A. Wild, Z.-X. Liu, Extended Magnetic Reconnection across the Dayside Magnetopause, *Phys. Rev. Lett.*, 107, 025004, 2011.

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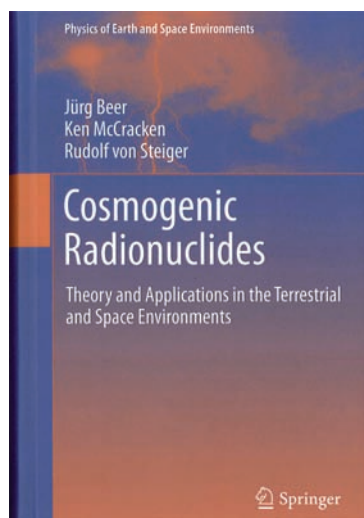
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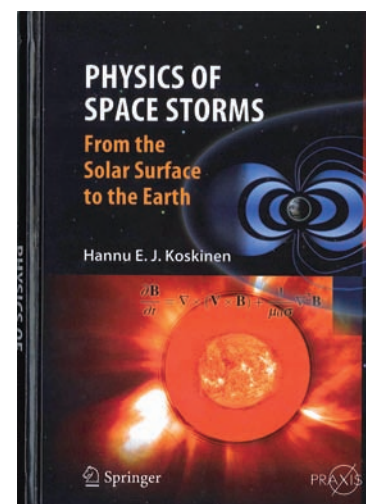
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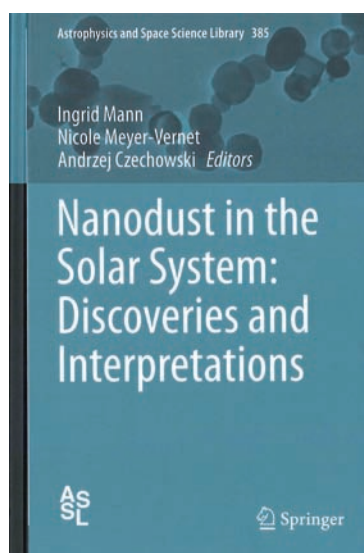
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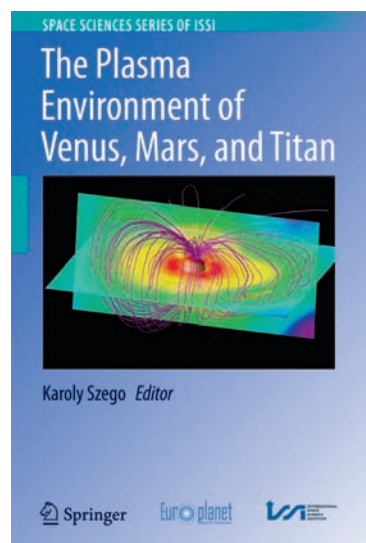
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edited by

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Volume resulting from an ISSI Workshop, published in 2012, Space Science Series of ISSI (SSSI), Volume 37. ISBN 978-1-4614-3289-0.

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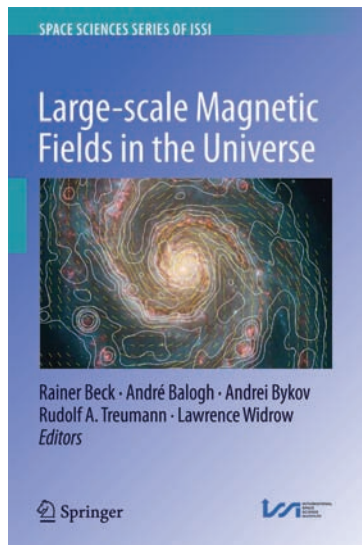
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Volume resulting from an ISSI Workshop, to be published in 2013, Space Science Series of ISSI (SSSI), Volume 39. ISBN 978-1-4614-5727-5.

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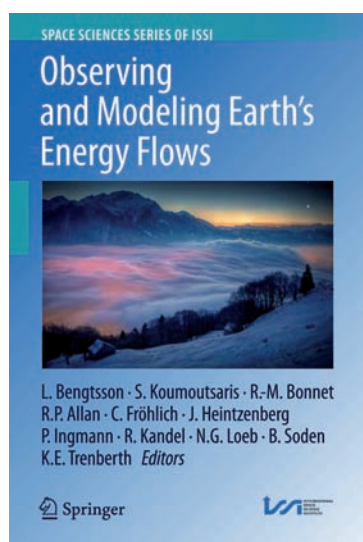
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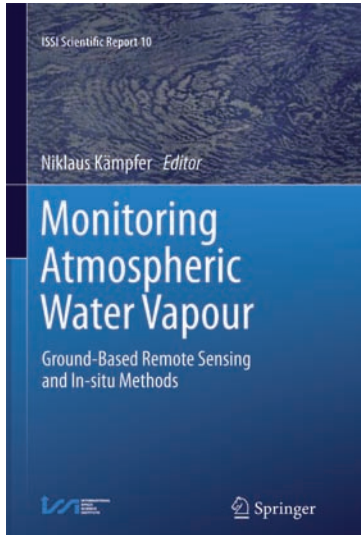
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Volume resulting from an ISSI International Team, published in September 2012, ISSI Scientific Report Series (SR), Volume 10, ISBN 978-1-4614-3908-0.

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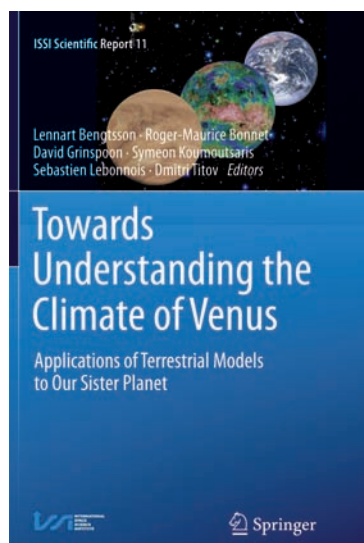
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Towards Understanding the Climate of Venus

Applications of Terrestrial Models to Our Sister Planet

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Volume resulting from an ISSI Working Group, to be published in November 2012, ISSI Scientific Report Series (SR), Volume 11, ISBN 978-1-4614-5063-4.

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