

# ANNUAL REPORT 2023







## IMPRINT

ISSI-BJ 2023 Annual Report

**Address** No. 1 Nanertiao, Zhongguancun, Haidian District, Beijing, China  
Postcode: 100190  
+86-10-62582811  
info@issibj.ac.cn  
www.issibj.ac.cn

**Editor/Graphic Design** Francesca Garfagnoli

## COVER PAGE

Bubbles composed of 7 images (from bottom left to top right):

1. Promotional poster of the 22 November 2023 Infinite Horizons Seminar on "X-ray Tomography of Hidden Matter in the Universe".
2. Group photo of the third Space Science School participants and organizers.
3. Photo of a blue moon (credit: Mark Roy/Wikimedia).
4. Group photo of the International Team on "Understanding Electron-scale Magnetic Structures in Space Plasmas".
5. Promotional poster of the 3rd China-ESA Mars Advanced School.
6. Large-scale render through the Illustris volume at  $Z=0$ , centered on the most massive cluster, 15 Mpc/H deep ( credit: Illustris Collaboration).
7. Cover of the Space Science Series of ISSI No. 88 "The Heliosphere in the Local Interstellar Medium".

## BACK COVER

Bubbles composed of 4 images (from bottom left to top right):

1. Yuri Gagarin; the first human to reach space in 1961 (credit: NASA).
2. Group photo of the Forum on "Detecting Missing Baryons in the Universe", held at ISSI-BJ 20-21 July, 2023.
3. Photo of the Earth (credit: NASA).
4. Photo of the Parker Solar Probe from the 2018 NASA mission (credit: JHU/APL).

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# INTRODUCTION

## Message from the Chairman of the Board of Trustees



Looking back to 2023, it was a year of milestones and transformative growth for our Institute, as we celebrate our 10th anniversary in a new era of international cooperation and scientific exploration, amidst

dramatic changes in the international environment.

The impact of the pandemic on our operations was still felt, but we were able to demonstrate our resilience and innovation. We maintained our commitment to advancing space science, with lots of online activity and a smooth transition to face-to-face events when conditions allowed. Our 10th anniversary coincided with the revival of face-to-face exchanges, giving us the opportunity to reconnect with the international space science community and reinvigorate our collaborative spirit.

The annual calls for International Teams have been the lifeblood of our collaborative research efforts. In 2023, we were delighted to bring together the teams approved during the pandemic for face-to-face meetings, resulting in fruitful outputs, and reflected in the number of truly impactful publications.

The forums and workshops organized by ISSI-BJ have been instrumental in shaping the discourse on critical scientific and policy issues. The forum on “Detecting Missing Baryons in the Universe” in 2023 was particularly noteworthy, setting the agenda for future space missions and research directions.

Our outreach activities have played a crucial role in engaging the public and inspiring the next generation of space scientists, while our educational initiatives, such as the Joint Space Science School with APSCO and the China-ESA Mars Advanced School, have provided invaluable training and opportunities for students and young scientists.

As we look to the future, ISSI-BJ stands ready to take on new opportunities together with big challenges, driven by our passion for exploration and discovery. We are committed to continuing our mission of advancing space science for the benefit of humanity.

On the management side, I would like to express special thanks to Prof. Wing-Huen Ip for his very generous enthusiasm and contribution in leading the development of ISSI-BJ in challenging conditions. We also welcome our new Executive Director, Prof. Richard de Grijs. In the second half of 2023, he already demonstrated his enthusiasm and capability for this new job. Finally, I would like to thank the excellent staff of ISSI-BJ, Lijuan En, Yinong Li, and Francesca Garfagnoli, for their daily work, as well as Xiaolong Dong and Xiaoyu Li for their efficient administrative support, making ISSI-BJ successful as ever. We hope that ISSI-BJ, led by its new Executive Director, Prof. Richard de Grijs, will continue to develop even further.

A large, stylized handwritten signature in black ink, which appears to read 'WU Ji'.

WU Ji,  
Beijing, December 2023



## Message from the Executive Director



Now that we have made it unscathed into 2024, it is my privilege to write my first foreword to an ISSI-Beijing Annual Report, as Executive Director. And although my appointment only took effect in July 2023, I must confess that the year has passed like a whirlwind.

It was the year when China fully reopened to the world and in-person activities resumed in earnest—including at ISSI-Beijing. My predecessor, Prof. Wing-Huen Ip, steered the institution through the difficult COVID years. His efforts allowed me to take the helm without any undue challenges shortly after the first in-person events had taken place in the post-COVID era.

When I received the offer of appointment from the ISSI-Beijing Board of Trustees, it felt as a culmination of many years of varying levels of involvement with the ISSI brand. I had been engaged with ISSI-Beijing from its inception in 2013, as advisor to the Executive Director (I was, at the time, employed at Peking University), as lead convener of a Workshop on the astronomical distance scale, as strategic partner in a Forum that had been convened to brainstorm about the future of ISSI-Beijing, and as Discipline Scientist (Astrophysics) for the final few years of my appointment at Peking University.

Earlier in my career, I had successfully led two International Teams at ISSI Bern, and so I was indeed very familiar with the tools employed by both ISSI and ISSI-Beijing. Meanwhile, I had moved to Australia, as Associate Dean (Global Engagement) of Macquarie University's Faculty of Science and Engineering. That latter role ceased after my initial three-year appointment, given that Australia's international borders were shut to non-citizens during the height of the COVID years, and there was no global engagement to speak of. So when the role of Executive Director became available at ISSI-Beijing, it felt like I might be able to hit the ground running.

At times, the flurry of activities undertaken at the institution must have felt like drinking from a firehose to our office staff. Long-delayed International Team meetings were rescheduled, a Forum on "Detecting missing baryons in the Universe" was convened by former ISSI-Beijing Executive Director Prof. Maurizio Falanga, we successfully organised the third Space Science School in Thailand with

our friends at APSCO (the Asia-Pacific Space Cooperation Organisation), proposals for future Forums and a Workshop were considered by the Science Committee—and endorsed—and numerous strategic opportunities were considered, debated, and acted upon. Meanwhile, we appointed a new international public relations and publications manager, who joined the office team mid-year.

ISSI-Beijing has, hence, successfully re-engaged with the community of international space scientists. We have a number of new initiatives in mind for 2024. We will host more new—and delayed—International Teams, several Forum meetings, and at least one Workshop this year. We also anticipate the re-launch of occasional Understanding Science public lectures, in addition to our continuing online seminar series (rebranded as Infinite Horizons) and joint colloquia with our friends at the National Astronomical Observatories, Chinese Academy of Sciences.

We have now attained a new operational equilibrium within our small team of dedicated staff, including my Administrative co-Director Prof. Xiaolong Dong, his deputy Dr. Xiaoyu Li, and our capable and enthusiastic office staff, Lijuan En and Francesca Garfagnoli. Our interactions with both the Board of Trustees (represented by its Chair, Prof. Ji Wu) and the Science Committee and its Chair, Prof. Emmanuelle Javaux, are going from strength to strength, as is the working relationship with our bigger and more established 'cousin' in Bern.

ISSI-Beijing is well-placed to become the prime networking venue for space scientists in the far East, where scientific excellence should drive progress and bring together diverse communities in a friendly, inclusive, and politically neutral environment. This requires hard work and dedication. Fortunately, we have an excellent support team in place, both in Beijing and in the form of a senior advisor (Prof. Fabio Favata) and four top-level expert Discipline Scientists from China, Japan, South Korea, and Australia. The future looks bright. I am excited to have the opportunity to shape developments at ISSI-Beijing in the near term.

Watch this space!

A handwritten signature in dark ink, appearing to read 'R. de Grijs', with a stylized, looping flourish at the end.

Richard de Grijs  
Beijing, January 2024

## About ISSI-BJ



The International Space Science Institute Beijing (ISSI-BJ) is a non-profit research institute jointly established by the National Space Science Center (NSSC) and the International Space Science Institute (ISSI) with the support of the International Cooperation Bureau of the Chinese Academy of Sciences and the Strategic Priority Program on Space Science. ISSI-BJ is a close cooperation partner of ISSI in Bern. Both institutes share the same Science Committee, the same study tools, and other information of mutual relevance and interest. However, both use independent operational methods and different funding sources.

The main mission of ISSI-BJ is to contribute to the achievement of a deeper scientific and technological understanding of future space missions as well as of the scientific results from current and past missions through multidisciplinary research, possibly involving whenever felt appropriate, ground-based observations and laboratory experiments. The Program of ISSI-BJ covers a widespread spectrum of space science disciplines, including solar and space physics, planetary science, astrobiology, micro-gravity science and Earth observation. It offers a complement to the ISSI program with special emphasis on future scientific opportunities.

## History

In October 2011, Professor Ji Wu, the Director General of the National Space Science Center (NSSC), visited the International Space Science Institute (ISSI). He proposed to establish an International Space Science Institute in Beijing (ISSI-BJ) during his visit.

In February 2012, Simon Aegeter, Chairman of ISSI's Board of Trustees and Roger-Maurice Bonnet, Executive Director of ISSI, visited NSSC for further discussion. Both parties exchanged opinions and signed a Memorandum of Understanding (MoU) which was approved by the ISSI Board of Trustees (BoT) in June

2012. On April 19, 2013, the BoT of ISSI signed the Agreement of Cooperation with NSSC and approved the implementation plan of cooperation between ISSI and ISSI-BJ. It was decided, for the first time in the history of ISSI, to share the name with another institution. This decision was made because it was convinced that NSSC is an extremely trustworthy partner. According to this decision, ISSI and NSSC moved forward on the implementation plan for establishment of ISSI-BJ.

The inauguration ceremony of ISSI-BJ was held at the NSSC in Beijing on July 16, 2013. Professor Rafael Rodrigo, Executive Director of the International Space Science Institute, and Professor Ji Wu, Chairman of the BoT of ISSI-BJ and Director General of NSSC, jointly inaugurated the new institute located on the 3rd floor of the NSSC building. In 2013, the ISSI-BJ Board of Trustees elected Professor Maurizio Falanga from Switzerland to head the Institute as its Executive Director.

A brainstorm Forum on the strategy of ISSI-BJ was held in November, 2014, and a international visiting assessment committee was established to evaluate the performance of ISSI-BJ. The international visiting assessment reports gave ISSI-BJ a very good credit and concluded that ISSI-BJ had a good start and had been gaining excellent reputations from the international science communities. Based on the evaluations, NSSC and ISSI agreed to continue their cooperation in support of ISSI-BJ. The Boards of Trustees of ISSI-BJ and ISSI approved assessment report and the new agreement in April and June, 2015, respectively. Therefore, on October 23, 2015, Professor Ji Wu, Director-General of the National Space Science Center of the Chinese Academy of Sciences (NSSC) and chair of the Board of Trustees of the ISSI-BJ, and Professor Rosine Lallement, representative and vice chair of the Board of Trustees of ISSI, signed a new agreement, which confirmed the cooperation of the sides as regards the continuation of ISSI-BJ. According to the new agreement, the cooperation will last for at least three years and after the specified period of three years, the agreement can be extended.

Finally, in 2022 a new contract was signed after unanimous approval by all parties, stating that the cooperation between ISSI-BJ, ISSI and NSSC, CAS will continue for three more years.

## ISSI-BJ 10<sup>th</sup> Anniversary



2023 marked the 10th anniversary of ISSI-BJ. So many engaging and stimulating events have happened over the course of the last ten years. The institution has hosted and organized countless International Teams, Forums, Workshops and Working Groups; three Space Science Schools, and three Mars Advanced Schools.

To celebrate all of these achievements, and discuss future plans and approaches, ISSI-BJ organized the symposium “Space Science in the Next Decade”. On the evening of July 10<sup>th</sup>, after the Board of Trustees’ team building meeting, where representatives of the funding institutions discussed the work accomplished at the Institute, all members were able to enjoy a delicious meal during the annual dinner.

The second day, on July 11<sup>th</sup>, six talks were given over the course of the morning. The seminar started with Prof. Jiang Jie, who talked about “Nonlinear and stochastic mechanisms of the solar cycle and their implications for the cycle prediction”, and continued with Prof. Alessandro Bemporad discussing on “The multiband Metis coronagraph on board the Solar Orbiter mission: first results”, and Prof. Xiaoshuai Zhu discussed “Modeling the magnetic field in the solar atmosphere”. After the break, the Symposium continued with the lecture of Prof. Takehiko Satoh on “Studying planetary atmospheres with the space missions”, an online lecture on “Exoplanet science from 2023-2033” given by Prof. Kevin Heng, and finally, the last talk was given by the new ISSI-BJ Executive Director Prof. Richard de Grijs, discussing this “Vision of ISSI-BJ in the coming decade”.



# ISSI-BJ SCIENTIFIC PROGRAMS

ISSI-BJ is an institute with the mission to serve the space science communities in multi-lateral and multi-disciplinary activities. ISSI-BJ is open to support projects from any Asian or international scientists or institutes, encouraging the scientists to work together in Beijing.

## Research Tools



Workshops are selected by the ISSI and ISSI-BJ Directors in consultation with the Science Committee. The programs and speakers are defined by a group of highly qualified experts serving as conveners. The Workshops can be attended by up to 50 invited scientists and experts. The results of the Workshops' discussions will be published in the Springer *Space Science Series*.



Working Groups are set up for specific tasks, also of a technical nature. The results of the Working Group's activities will be published as volumes in the Springer *ISSI Scientific Report Series* (SR) and in the scientific literature.



International Teams are composed of about 8-12 scientists from different institutes and nationalities, covering a wide range of expertise. They hold two or three one-week in person meetings at ISSI-BJ or at ISSI-BJ and ISSI Bern over a period of 12 to 18 months. During their weeklong meetings, they are expected to work collaboratively on data analysis and interpretation.

The main purpose of International Teams is to carry out a research project that will result in publications in peer-reviewed international scientific journals. The team's activity is directed and organized by a team leader (who is usually also the proposal's initiator). Although they will operate in close contact with the ISSI-BJ scientific staff, teams are largely autonomous in the execution of their projects.



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



Senior and Junior Visiting Scientists carry out scientific work in collaboration with, or under the supervision of the ISSI-BJ scientific staff on matters directly or indirectly connected with the ISSI-BJ projects. They contribute to the scientific environment at ISSI-BJ in complement to the ISSI-BJ scientific staff.



ISSI-BJ Space Science School is a biennial school for international students dedicated to research of space sciences and space science missions' topics. It teaches students to draw connections and links between scientific objectives and requirements, missions and spacecraft design, and mission costs. In other words, its aim is also to adopt a comprehensive approach for the successful design of space science missions. The students are in fact provided with the required scientific background relevant to produce a report outlining a possible space science mission concept.

## How to Use ISSI-BJ Tools



### INTERNATIONAL TEAM

1. A joint call for proposals is released by ISSI/ISSI-BJ every year in January.
2. Submit your proposal corresponding to the topics broadly identified in the Call.
3. The proposals are evaluated, prioritized and recommended to ISSI-BJ by the ISSI/ISSI-BJ Science Committee.
4. The activity is directed and organized by a team leader who is usually the initiator of the proposal to ISSI-BJ.
5. The team holds a series of two to three one-week meetings over a period of 12 to 18 months.
6. The results of Teams are published in scientific journals

### WORKSHOP, WORKING GROUP & FORUM

1. There is no annual call. The scientific community can put forward suggestions at any time on future Workshops and Forums.
2. Submit a summary of maximum one page, explaining the proposal topic, the rationale to organize the event at ISSI-BJ and the list of proposers.
3. The proposals are evaluated, prioritized and recommended by the Executive Director.
4. The activity is organized by the conveners.
5. The activity is held at ISSI-BJ.
6. The activity outcome is prepared and published.

## ISSI-BJ Code of Conduct

All collaborations at ISSI-BJ must strive to achieve a professional, positive and inclusive experience for everyone, even in a virtual environment, in written or spoken form. We expect that ISSI-BJ meeting attendees abide by the following principles:

- We are committed to providing a friendly, safe and welcoming environment for all colleagues and international participants.
- We expect everyone to treat one another with respect, dignity and courtesy.
- We expect that people will refrain from demeaning and/or discriminatory behaviour and/or speech.
- Everyone should be mindful of their surroundings and remember that this is a workplace where professional interactions are expected and should be the norm.
- Unacceptable behaviour includes intimidating, harassing, abusive, discriminatory, derogatory or demeaning conduct.
- Keep in mind that when communicating virtually, many clues we typically derive from nuances of emotion, tone and body language are lost. This makes it all the more important to consider the content and tone of contact and communication, so as to avoid misinterpretation or miscommunication.
- Respect requests about (not) copying and use of materials and ideas, including knowing when you may need to obtain permission regarding copying materials.

# International Teams

Since 2014, every year in January ISSI-BJ and ISSI jointly release the Call for International Teams in Space and Earth Sciences to invite proposals for study projects from internationally collaborating teams of scientists from different institutions.

## 1. Zhu X. (CN) & Chifu I. (DE)



### MAGNETOHYDROSTATIC MODELING OF THE SOLAR ATMOSPHERE WITH NEW DATASETS

Session: July 10-14, 2023

Abstract: Gaining insight into the magnetic fields and plasma in solar active regions is very important for studying various solar activities. So far the main approach to obtaining the three-dimensional (3D) magnetic field structure of active regions is to extrapolate the magnetic field from magnetograms measured in the photosphere. A basic assumption in the past was to completely neglect all plasma effects and to perform the so-called force-free field (FFF) extrapolations. A couple of methods (e.g. PFSS, linear FFF, nonlinear FFF) are available. Among these methods, till now, the NLFFF performed the best when compared with observations. While the force-free assumption is well justified in the solar corona, it is not the case in the photosphere and chromosphere. New approaches that take into account plasma forces (e.g., plasma pressure and gravity) developed rapidly in the last decade, for example magnetohydrostatic (MHS) extrapolations. It was found that the MHS extrapolation when applied to simple test cases performs better than the NLFFF extrapolation in terms of the accuracy of the reconstructed magnetic field. To calculate the plasma forces correctly, the MHS extrapolation requires a very high-resolution magnetogram ( $<100$  km) which could not be obtained regularly in the past. However, such regular measurements of the magnetic field are possible with the advent of the Daniel K. Inouye Solar Telescope (DKIST). Moreover, the Solar Orbiter (SolO) provides an additional view angle which helps to constrain the magnetic field modelling.


## 2. Alessandro Bemporad (IT)

### SOLAR ERUPTIONS: PREPARING FOR THE NEXT GENERATION MULTI-WAVEBAND CORONAGRAPHS

Session: July 10-14, 2023

Abstract: Space- and ground-based coronagraphs, together with EUV space-based imagers, are the only instruments capable of providing observations of Coronal Mass Ejections (CMEs) from their early acceleration phases to interplanetary propagation. As the study of these phenomena is key for our understanding of how the Sun interacts with planets and modulates the whole Heliosphere, coronagraphs will be on-board the recently launched and upcoming solar missions, such as the ESA Solar Orbiter and PROBA-3 missions, the Chinese ASO-S mission, the Indian Aditya-L1 mission. These future coronagraphs will provide a new capability that was almost unexplored so far: the acquisition of coronagraphic images in multiple narrow-band spectral ranges, from visible light (VL) to ultraviolet (UV). Moreover, next space- (Aditya-L1/VELC) and ground-based coronagraphs (UCoMP, CorMAG) will acquire spectro-polarimetric observations to measure the weak coronal magnetic fields.

The analysis of these innovative data will require the development and testing of new diagnostic techniques to determine not only the CME plasma densities (usually done from broad-band VL images), but also other parameters such as the electron temperature, line optical thickness, filling factors, and magnetic fields. The goal of the proposed Team at ISSI-BJ is to investigate how the CME properties affect the expected emission in the future multi-waveband coronagraphic observations, with the aim of developing new diagnostic techniques to tackle the open

Note:  used to mark the joint ISSI/ISSI-BJ teams



science questions on CMEs. This will be done by building synthetic data based on existing MHD simulations, testing new diagnostics with synthetic data inversion, and by applying the newly developed techniques to existing and future data.

3. Li Ran (CN)

STRONG GRAVITATIONAL LENSING STUDIES WITH CSS-OS AND EUCLID

Session: September 11-15, 2023

Abstract: Strong lensing systems provide a unique laboratory in which to study the fundamental physics of the Universe and the evolution of galaxies. Two next-generation space-based surveys, the Chinese Space Station Telescope survey (CSS-OS) and the ESA Euclid mission, will increase the number of known strong lenses by more than two orders of magnitude, and survey them all with high-resolution imaging in near-UV to infrared wavelengths. We propose an international team comprising experts in strong lensing from both missions, to explore the potential scientific return of a joint analysis of the combined data.

4. Li G. (US) & Wang L. (CN)

USING ENERGETIC ELECTRON AND ION OBSERVATIONS TO INVESTIGATE SOLAR WIND STRUCTURES AND INFER SOLAR WIND MAGNETIC FIELD CONFIGURATIONS

Session: September 18-22, 2023

Abstract: Solar electron events are common phenomenon observed in interplanetary space. Electrons from  $< 1$  keV to  $> 300$  keV are often observed in these events with an occurrence rate near the earth of  $\sim 190$  events per year during solar maximum and  $\sim 10$  per year during solar minimum [Wang et al., 2012]. In many of these events 3He ions are also observed at a significantly enhanced level. A majority of these events is related to small flares and they have no fast coronal mass ejections (CMEs) associated with them.

Thus the underlying acceleration process is confined both spatially and temporally. Once they are accelerated and escape from the Sun, high energy electrons and ions propagate along the interplanetary magnetic field and scatter off various plasma waves. Observational characteristics (time intensity profiles and



Group photo of the International Team on “Understanding Electron-scale Magnetic Structures in Space Plasmas”

spectra) of these electrons and ions provide a probe of the configuration and turbulence level of the interplanetary magnetic field. Recent observations from multiple spacecraft (e.g. STEREO-A/B, Wind, and ACE) showed that electrons and ions in many of these events can be observed over a longitudinal separation of  $> 90$  degrees or larger. What causes these large separations? Could it be due to large cross field diffusion or due to significant field line meandering, or perhaps the magnetic field near the Sun experiences a significant divergence within a few solar radii? To answer these questions, we propose a comprehensive investigation which includes both observations and simulations, to be carried out by a group of experts in solar and heliospheric theory, modelling, and observations. With these combined studies, we aim to reveal the interplanetary magnetic field configuration in solar electron events. We will also quantify the solar wind turbulence level in these events through numerical simulation, obtain particle mean free paths; and using the resulting mean free path parameter to classify events into scatter-free and scatter-dominated cases. We will construct an event database which can be used by the heliospheric community. We have collected a team with significant expertise in solar and heliospheric modelling, theory, observations and instrumentation. Such a diverse team will allow successful execution of the proposed study.

5. Elena Grigorenko (RU) & Huishan Fu (CN) UNDERSTANDING ELECTRON-SCALE MAGNETIC STRUCTURES IN SPACE PLASMAS

Session: October 30- November 3, 2023

Abstract: The main scientific objective of this team is discussing the key problems concerning electron physics and the important process of energy conversion and dissipation in space plasmas: magnetic reconnection, current sheet instabilities and disruption. These are the major points of discussion: 1) searching for electron diffusion region of magnetic reconnection in the Earth's magnetopause by using machine learning (Dr. S. Toledo); 2) searching of ion-scale reconnecting current sheets (Ms. I. Albert); 3) electron current sheets in the Earth's magnetotail (Prof. R. Wang); 4) energy dissipation in filamentary currents in flux



ropes (Dr. S. Wang); 5) interaction between magnetic island and dipolarization fronts; 6) Electron structure of dipolarization fronts (Dr. J. Hwang); 7) current sheets generated by unmagnetized electrons as the sources of fast electron tearing (Prof. L. Zelenyi and Dr. O. Tsareva); 8) methods of analysis of multiscale current structures in different plasmas (Prof. M. Dunlop) 9) methods of analysis of 3D electron scale magnetic structures in different plasmas (Prof. H. Fu); 10) electron-scale currents in turbulent plasma and generation of strong electric fields (Dr. E. Grigorenko, Mr. M. Leonenko).

6. Li Bo (CN) & Nakariakov V. (UK) MAGNETOHYDRODYNAMIC WAVETRAINS AS A TOOL FOR PROBING THE SOLAR CORONA

Session: December 04-08, 2023

Abstract:

Magnetohydrodynamic (MHD) wave-caused perturbations abound in the highly structured solar corona, with their measurements key to the flourishing field of coronal seismology. However, these perturbations are seldom as ideal as canonically theorized. Rather, they tend to appear as isolated or intermittent sequences of wavetrains (WTs), here broadly taken to refer to wave motions localized in time and space with or without envelope modulation. While already heavily involved in the establishment of coronal seismology, WTs have been shown to be ubiquitous only in the past decade. This stride was made possible largely due to the availability of cutting-edge instruments with ever-increasing temporal and spatial resolution. WTs are now known to be associated with a diverse set of eruptive activities, ranging from microflares to miniature jets to fully-fledged flares and coronal mass ejections (CMEs). Likewise, WTs have been identified in post-flare loops, quiescent active region loops, polar plumes, as well as the flanks and wakes of CMEs. On the theoretical side, WTs are known to encode a rich set of information not only on their excitors and host media, but also on the processes that shape their hosts. Nonetheless, available studies on WTs remain to be conducted largely on an individual basis by disparate groups with their own focuses/emphases.

## Forum

### Detecting Missing Baryons in the Universe

July 20-21, 2023

Conveners: Bregman Joel, Cui Wei, Falanga Maurizio, Fang Taotao , McCammon Dan, Mitsuda Kazuhisa, Simionescu Aurora, Yamasaki Noriko, Yuan Feng

The goals of this ISSI-BJ forum were to discuss the problems of missing baryons on scales of galaxies and large-scale structures and to make plans for X-ray missions that are dedicated to solving these problems. The missing baryons are deemed to constitute a major component of the circumgalactic medium (CGM) and intergalactic medium (IGM), but they are difficult to observe due to the limitations of the current instrumentation, and thus, they represent a key obstacle to our understanding of the galaxy evolution. During this activity, the forum participants will discuss the results yielded from cosmological hydrodynamical simulations on the properties of the hot CGM and IGM, the observational evidence for their existence, and the implications on galaxy evolution. Moreover, it will be discussed how to fill the observational gap of directly detecting the missing baryons and thus measuring their properties and distributions. Since they are postulated to exist in the form of low-density, hot CGM/ IGM and to radiate mainly in soft X-rays,

the discussions will center on effective X-ray means. To this end, a number of proposed mission concepts will be presented. Consensus will be sought on an optimal strategy to collectively push for a high- resolution X-ray spectroscopic mission and to sustain the momentum over the long run. Besides the subject of missing baryons, the participants will also discuss some important scientific issues related to the topic that can benefit from high- resolution X-ray spectroscopic observations, including diffuse X-ray background, supernova remnants, and cluster outskirts, as well as techniques of modeling the high-resolution X-ray spectra obtained.

Objectives of the Forum:

- Census of cosmic baryons
- Theoretical understanding of missing baryons
- Recent observations of WHIM and implications
- High resolution X-ray spectroscopic observations and modeling
- Synergies and collaborations



Group photo of the Forum on “*Detecting Missing Baryons in the Universe*”



# The 3rd China-ESA Mars Advanced School

May 20-21, 2023

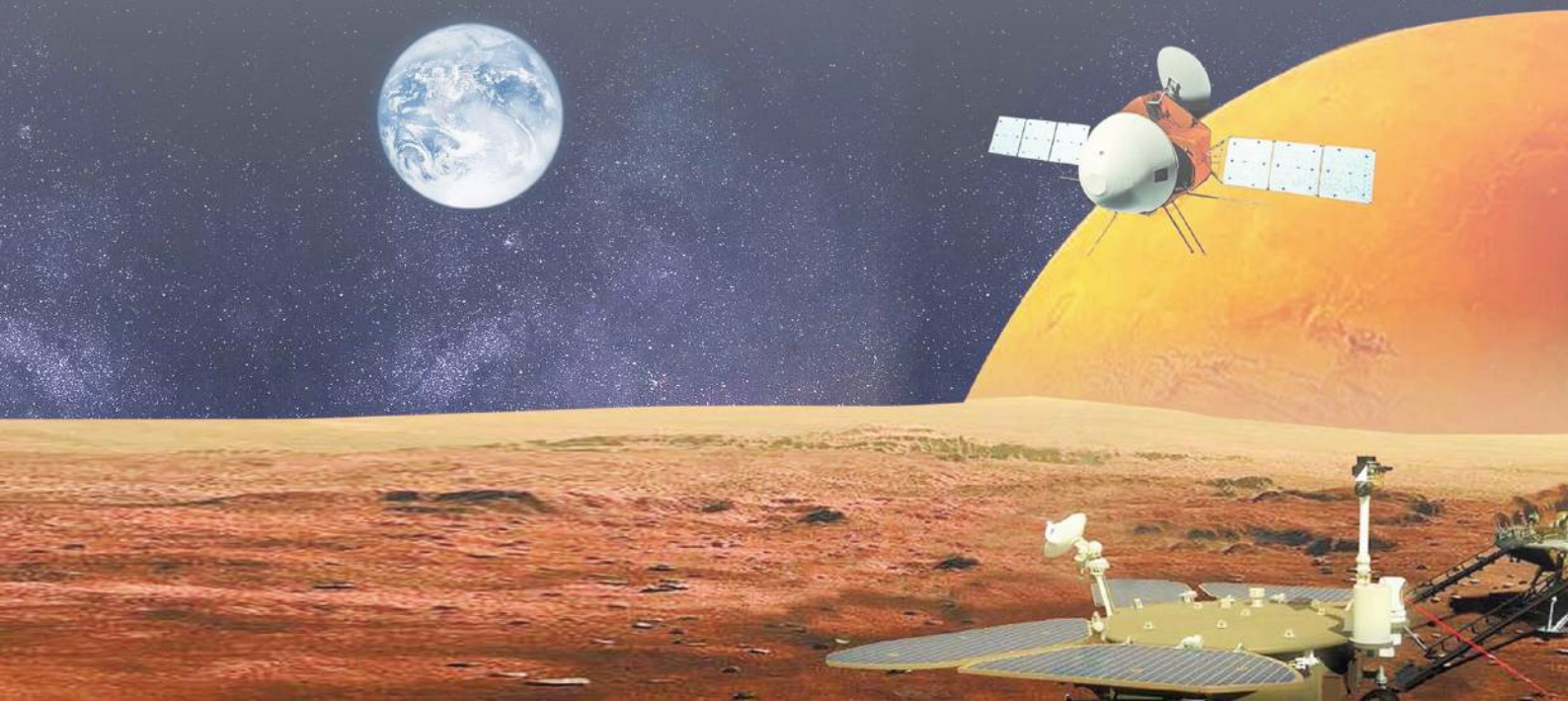
Science Organising Committee: Colin Wilson, Yang Liu, Jun Cui, Jingnan Guo, Ana Plesa, Louisa

The third China-ESA Mars Advanced School was jointly organised by the International Space Science Institute - Beijing (ISSI-BJ) and the European Space Agency (ESA), co-sponsored by National Space Science Center, Chinese Academy of Sciences (NSSC, CAS).

Inspired by the scientific investigations conducted by an ever-growing fleet of missions, the Mars School aimed to provide a broad overview of Martian planetary science, from its interior and surface to its atmosphere and interactions with space. Lectures covered theoretical background & modelling to observation techniques & datasets, as well as the search for past or present life. The school also included breakout discussions, social excursions, a poster session and also a hands-on session with Mars mission data.

## List of lecture topics:

- Interior structure & evolution
- Volcanism & tectonism
- Mineralogy and climate evolution
- Aqueous surface processes
- Geomorphology / landscape evolution
- Atmospheric dynamics
- Atmospheric chemistry
- Upper atmosphere / thermosphere
- Aeronomy (airglows, aurorae etc)
- Space weather & radiation environment
- Magnetosphere / solar wind interaction & escape
- Habitability and the search for life on Mars
- Chinese Mars missions – science investigations
- European Mars missions – science investigations.



## Third ISSI-BJ Space Science School



Group photo of the participants and organizers of the 3rd Space Science School

On October 17–24, 2023, the 3rd ISSI–BJ and APSCO Space Science School on Exploring the Moon was held at the Sirindhorn Center for Geo-Informatics (SCGI) located in the Space Krenovation Park (SKP), Si Racha, Chon Buri Province, Thailand. Throughout the School, 6 lecturers and 2 tutors from China shared their knowledge and experience with 25 students from 8 countries.

The school was intended for Master's and Ph.D. students, as well as post-doctoral and early career scientists or engineers. The school provided the participants with the in-depth knowledge of the Lunar sciences, observational methods and its relevance to applications. It also helped the students build links between participants, and between teachers and participants in order to facilitate future collaboration in Lunar or Planetary sciences. It facilitated and initiated different discussions in an international and multi-disciplinary way; encouraged creativity and provided the contacts for the participants to develop a professional network.

The School started with a short introduction to the school, given by the organizers: Prof. Maurizio Falanga, Executive Director of the International Space Science Institute (ISSI), Dr. Ebrahimi Mohammad Seyedabadi, Director General of

Education and Training of the Asia-Pacific Space Cooperation Organization (APSCO), and Ms Pranpriya Wongsra from the Geo-informatics and Space Technology Development Agency (GISTDA).

The first two days of the School were dedicated to introductory lectures focusing on craters, water and the geology of the Moon. These lecturers were given by invited speakers, chosen among experts and well-recognized scientists and engineers with an excellent reputation in teaching and supervising participants.

On the following days, experts such as Prof. Xiao Long, from the China University of Geosciences, Wuhan, and Prof. Huang Jun, from the China University of Geosciences, Wuhan, gave an overview of the Chang E space exploration mission and data, with a particular focus on imaging and spectral data. After Prof. Xiao Zhiyong's (Sun Yat-sen University, China) talk on the impact craters and crater chronology on the moon, and the lecture on the shallow subsurface of the moon by Prof. Xu Yi (Macau University of Science and Technology, China), the following lectures by Prof. Ding Min from the Macau University of Science and Technology, China, concluded the lecturers of the Space Science School.



After two days of lectures, the students were divided into two Working Groups, depending on their expertise and background: Understanding the Gravity Field of the Moon, and Field Geology of the Moon. The groups were to analyze evolution and geological events of the Moon. Each group had its own theme and agenda using actual observations, as well as computer models. The different groups were supported and guided by expert tutors.

#### *Understanding the Gravity Field of the Moon:*

The purpose of the Working Group on Understanding the Gravity Field of the Moon was doing research on high-resolution gravity data from the Gravity Recovery and Interior Laboratory (GRAIL) mission and compared those data with other terrestrial planets. These data have made it possible to investigate spatial variability of crustal porosity, depth-dependent megaregolith structure, and internal structures of small-scale geologic features from impact craters to lava tubes and rifts. Comparison between the Moon and the other terrestrial planets help us obtain deeper insights into their internal structures and evolution histories and identify primary influencing factors.

The group focused on five main topics: (a) gravity forward modeling and inversion for crustal thickness; (b) inversion for lateral and vertical variations of crustal density/porosity; (c) impact structures: large impact basins and small impact craters; (d) procellarum border rift system and lava tubes; (e) comparison with other terrestrial planets.

#### *Field Geology of the Moon:*

The main focus Working Group on the Field Geology of the Moon was identifying the geological features of the Moon, which primarily consists of highlands and maria, impact craters, and various volcanic features. Students also had to create related geological maps that help analyze the Moon's geological evolutionary history, providing a geological background reference for in-situ explorations. The data for the geological mapping course includes the lunar surface elevation data and orthoimages obtained by China's Chang E 1, as well as the lunar surface spectral data obtained internationally by Clementine.

In order to do that, they had to first identify lunar surface features and map regional geological maps; they focused on the following main topics: a) introduction of QGIS; b) mappy for geological mapping; c) draw profile map. Each student had their on laptop, in which they had installed a few software that allowed them to conduct their research, such as QGIS, Inkscape, and IDL.



Photo of students from Working Group 1 on Understanding the Gravity Field of the Moon



# ISSI-BJ ACTIVITIES

## Understanding Science



From left to right: David Evans (Beijing University of Chemical Technology); Alan Babington-Smith (President, Royal Asiatic Society of China, Beijing); Richard de Grijis (Executive Director of ISSI-BJ)

On September 6th, 2023, ISSI-BJ “Understanding Science” on “All Hands to Dance and Skylark!—Captain Cook and Health at Sea” was successfully held. This public lecture was organised in collaboration with the Royal Asiatic Society China, and was held at the Courtyard Institute, Beijing. About 24 people attended this event and took part in the conversation about physical and mental health at sea. The speaker was the Executive Director of ISSI-BJ Richard de Grijis (who also spoke on behalf of the Australian National Maritime Museum), and the main focus of his presentation was the lack of proper diet and hygiene in seventeenth and eighteenth century ships that were sailing for many months at sea, and how this directly affected their health and wellbeing. Some of the most common diseases that afflicted members of these Western ships actually never affected sailors from the Pacific islands; this is because their diet included many fruits and vegetables, coconut milk instead of alcohol and small amounts of salty meat. Professor Richard de Grijis explained how Captain Cook tried to improve British sailors’ diet by offering his crews sauerkraut and citrus fruits, and also tried to improve their mental and physical wellbeing with mandatory dancing every day.

## Infinite Horizons



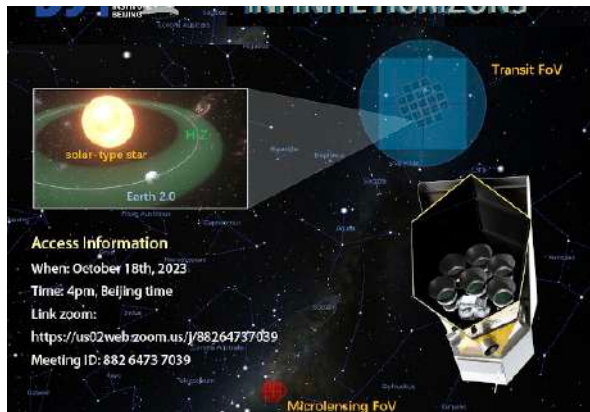
Date: 22 September 2023

Title: Mars Express and ExoMars Trace Gas Orbiter—science highlights

Speaker: Dr. Colin Wilson

Abstract: The European Space Agency currently has two spacecraft investigating Mars. The Mars Express orbiter, launched in 2003, carries a suite of scientific payloads addressing topics from subsurface and surface, to atmospheric and ionospheric science. Its observational data now span more than ten Mars years, allowing detailed study of interannual variations; furthermore, continued innovation from the payload teams is permitting ever-new ways of using the spacecraft. The ExoMars Trace Gas Orbiter (TGO), launched in 2016, is the first element in ESA’s ExoMars programme. It carries two spectrometer suites

designed to use solar occultation to measure trace gas abundance profiles to exquisite sensitivity – approaching 10s of parts per trillion in the case of methane. The presentation reviewed the achievements of these missions, with a focus on recent investigations.

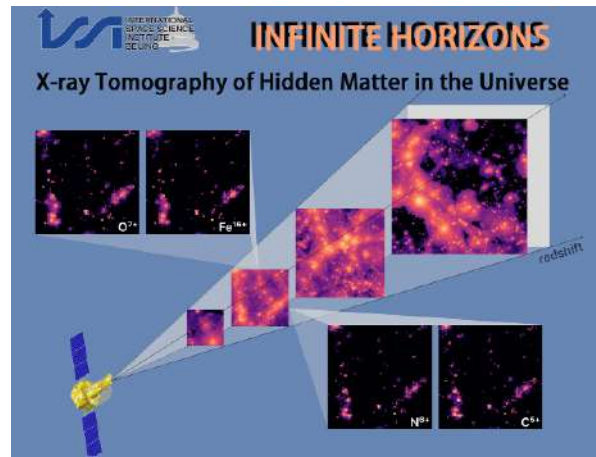


Date: 18 October 2023

Title: Searching for Earth 2.0s and Life in the Universe

Speaker: Prof. Jian Ge

Abstract: “Are we alone?” has been a fundamental question since the dawn of civilization, and we have always been curious about the possibility of extraterrestrial life. Since the discovery of the first exoplanet, a hot Jupiter orbiting a sun-like star named 51 Peg, in 1995, the number of exoplanet detections has grown exponentially. To date, we have discovered over 5000 exoplanets, each with unique properties and characteristics that are often vastly different from our own planet. However, despite these great advancements, we have yet to discover another habitable Earth-sized planet orbiting a sun-like star - an Earth 2.0. The Earth 2.0 (ET) space mission has been designed to take advantage of a wide field, high precision photometer and a wide field microlensing telescope to monitor millions of stars in the Milky Way for detecting exoplanets.



Date: 22 November 2023

Title: X-ray Tomography of Hidden Matter in the Universe

Speaker: Prof. Wei Cui

Abstract: Over the past six decades, X-ray astronomy has evolved from a field that relied on sounding rockets, which are reminiscent of the World War II, to one that is built upon satellites, which are ubiquitous in this day and age. Consequently, the duration of observations has gone from minutes to days or longer, facilitating the study of increasingly weaker sources. As detector technologies advanced, observing capabilities have reached unprecedented heights, particularly in terms of imaging and timing resolution, propelling the field to become a fully-fledged astronomy discipline. How the field progresses over the next 60 years or longer is anyone’s guess, but lessons from optical astronomy seem to suggest that the technique of X-ray tomography is likely to be featured prominently, as the evolution of galaxy ecosystems and large-scale structures comes into focus.





Date: 13 December 2023

Title: The local NewSpace ecosystem - Does Hong Kong and indeed China have the right stuff?

Speaker: Prof. Quentin Parker

Abstract: The globally emerging NewSpace economy could be worth 1 trillion USD by decades end according to the Bank Morgan Stanley. How is China faring in this burgeoning ecosystem and

what role could HK SAR play within the one country two systems structures? These issues are explored and discussed including from the context of STEM education and identifying talents and the opportunity to leverage off Hong Kong's innate strengths in fintech, regulatory and compliance infrastructure and IPO expertise.

## On Things to Come

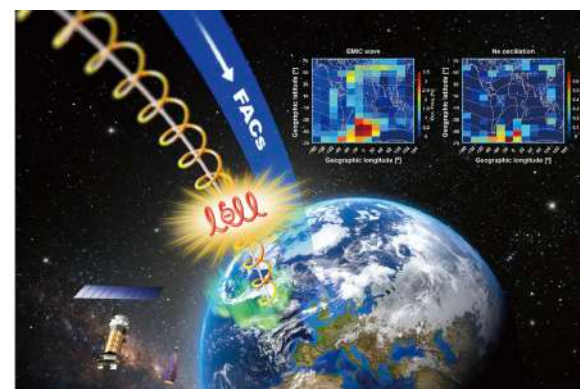
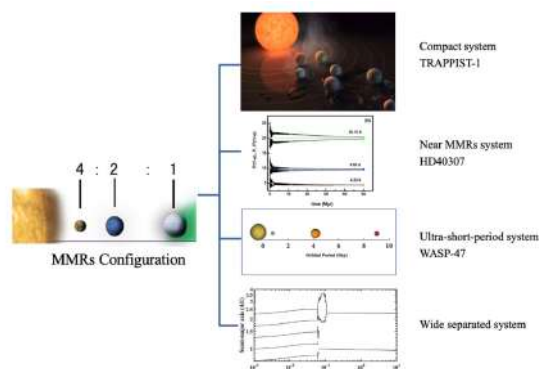
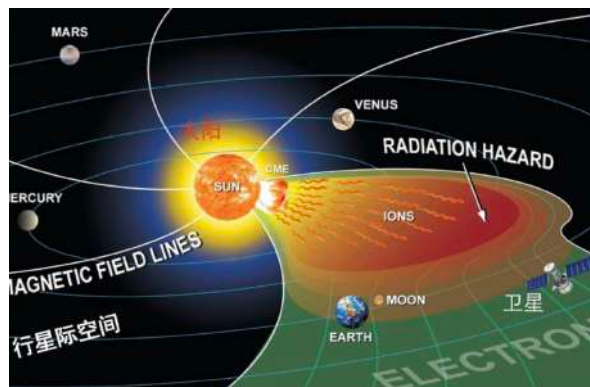
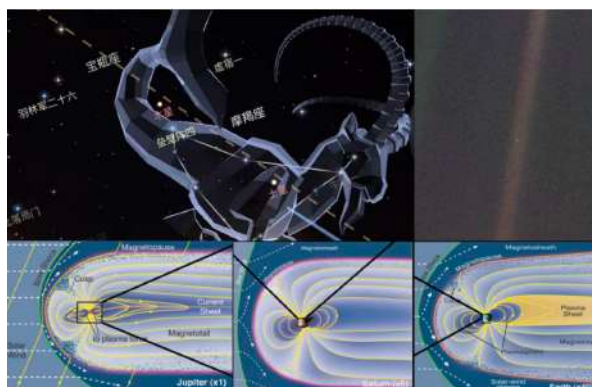
Jan. 4	Matthias Sperl - Granular Matter in Space
Feb. 22	Makiko Ohtake - Objectives and current status of Smart Lander for Investigating Moon
Mar. 15	Wen Chen - Introduction of IAMC and Science Missions
Apr. 19	Xiaoping Zhang - Exploring space-dust dynamics of Moon and asteroids with LADEE and Tianwen-2 mission



## 1001 Space Nights

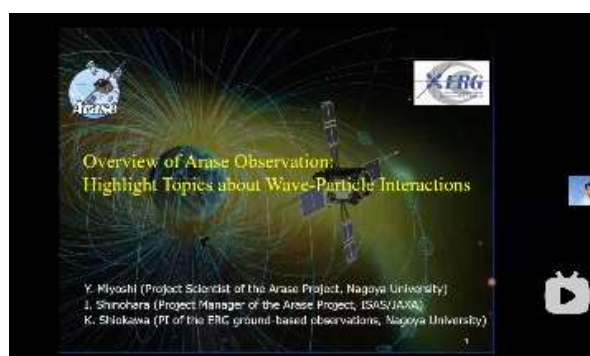
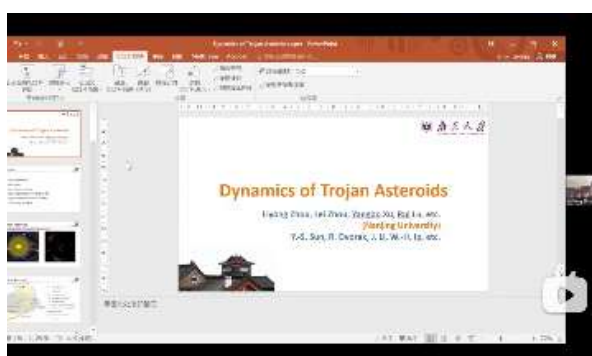
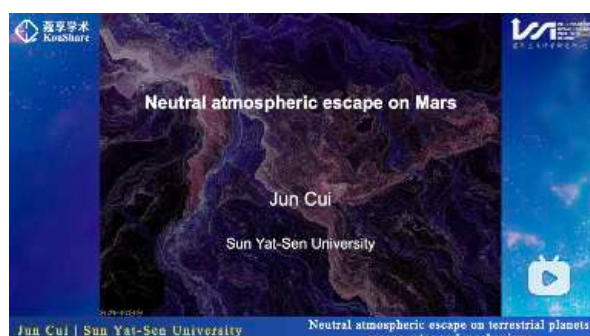
Feb. 13	Chongjing Yuan 袁憧憬 相对论电子辐射带：从土星和木星回望地球
Jun. 26	Linghua Wang 王玲华 高能粒子暴
Jul. 3	Su Wang 王素 - 体验百味“星生”-行星系统构型的形成演化
Aug. 28	Hui Wang 王慧 - 电离层 EMIC 波的时空分布和传播特性





## Topical View

Jan. 12	Xian Shi - Multifaceted cometary activity revealed by Rosetta
Mar. 9	Jun Cui- Neutral atmospheric escape on terrestrial planets: escape rates and mechanisms
Jun. 8	Liyong Zhou - Dynamics of Trojans Asteroids of Outer and Inner Planets
Jun. 14	Yoshi Miyoshi - Overview of Arase Observation: Some Highlights about wave-particle interactions



## Scientific Seminars Given or Supported by ISSI-BJ & its Staff



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You are welcome to nominate speakers to [colloquium@nao.cas.cn](mailto:colloquium@nao.cas.cn). The video and slides of previous colloquia and more information can be found at <http://www.nao.cas.cn>

# 国台学术报告 NAOC COLLOQUIUM

## 2023 年第 18 次 / No.18 2023

**Time: Wed., 2:30 PM, Sep 13<sup>th</sup> Location: A601, NAOC & Live Streaming**  
**Towards First Light of the Legacy Survey of Space and Time**  
**Prof. Richard de Grijs (Macquarie University & ISSI-BJ)**



Richard de Grijs obtained his PhD from the University of Groningen (Netherlands) in 1997, and subsequently held two postdoctoral positions (at the University of Virginia, USA, and the Institute of Astronomy, University of Cambridge, UK), before being appointed to a permanent post at the University of Sheffield (UK) in 2003. He joined the Kavli Institute for Astronomy and Astrophysics at Peking University in September 2009 as a full professor, where he actively contributed to the Institute's development (until February 2018). Since March 2018, he has been a Professor of Astrophysics and Associate Dean (Global Engagement) at Macquarie University in Sydney, Australia. Since July, 2023 The Board of Trustees of the International Space Science Institute in Beijing (ISSI-BJ) has elected Professor Richard de Grijs to head the Institute as its Executive Director.

### Abstract

The Vera C. Rubin Observatory, hosting an 8 m-class optical survey telescope, is currently under construction in Chile. During the first 10 years of its operations, the Rubin Observatory will conduct the Legacy Survey of Space and Time (LSST) and provide the widest, fastest and deepest views of the (southern) night sky ever observed. In essence, the survey will cover the entire visible sky every three days, thus allowing unprecedented science of the variable and transient universe. With 189 CCDs, the Vera Rubin Observatory's 3.2 gigapixel camera, with its large field of view (9.6 sq. deg.), offers a step change in the scientific questions we will be able to tackle. From solar system science to the structure and composition of the Milky Way and the nature of dark energy, time-domain astrophysics will never look the same. However, with the expected flurry of new data come serious challenges in data management, data transportation and data reduction to allow scientists to make the most of the 10 million 'alerts' expected to be triggered each night, and the overall data volume of 515 PB that will be accumulated over the LSST's 10-year lifetime. I will provide an update of the latest developments facilitating first light, currently foreseen for August 2024. I will also discuss both the exciting opportunities this new facility will offer in a truly unique parameter space, but also address the significant engineering and data science challenges we still have to overcome to facilitate breakthrough science.

*All are welcome ! Live Streaming QR Code*



Promotional poster made by NAOC for the seminar given by Prof. Richard de Grijs





中国科学院国家天文台  
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You are welcome to nominate speakers to [colloquium@nao.cas.cn](mailto:colloquium@nao.cas.cn). The video and slides of previous colloquia and more information can be found at <http://www.nao.cas.cn>

# 国台学术报告 NAOC COLLOQUIUM

2023 年第 29 次 / No.29 2023

Time: Wed., 2:30 PM, Dec 6<sup>th</sup> Location: A601 NAOC & Live Streaming

## The magnetohydrodynamic orchestra of the corona of the Sun

Prof. Valery M Nakariakov (University of Warwick, United Kingdom)

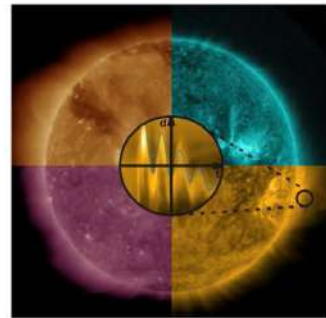


Professor Valery M Nakariakov graduated from the School of Radiophysics of Lobachevsky's Gorky State University, USSR in 1989, and gained PhD in Plasma Physics at the Applied Physics Institute of the Russian Academy of Sciences in 1994. In 1995-1999, he was a postdoc at St Andrews, UK, and since 1999 he has a permanent academic position (Full Professor since 2007) at the University of Warwick, UK. His main research interests relate to the observational study and theoretical modelling of magnetohydrodynamic (MHD) wave process in the corona of

the Sun, in particular, coronal plasma diagnostics by MHD waves, plasma astrophysics and radiophysics. For the development of the method of MHD seismology Nakariakov was granted a Payne-Gaposchkin Medal and Prize. In 2011-2014 Nakariakov was President of the Solar Physics Division of the European Physical Society.

### Abstract

The corona of the Sun is the outermost part of the solar atmosphere. The corona consists of a hot, fully ionised plasma dominated by the magnetic field. One of the most fascinated discoveries made with high-precision spaceborne imaging telescopes operating in the extreme UV band is the ubiquitous dynamics of the corona in a form of various large-scale wave motions. An example of such an instrument is the Extreme UV Imager on the recently launched Solar Orbiter spacecraft. The typical oscillation periods are several minutes, typical wavelengths are tens to hundred thousand kilometres, and typical speeds are from several tens to several thousand kilometres per second, which make the solar coronal waves the largest wave motions resolved simultaneously in time and space, detected in the Universe. Specific properties of various wave and oscillatory processes are determined by parameters of the coronal plasma non-uniformities which support them, acting together as an orchestra consisting of various music instruments. In the talk we shall discuss most typical kinds of solar coronal oscillations, their interpretation in terms of the magnetohydrodynamic theory, and the diagnostics of the coronal plasma by the method of magnetohydrodynamic seismology.



All are welcome ! Live Streaming QR Code



Promotional poster made by NAOC for the seminar given by Prof. Valery M Nakariakov





Laboratory for  
Space Research

# Unveiling the complexities of massive star clusters

For further details see:



<https://researchers.mq.edu.au/en/persons/richard-de-grijs>



December 12, 2023 (Tue)



3:30 pm - 4:30 pm



LSR, Cyberport 4

## Abstract

Around the turn of the last century, star clusters of all kinds were considered 'simple' stellar populations. Over the past decades, this situation has changed dramatically. At the same time, star clusters are among the brightest stellar population components and, as such, they are visible out to much greater distances than individual stars, even the brightest, so that understanding the intricacies of star cluster composition and their evolution is imperative for understanding stellar populations and the evolution of galaxies as a whole. In this brief review of where the field has moved to in recent years, we place particular emphasis on the properties and importance of the effects of rapid stellar rotation, and the presence of multiplicity among the red-giant-branch populations in Magellanic Cloud star clusters with ages up to a few billion years.

## Biography

Professor Richard de Grijs is a highly accomplished professor and researcher in the field of astronomy. He has held positions at prestigious institutions such as the University of Sheffield, Peking University, and Macquarie University. Richard has made significant contributions to the field, including serving as a scientific editor for The Astrophysical Journal and founding the East Asian Regional Office of Astronomy for Development. His research interests include star clusters, stellar variability, and the history of maritime navigation.

## Speaker



## Professor Richard De Grijs

- Macquarie University, Sydney, Australia
- International Space Science Institute--Beijing, China



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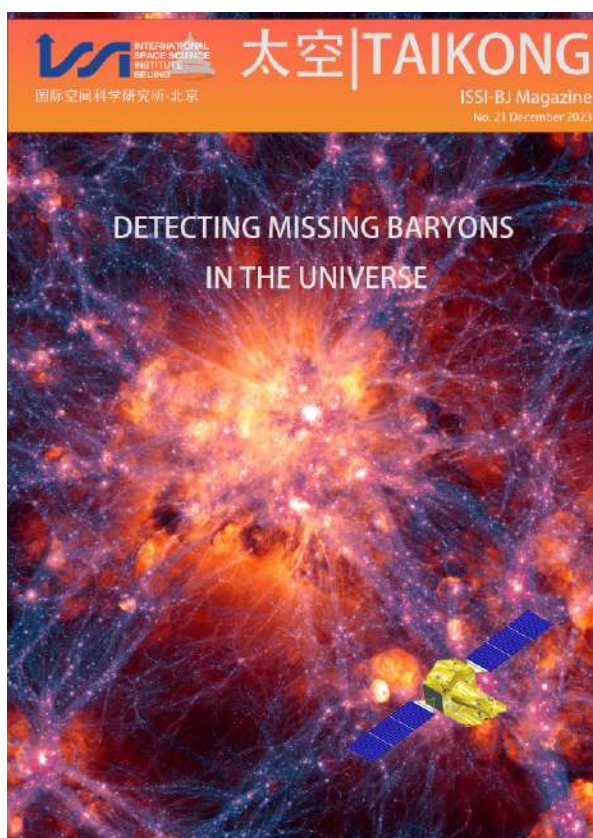
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Promotional poster made by the University of Hong Kong for the talk given by Prof. Richard de Grijs

## Taikong Magazine



Authors: Cui Wei (THU), Ji Li (PMO), Ji Suoqing (SHAO), Jing Hai (THU), Kang Xi (ZJU), Li Jiangtao (PMO), Li Xinfeng (CSU), Xu Dandan (THU), Xu Haiguang (SJTU), Yuan Feng (SHAO), Zhang Wei (SAST)

No. 21, December 2023

### Detecting Missing Barions in the Universe

This Taikong edition was written after the ISSI-BJ Forum on “Detecting Missing Bayrons in the Universe”, held in Beijing on July 20-21, 2023.

Cosmic Ecosystems is listed as one of the three themes highlighted in the Astro2020 decadal survey, and is the focus of this forum.

The main purpose of this ISSI-BJ Forum is to discuss the missing baryon problem, at the level of galaxies and largescale structures, and plans for a space-borne X-ray observing facility to solve this problem. The missing baryons are considered to be a key component of circumgalactic and intergalactic medium but, due to the limitations of existing observing facilities, they are currently difficult to detect, thus becoming an important obstacle to our understanding of galaxy ecosystems. During the event, the experts participating in the forum described the properties of hot gas in the circumgalactic and intergalactic medium, based on the results of hydrodynamical numerical simulations, its impact on galaxy evolution and existing observational evidence for

its presence. At the theoretical level, the missing baryons are believed to exist in the extremely low-density hot gas around and between galaxies, and its radiation is mainly in the soft X-ray band. Based on this, the participants discussed how to fill the gap in direct detection of the missing baryons, specifically examined the proposed HUBS mission, and concluded that it was technically feasible and of great scientific significance. In addition to the central issue of missing baryons, the forum also covered other scientific issues that could benefit from high-resolution X-ray spectroscopic observations, including diffuse X-ray background, supernova remnants, the outer regions of galaxy clusters, and so on.

During the forum, the participants from China, Japan, Europe and US presented theoretical predictions, mainly based on cosmological hydrodynamical simulations, and available (albeit limited) observational evidence for the presence of hot baryons, and discussed how to ill the observational void of directly detecting such baryons and measuring their properties.

A mission concept (HUBS) was presented, highlighting the roles of high-resolution X-ray spectroscopy, and received strong support from the participants. Besides the subject of missing baryons, the participants also discussed other important scientific issues of relevance to the topic that can benefit rom high-resolution X-ray spectroscopic observations.

## Visitors' Publications

Bian, N. H.; Li, G. (2023), On the Local Structure of Stochastic Parker Spirals in the Solar Wind, *The Astrophysical Journal*, 941:1, id.58, 4 pp, doi: 10.3847/1538-4357/aca279

Cao, X; et al. (2023), CSST Strong Lensing Preparation: Forecast the galaxy-galaxy strong lensing population for the China Space Station Telescope, Cornell University, doi: 10.48550/arXiv.2312.06239

Ding, Z.; Li, G.; Santa Fe Dueñas, A.; Ebert, RW.; Wijzen, RW; et al. (2023), The East-West Asymmetry of Particle Intensity in Energetic Storm Particle Events, *Journal of Geophysical Research: Space Physics*, 128:7, doi: 10.1029/2023JA031502

Kolotkov, V.M., Nakariakov, V.M., Cloesen, M. (2024), The centroid speed as a characteristic of the group speed of solar coronal fast magnetoacoustic wave trains, *MNRAS* 527, 6807-6813, doi: 10.1093/mnras/stad3681

Li, B., Guo, M., Yu, H., Chen, S.-X., and Shi, M. (2023), Three-dimensional propagation of kink wave trains in solar coronal slabs, *Monthly Notices of the Royal Astronomical Society*, 518:1, OUP, pp. L57–L62, doi:10.1093/mnras/slac139

Li, G.; Bian, N. H. (2023), Lagrangian Stochastic Model for the Motions of Magnetic Footpoints on the Solar Wind Source Surface and the Path Lengths of Boundary-driven Interplanetary Magnetic Field Lines, *The Astrophysical Journal*, 945(2):150, doi: 10.3847/1538-4357/acbd43

Liu, X.; Tian, H.; Török, T.; Gibson, S.; Yang, Z.; Li, W.; Samanta, T. (2023), Magnetic Field and Plasma Diagnostics for Solar Coronal Mass

Ejections: A Case Study Using the Forward Modeling Approach, *Solar Physics*, Volume 298, Issue 10, doi: 10.1007/s11207-023-02207-5

Shi, M., Li, B., Chen, S.-X., Guo, M., and Yuan, S. (2023), Excitation of Multiperiodic Kink Motions in Solar Flare Loops: Possible Application to Quasiperiodic Pulsations, *The Astrophysical Journal*, 943:2, IOP, doi:10.3847/2041-8213/acb3c6

Wang, Q.; Zhang, M.; Yang, S.; Yang, X.; Zhu, X. (2023), Change Ratios of Magnetic Helicity and Magnetic Free Energy During Major Solar Flares, *The Astrophysical Journal*, 23:095025 (13pp), doi: 10.1088/1674-4527/acee4f

Wang, W.; Battaglia, A.; Krucker, S.; Wang, L. (2023), The 2013 November 12 Solar Energetic Electron Event Associated with Solar Jets, *The Astrophysical Journal*, 950:118, doi: 10.3847/1538-4357/accc86

Wang, W.; Wang, L.; Krucker, S.; Wimmer-Schweingruber, R. (2023), Energy Spectrum of Solar Energetic Electron Events over 25 Years, *The Astrophysical Journal*, 948:51, doi: 10.3847/1538-4357/acbea2

Wang, Z., Li, B., Chen, S.-X., and Shi, M. (2023), Standing Sausage Perturbations in Solar Coronal Slabs with Continuous Transverse Density Profiles: Cutoff Wavenumbers, Evanescent Eigenmodes, and Oscillatory Continuum, *The Astrophysical Journal*, 943:2, IOP, doi:10.3847/1538-4357/aca976



Wijzen, N.; Li, G.; Ding, Z.; Lario, D.; Poedts, S.; Filwett, R. J.; et al. (2023), On the Seed Population of Solar Energetic Particles in the Inner Heliosphere, *Journal of Geophysical Research: Space Physics*, 128:3, doi: 10.1029/2022JA031203

Wu, W.; Su, J.; Chen, J.; Zhu, X.; Sych, R. (2023), Propagation Properties of Sunspots Umbral Oscillations in Horizontal and Vertical Directions, *The Astrophysical Journal*, 958:10 (14pp), doi: 10.3847/1538-4357/acf457

Wu, X.; Li, G.; Zhao; L., Effenberger; F., Wang, L.; Yao, S. (2023), Statistical study of release time and its energy dependence of in situ energetic electrons in impulsive solar flares, *Journal of Geophysical Research: Space Physics*, 128:3, doi: 10.1029/2022JA030939

Yu, F.; Zhao, J.; Su, Y.; Zhu, X.; Guo, Y.; Shen, J.; Li, H. (2023), Magnetic Field Extrapolation in Active Region Well Comparable to Observations in Multiple Layers, *The Astrophysical Journal*, 951:54 (12pp), doi: 10.3847/1538-4357/acd112

Zhao, J.; Zhang, P.; Gibson, S. E.; Fan, Y.; Feng, L.; Yu, F.; Li, H.; Gan, W. Q. (2022), Synthetic Lyman- $\alpha$  emissions for the coronagraph aboard the ASO-S mission. I. An eruptive prominence-cavity system, *Astronomy & Astrophysics*, Volume 665, id.A39, 14 pp, doi: 10.1051/0004-6361/202243029

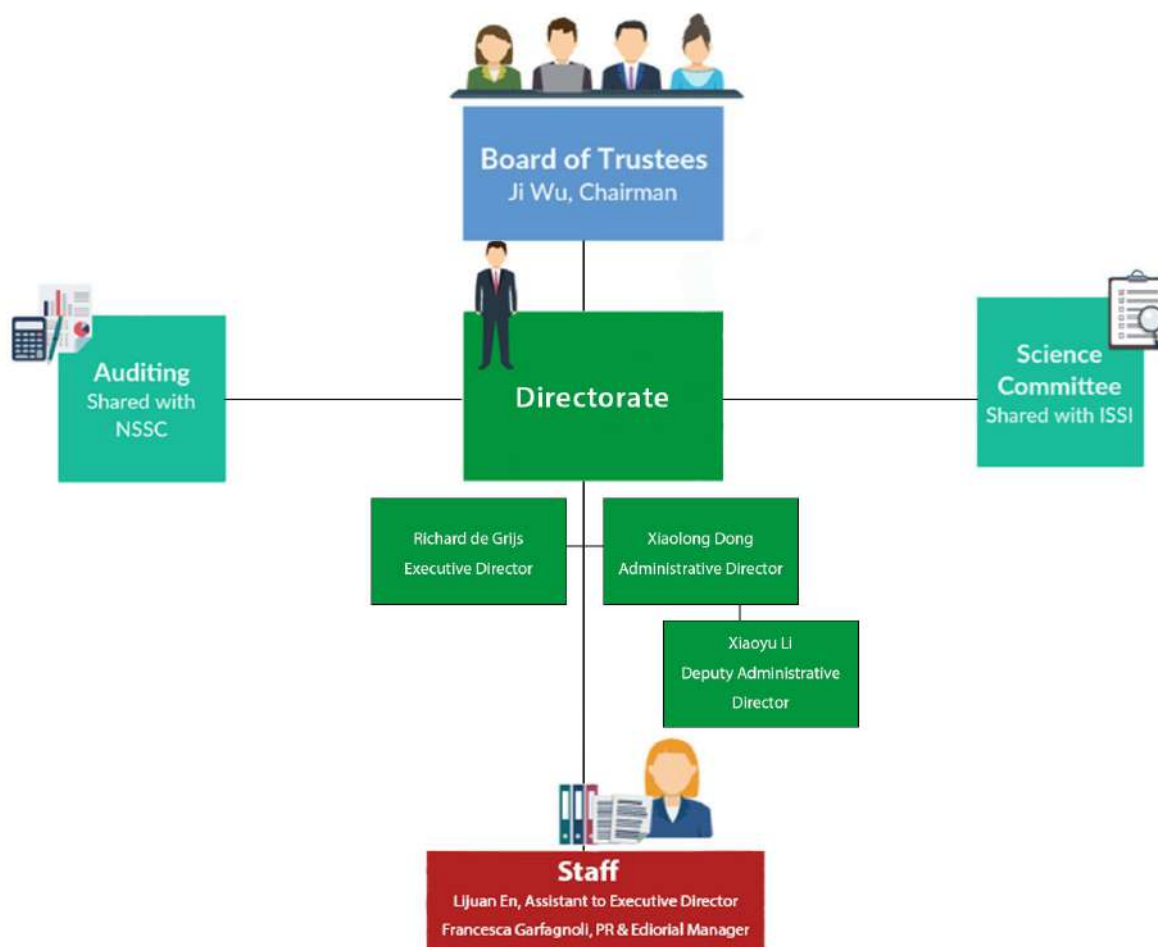
## Staff Publications

Abbott, L.; de Grijs, R. (2023): Fireball that lit up Melbourne night sky was most likely debris from Russian rocket, *The Age*, Melbourne, <https://www.theage.com.au/national/victoria/mystery-object-lights-up-melbourne-night-sky-20230808-p5duok.html>

Thomson, J.; de Grijs, R. (2023): Mystery Solved After Fireball Lit Up the Night Sky, *Newsweek*, <https://www.newsweek.com/fireball-melbourne-russian-rocket-debris-1818476>

# ORGANIZATIONAL STRUCTURE

## Board of Trustees & Staff



### Board of Trustees

The Board of Trustees supervises the work accomplished at the Institute, exerts financial control and appoints the Directors. It consists of representatives of the Founder and of the funding agencies. The Board of Trustees is presided over by Wu Ji.

### Science Committee

The Science Committee is shared with ISSI and is made up of internationally known scientists active in the field covered by ISSI-BJ and ISSI. Chaired by Emmanuelle J. Javaux, 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 International Team proposals in response to the annual call. Science Committee members serve a three year term with a possible extension of one year.

### Directorate

The Directorate is in charge of the scientific, operational and administrative management of the Institute. It interacts with the Funding Agencies, the Board of Trustees and the Science Committee. The Directorate consists of Richard de Grijs (Executive Director), Dong Xiaolong (Administrative Director), and Li Xiaoyu (Deputy Administrative Director).

## Board of Trustees:

Chairman of the Board of Trustees:

Prof. Wu Ji, National Space Science Center, CAS, China

Secretary of the Board of Trustees:

Dr. Li Xiaoyu, National Space Science Center, CAS, China

Members of the Board of Trustees:

- Prof. Willy Benz, University of Bern, Switzerland
- Dr. Karl Bergquist, Administrator for the International Relations Department, European Space Agency
- Prof. Roger Bonnet, International Scientist, France
- Prof. Alvaro Gimenez, International Scientist, Spain
- Prof. Wang Chi, Director-General, National Space Science Center, CAS, China
- Prof. Yu Qi, Asia-Pacific Space Cooperation Organization
- Prof. Zhang Shuangnan, Institute of High Energy Physics, CAS, China
- Prof. Wang Zhenyu, Deputy Director-General, Bureau of International Cooperation, CAS, China



ISSI-BJ Current Directors:

- Prof. Richard de Grijs, Executive Director of ISSI-BJ
- Prof. Dong Xiaolong, Administrative Director of ISSI-BJ

## ISSI-BJ Staff:



Richard de Grijs  
Executive Director



Dong Xiaolong  
Administrative Director



Li Xiaoyu  
Deputy Administrative Director



Lijuan En  
Assistant to the  
Executive Director



Francesca Garfagnoli  
PR & Editorial Manager



## Discipline Scientists



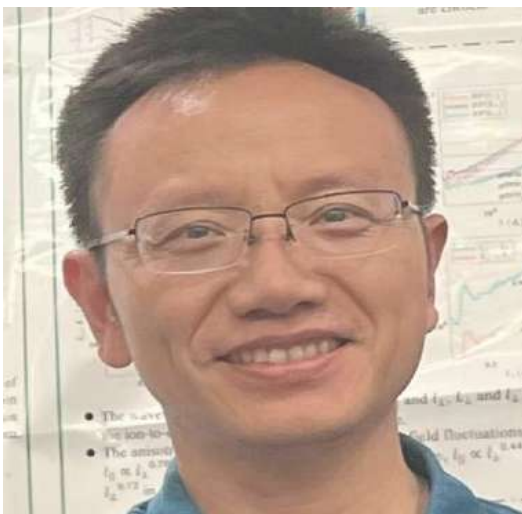
**Craig O'Neill**  
(QUT Science and Engineering, Australia)

Professor O'Neill received his PhD from The University of Sydney in 2004, and undertook a postdoctoral degree at Rice University on Martian volcanism. He has published fundamental works on planetary evolution, impacting, and tectonics, surface volcanism, and core structure.



**Sungsoo S. Kim**  
(Kyung Hee University, Korea)

Since 2003 Professor Sungsoo S. Kim has been working at the Department of Astronomy and Space Science of Kyung Hee University; since 2002 he has been working as Postdoctoral Researcher at Space Telescope Science Institute of Baltimore.



**Chen Pengfei**  
(Nanjing University, China)

Chen Pengfei is a professor at school of Astronomy & Space Science, Nanjing University. After he obtained his Ph.D. degree in Astrophysics from Nanjing University in 1999, he receives a lot of awards and services in the Solar Community. Since September 2006, he has taken the role of Vice President of the Board of the Solar Physics Division of the Chinese Astronomical Society; also, he has been a member of ISSI/ISSI-BJ Science Committee since July 2019.



**Takehiko Satoh**  
(JAXA, Japan)

Takehiko Satoh is a professor at the Department of Solar System Sciences, Institute of Space and Astronautical Science (ISAS), Japan Aerospace Exploration Agency (JAXA). After receiving his PhD from the Science University of Tokyo in 1992, he started his study of Jupiter's infrared auroras, magnetospheric, and atmospheric activities.

## Science Committee:



### Members of the Science Committee:

Elena Amato, INAF, Osservatorio Astrofisico di Arcetri, Firenze, Italy

Annett Bartsch, b.geos, Korneuburg, Austria

Svetlana Berdyugina, Leibniz Inst. für Sonnenphysik, Freiburg, Germany

Emeline Bolmont, Obs. of Geneva, University of Geneva, Switzerland

Frédéric Courbin, EPFL, Observatoire de Sauverny, Versoix, Switzerland

Xiaolong Dong, International Space Science Institute Beijing, Beijing, China (ex officio)

Eelco Doornbos, KNMI, the Netherlands

Ilaria Ermolli, INAF-OAR, Italy

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Vladislav Izmodenov, IKI, Russian Academy of Sciences, Moscow, Russia (ex officio RAS)

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Benjamin Koetz, ESA ESRI, Frascati, Italy (ex officio ESA)

Jasmina Magdalenić, University of Leuven, Belgium

Philippa J. Mason, Imperial College London, United Kingdom

Mark McCaughrean, ESTEC ESA, Noordwijk, The Netherlands (ex officio ESA)

Céline Péroux, ESO (European Southern Observatory), Garching, Germany

Daniel Verscharen, UCL, UK

Linghua Wang, Peking University, China

## Partners & Sponsor:



International Space Science Institute



Chinese Academy of Sciences (CAS)



National Space Science Center (CAS)

## Financial overview:

In the 2023 fiscal year, from 1 January, 2023 to 31 December of 2023, ISSI-BJ operated with the total revenue of 1,552,636.98 RMB and the total expenses were 1,911,622.96 RMB, thus, the overspending is 358,985.98 RMB.

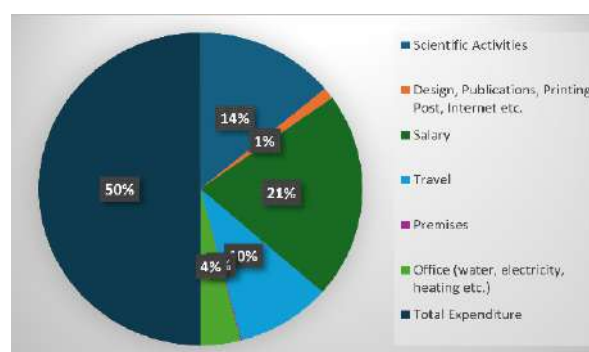
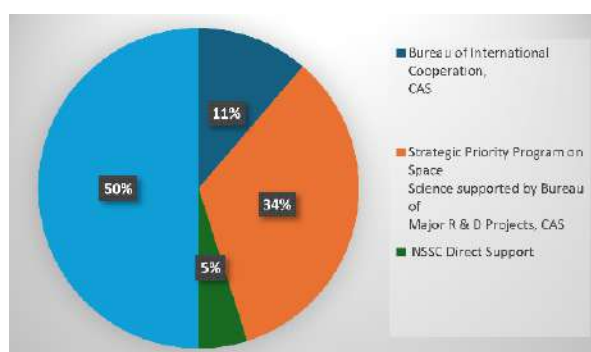
The funding includes: direct financial support of 350,000.00 RMB from the Bureau of International Cooperation of the Chinese Academy of Sciences (CAS) as international organization project for ISSI-BJ activities; project fund of 1,050,000.00 RMB from the Strategic Priority Program on Space Science supported by the Bureau of Major Research and Development Programs of CAS for activities; support of 152,636.98 RMB from the NSSC Direct Support for operational expenses.

The expenses include: scientific activities including 6 International Teams, 1 Forum, 2 Schools, and events such as the 10th Symposium; communication and outreach activities; 3 ISSI-BJ staff salaries; international and domestic travel of IT leaders, BoT members, and staff; office consumables and equipment; utilities such as water, electricity, and heating, supported directly by the NSSC. The expenses of premises use, administrative expenses, salary of administrative director for ISSI-BJ activities, which are in-kind support from NSSC, are not included.

The institute experienced an overspending of RMB 358,985.98 for the fiscal year 2023, which was covered by Strategic Priority Program on Space Science supported.



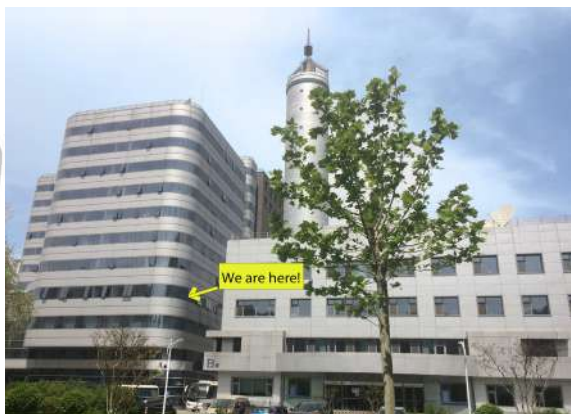
Total Revenues in RMB for 2023 Fiscal Year	
Bureau of International Cooperation, CAS	350,000
Strategic Priority Program on Space Science supported by Bureau of Major R & D Projects, CAS	1,050,000
NSSC Direct Support	152,636.98
Total Revenues	1,552,636.98



Total Expenditure in RMB for 2023 Fiscal Year	
Item	Amount
Scientific Activities	533,171.02
Design, Publications, Printing, Post, Internet etc.	44,226.37
Salary	815,392.86
Travel	36,247.03
Premises	3,719.70
Office (water, electricity, heating etc)	152,636.98
Total Expenditure	1,911,622.96
Overspending	-358,985.98

## Facilities:

ISSI-BJ offices are situated on the fourth floor of the Building B at the Zhongguancun campus of the the National Space Science Center, Chinese Academy of Sciences (NSSC, CAS).



Two offices are for the staff; the third room (A0419) can be used as a visiting scientists' office. We also offer two Halls for meetings. The first is the Saturn Hall (room A0418), dedicated to smaller meetings such as International Teams, or groups of up to 20/25 persons. It is situated right in front of the coffee room, where food and beverages are available at any time of the day.

ISSI-BJ can also provide the Earth Hall (room A0423), for larger meetings such as Forums or Workshops.



Earth Hall



Saturn Hall



Coffee Room



Facilities' Plan

Furthermore, ISSI-BJ shares its conference facilities with the National Space Science Center of the Chinese Academy of Sciences. The facilities are composed of six seminar rooms (20-30 participants each), two lecture halls (up to 100

participants each) and one multimedia conference hall (30 participants). All rooms are equipped with overhead projectors for large screen presentations and high speed wireless network connection.



## About ISSI:

The International Space Science Institute (ISSI) was created by Space Pioneer Professor Johannes Geiss in 1995. Since then the institute offers scientists from all around the world a forum to work together.

The main function is to contribute to the achievement of a deeper understanding of the results from different space missions, ground based observations and laboratory experiments, and adding value to those results through multidisciplinary research.

The program of ISSI covers a widespread spectrum of disciplines from the physics of the solar system and planetary sciences to astrophysics and cosmology, and from Earth sciences to astrobiology.

## Workshops:

ISSI organized four Workshops during 20023:

- Evolution of the Solar System: Constraints from Meteorites (05–09 June 2023)
- Magnetic Switchbacks in the Young Solar Wind (18–22 September 2023)
- Remote Sensing In Climatology – ECVs and their Uncertainties (13–17 November 2023)
- Megavolt Sky Astronomy (11–15 December 2023)

## Forums:

In the reported period, one Forum was held discussing the following topic: “International Cooperation in Space to Advance Science”.

## Working Groups:

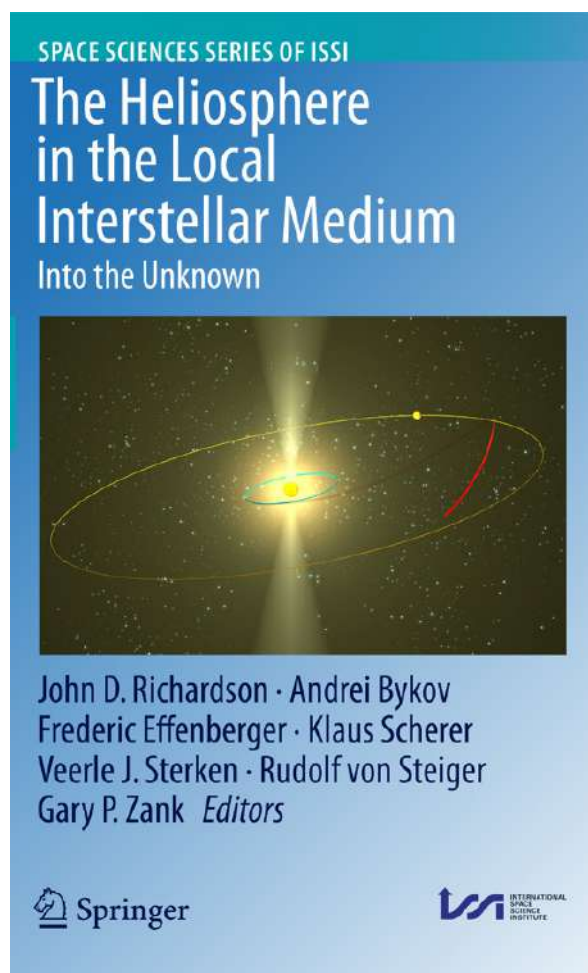
ISSI organized five Working Groups over the course of 2023:

- Observing Photons in Space (leaders: A. Parmar, M.C.E. Huber)
- Solar Forcings for CMPI7 (leaders: B. Funke

& T. Dudok de Wit)

- Exploitation and Scientific Performance of ESA Space Missions (leader: A. Parmar). This Working Group met twice in 2023.
- The Variability of the Airglow for the Detection of Atmospheric Dynamics (leaders: M. Rast, M. Bittner, S. Wüst). This Working Group met twice in 2023.
- Global Assessment of Limnological, Estuarine and Neritic Ecosystems (leaders: A. Bracher & M. Rast)
- Why Do We Still Have a “Coronal Heating Problem”? (leader: P. Judge).

Every Working Group result leads to a Scientific Report Volume in the Space Science Series of ISSI.



Cover of the Space Science Series of ISSI on “The Heliosphere in the Local Interstellar Medium” published in 2023





## Team Meetings:

Furthermore, 91 International Team Meetings were organized. Teams usually publish their results in refereed journals with acknowledgement to ISSI. Over 200 papers are published per year based on ISSI Team activities. Thirty new International Teams were approved by the Science Committee in 2023, and 15 of them started their activities over the course of the year.

## Operation:

ISSI is using all these tools to address, in a strict scientific framework, controversial issues and to promote a science program related directly to the most pressing issues raised by space and Earth science missions. On average ISSI is now hosting around 950 scientists per year in its activities.

Three statutory bodies interact regularly in matters of strategy, operation, finance or public relations: the Board of Trustees, the ISSI Directorate and the Science Committee. The latter

gives also scientific advice to ISSI-BJ. Rafael Rodrigo is ISSI's Executive Director. Together with the other directors Rudolf von Steiger, Anny Cazenave and John Zarnecki, the directorate is in charge of the scientific, operational and administrative management of the institute. The complete ISSI staff (scientists and administration) counts 17 members.

The European Space Agency (ESA), the Swiss Confederation, the Swiss National Science Foundation (SNF) provide the financial resources for ISSI's operation. The University of Bern contributes through a grant to a Director and in-kind facilities. The Space Research Institute (IKI) and the Institute of Space and Astronautical Science (Japan Aerospace Exploration Agency, JAXA) are supporting ISSI with an annual financial contribution.

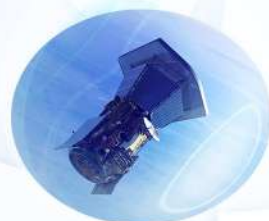
The complete information about the Institute, its present and near term program and its publications can be found on the web page [www.issibern.ch](http://www.issibern.ch).











[www.issibj.ac.cn](http://www.issibj.ac.cn)

International Space Science Institute - Beijing

No.1 Nanertiao, Zhongguancun, Haidian District, Beijing China Postcode: 100190

telephone: +86-10-62582811 / email: [info@issibj.ac.cn](mailto:info@issibj.ac.cn)

地址：北京市海淀区中关村南二条一号（100190）