



# Progresses and Activities of the International Space Science Institute in Beijing (ISSI-BJ)

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## 1. Introduction

The International Space Science Institute - Beijing (ISSI-BJ; <http://www.issibj.ac.cn>) was jointly established by the National Space Science Center of Chinese Academy of Sciences (NSSC, CAS) in Beijing, China, and the International Space Science Institute (ISSI) in Bern, Switzerland, with the support of the Chinese Academy of Science (CAS). ISSI-BJ is a close cooperation partner of ISSI by sharing the same Science Committee, the same study tools, the connections with international space science community, and other information of mutual relevance and interest. But both institutes have independent operational fund resources and operation modes.

ISSI-BJ is an Institute of Advanced Study where scientists from all over the world meet in a multi- and interdisciplinary setting to reach out for new scientific horizons. Its main mission 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 ground-based observations and laboratory experiments, whenever felt appropriate. ISSI-BJ uses the same tools as ISSI, i.e. International Teams, Forums, Workshops, Working Groups or individual Visiting Scientists (see details at <http://www.issibj.ac.cn/Program/>), as well as outreach tools such as Understanding Science seminars and Space Science School. The Program of ISSI-BJ covers a wide spectrum of space science disciplines, including astronomy and astrophysics, solar and space physics, planetary science, astrobiology and microgravity science, and Earth science from space-based observations. It offers a complement to the ISSI program with

some special emphases on future scientific opportunities.

ISSI-BJ was officially inaugurated on July 16, 2013. During its five-year operation, ISSI-BJ has become a platform for the exchange of scientific and technological ideas in the field of space research. ISSI-BJ is also a window for the Chinese space science community to know the frontiers of space research, and for the international space science community to know the most recent development of China in the field of space sciences.

During the two-year period from 2016 to 2017, ISSI-BJ had selected and supported 13 international teams for the advanced study of space science data processing and research; ISSI-BJ organized 2 forums for the discussion of the science, technology and international cooperation for 2 candidate space science missions and future of the development of ISSI-BJ itself; ISSI-BJ also organized one workshop on Astronomical Distance Determination in the Space Age. As part of the Understanding Science seminar series, ISSI-BJ organized 3 public talks, and jointly with the Asia-Pacific Space Cooperation Organization (APSCO) for the first time organized the Space Science School on “How to Design a Space Science Mission”. In the years 2016-2017, ISSI-BJ attracted almost 400 international visitors to participate in different activities. ISSI-BJ has established its reputation as an important platform for the exchange and collaborated research in space sciences.

## 2. International Teams

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 dif-

ferent institutions. In 2016 and 2017, after the review by the science committee, ISSI-BJ selected 13 teams for independent or joint activities, from the received proposals. The teams cover a wide range of fields of space sciences.

**The international teams approved in 2016 are:**

(1) Understanding multi-wavelength rapid variability: accretion and jet ejection in compact objects. Team leaders: Tomaso M. Belloni (INAF-Osservatorio Astronomico di Brera, Italy), Dipankar Bhattacharya (IUCAA, Pune, India).

(2) Climate Change in the Upper Atmosphere. Team leader: Shunrong Zhang (MIT Haystack Observatory, USA) (ISSI-BJ & ISSI Team).

(3) Understanding the fate of binary systems in the Gaia era. Team leader: Nami Mowlavi (Astronomy Department, University of Geneva, Switzerland) (ISSI-BJ & ISSI Team).

(4) Multiple-instrument observations and simulations of the dynamical processes associated with polar cap patches/Aurora and their associated scintillations. Team leader: Qinghe Zhang (Institute of Space Sciences, Shandong University, China).

(5) Snow reanalyses over the Himalaya-Tibetan Plateau region and the monsoons. Team leader: Yvan Orsolini (University of Bergen, Norway).

(6) Diagnosing heating mechanisms in solar flares through spectroscopic observations of flare ribbons. Team leader: Hui Tian (Peking University, China) (ISSI-BJ & ISSI Team).

**The international teams approved in 2017 are:**

(1) Hydrogen Escape across the Solar System and Beyond. Team leader: Mike Chaffin (LASP, University of Colorado, USA) (ISSI-BJ & ISSI Team).

(2) Radioactive Nuclei in the Cosmos and in the Solar System. Team leaders: Alexander Heger (Monash University, Australia), Maria Lugaro (Research Center for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Hungary).

(3) Stellar libraries of 2020. Team leader: Paula Jofre (Nucleo de Astronomia, UDP, Chile).

(4) Magnetic topology effects on energy dissipation in turbulent plasma. Team leaders: Vyacheslav Olshevsky (KU Leuven, Belgium), Francesco Valentini (University of Calabria, Italy) (ISSI-BJ & ISSI Team).

(5) Pulsations in solar flares: matching observations and models. Team leaders: Ivan Zimovets (Space Re-

search Institute of Russian Academy of Sciences, Russia), Zongjun Ning (Purple Mountain Observatory, CAS, China).

(6) An international reference for seismological data sets and internal structure models of the Moon. Team leaders: Raphael F. Garcia (ISAE-SUPAERO, France), Peimin Zhu (China University of Geosciences Wuhan, China) (ISSI-BJ & ISSI Team).

(7) Dayside Transient Phenomena and Their Impact on the Magnetosphere-Ionosphere. Team leaders: Hui Zhang (University of Alaska Fairbanks, USA), Qiugang Zong (Peking University, China).

Up to the end of 2017, the teams had met in ISSI-BJ for one or two one-week long meetings, and the ISSI-BJ team members had published 61 papers in peer-reviewed journals.



*International team meeting on “Understanding the fate of binary systems in the Gaia era” held in November 2017*



*Group photo of the team on “Pulsations in solar flares: matching observations and models” held in October 2017*

### 3. Forums

Forums are informal and free debates on open questions

of scientific nature or science policy matters among 20 to 25 high-level participants. Forums may lead to formal recommendations or decisions depending upon the topic or issues addressed in the Forum. At ISSI-BJ, forums are also organized to discuss the science, technology and international cooperation of future space science missions. The outputs of ISSI-BJ forums are published in the ISSI-BJ's TAIKONG magazines, which report the contents of the Forums and reflect in a neutral way the Forum discussions and advises from all the participants.

In the period from 2016 to 2017, ISSI-BJ organized forums dedicated to discussions on the science, payload the satellite technology and international cooperation of 2 candidate space science missions, which were selected and supported by the Strategic Priority Program on Space Science of the Chinese Academy of Sciences and targeted at being implemented from 2016:

(1) Forum on the Link between Solar Wind, Magnetosphere, Ionosphere (SMILE Mission) - July 2016.

(2) Forum on Lunar and Planetary Seismology (Chinese Lunar Exploration Program) - January 2017.

During the two days of each forum, the participants from international communities discussed the key science, payload configurations and technologies, and the international cooperation of these missions. Some suggestions were proposed to the mission teams, which would promote the definition and pre-study of these future missions. After the forums, 1 issue of the TAIKONG magazine which summarized the output of

the forum and provided the international community a thorough introduction to these candidate missions has been published, and one is scheduled for publication in 2018. The summaries of the forums are also published in the peer-reviewed Chinese Journal of Space Science, based on the authors' intentions.

#### 4. Workshops

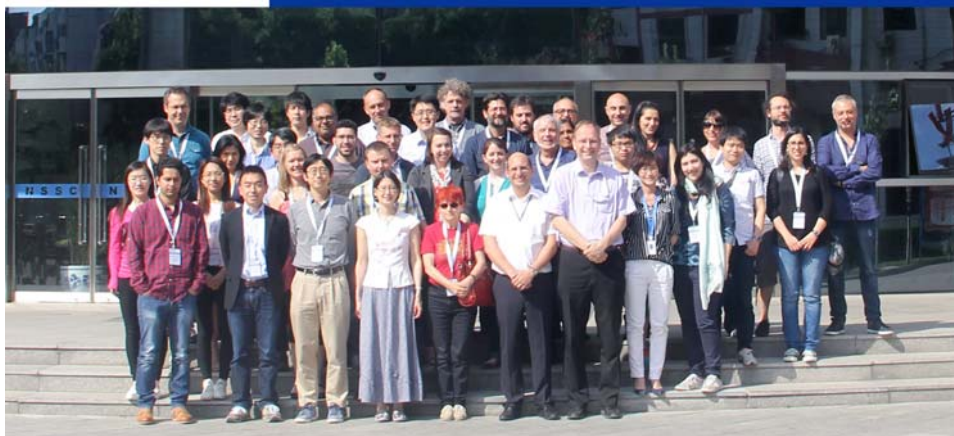
Workshops are study projects on specific scientific themes, selected in consultation with the Science Committee. The duration of Workshops is typically one week. Workshops are organized by a group of conveners who define the theme, set up the program, and list the group of participants. Participation is by invitation only. The size of any Workshop is usually limited to a maximum membership of 45 including a few young scientists. The results of the Workshops are published as refereed papers in issues of Space Science Reviews and in parallel as volumes of the Space Science Series of ISSI/ISSI-BJ (SSSI). In 2016 and 2017, one workshop was organized by ISSI-BJ, and one book will be published by Springer.

##### **Workshop on Astronomical Distance Determination in the Space Age (May 23-27, 2016)**

The workshop was divided into five main sessions, focusing on the following topics: "highlight the tremendous amount of recent and continuing research into a myriad of exciting and promising aspects of accurately pinning down the cosmic distance scale. Putting the



ISSI-BJ Workshop on  
Astronomical Distance Determination in the Space Age  
May 23-27, Beijing



*Group photo of participants of the ISSI-BJ Workshop on Astronomical Distance Determination in the Space Age held in May 2016*

many recent results and new developments into the broader context of the physics driving cosmic distance determination is the next logical step, which will benefit from the combined efforts of theorists, observers, and modelers working on a large variety of spatial scales, and spanning a wide range of expertise”.

## 5. Outreach Activities

### *Understanding Science*

In addition to the research projects, ISSI-BJ also organized outreach activities to public, as part of the "Understanding Science", which is a series outreach activities organized by the UK Royal Society of Chemistry (RSC), the Institute of Physics (IoP) and ISSI-BJ. Its goal is to make a broader public aware of today's accomplishments in research through short scientific lectures in English (popularization talks) as well as to have an opportunity to talk with either international or Chinese scientists currently carrying out research in China, in a friendly environment. During the year of 2016 to 2017, the "Understanding Science" activities organized by ISSI-BJ included:

- On Wednesday, May 25, 2016, Prof. Tilman Spohn, from DLR Institute of Planetary Research of Germany gave a talk on The Evolution of Planets, Habitability, and Life
- On Tuesday, March 7, 2017, Dr. Jeremie Lasue from Institut de Recherche en Astrophysique et Planetologie (iRAP/OMP), gave a talk on Exploring Mars
- On Tuesday, December 12, 2017, Prof. David Blair from Australian Research Council Centre of Excellence for Gravitational Wave Discovery (ARCC), gave a talk on Listening to the Sounds of the Universe: The Future of Gravitational Wave Astronomy

### *Summer School*

ISSI-BJ Space School is a biennial Summer School on space sciences and space science missions for international students. The students are provided with the required scientific background relevant to producing a report. In 2016, ISSI-BJ organized the first Space Science School.

On October 17–26, the 1st ISSI-BJ and APSCO Space Science School on *How to design a Space Science Mission* was held at the Sirindhorn Center for Geo-Informatics, located in Space Krenovation Park, Si

**懂 Understanding Science**  
Scientific seminars for the general public

**EXPLORING MARS**

TUESDAY, MARCH 7, 2017  
7:30 PM

Bridge Café, 8-12 Huxiang Jiyuan, Chenggu Lu  
(Wuziakou), Haidian District, Beijing  
Free entrance, food & drinks at your own expense

**Jérémie Lasue, PhD**  
Institut de Recherche en Astrophysique et Planétologie (IRAP/OMP), Toulouse, France

With 6 satellites and 2 rovers operational at Mars, the red planet is currently the most explored object of our planetary system after the Earth. While it is currently mostly a desiccated frozen world, signs of large amounts of water flowing on Mars over long periods of time in the past have triggered the question of its habitability. The NASA Mars Science Laboratory (Curiosity) has found evidence for past liquid water at Gale and the presence of all the necessary elements for life indicating that Gale Crater must have been originally habitable. The talk will review the exploration of Mars and its results. We will discuss the possible emergence of life in the past and in the present. Finally, the opportunities and challenges for future exploration of the Red Planet by robots and humans will also be reviewed.

IRAP/OMP Institute of Physics

Poster advertising the Understanding Science seminar on "Exploring Mars" by Dr. Jeremie Lasue (IRAP/OMP)

Racha district, Chon Buri province, Thailand. Throughout the school, 18 lecturers from Asia and beyond shared their knowledge with 57 students from 16 countries.

The School began with a formal opening ceremony, during which the participants were officially greeted by the organizers, as well as by the officials representing Switzerland – the country where ISSI-BJ takes its roots from, and Thailand – the host country. The informal and friendly tone of the School was set during the opening lectures given by Prof. Roger M. Bonnet from the International Space Science Institute in Bern, Switzerland, and Prof. Claude Nicollier from the Swiss Space Center at EPFL Lausanne, Switzerland. Prof. Bonnet discussed the importance of international collaboration in space science research, whereas Prof. Nicollier shared his spaceflight experiences as a European Space Agency astronaut.

The School provided the young Asian-Pacific space researchers and engineers an opportunity to gain a global view on how to design a space science mission and encouraged international cooperation. Overall, the School featured 29 lectures given by the leading experts

in the field and covered the topics of scientific objectives and requirements of the space science missions, mission and spacecraft design, mission cost, etc. The students actively contributed to the School not only with questions and constructive comments after the lectures but also with oral presentations and posters. During the students' talk sessions, young scientists had an occasion to present their research, and receive invaluable comments and advice from the experts in the field.

Apart from the strictly scientific aspect, the School also helped in building links between students and experts from different countries. Young scientists could develop a professional network during coffee breaks and everyday meals, as well as through such events as Welcome Cocktail, Social Dinner, and Social Excursion. It was a wonderful and one of a kind experience to see

the space science research and engineering students and lecturers from all over the world brought together, exchanging their ideas also outside of the lecture hall, in the breathtaking surroundings of Thailand.

The 10-day School concluded with the lecture given by Prof. Suthi Aksornkitti, member of Thailand's space development committee, followed by the closing ceremony, during which each student was granted a Certificate of Completion. The participants expressed their great satisfaction with the School, praising the stimulating atmosphere of mutual learning and the unique networking opportunity, as well as appreciating the shared knowledge and skills which they could take back and apply to their work. After the huge success of the 1<sup>st</sup> Space Science School, the second edition is planned in two years.



Group photo of the participants of the 1st ISSI-BJ and APSCO School on "How to Design a Space Science Mission" held in October 2017

## 6. Publications

### *Taikong Magazine*

The Taikong magazines constitute the output of the Forums organized at ISSI-BJ. The magazine reports the contents of the forums and reflects in a neutral way the Forum discussions and advises from all the participants. Two issues were published in 2016-2017:

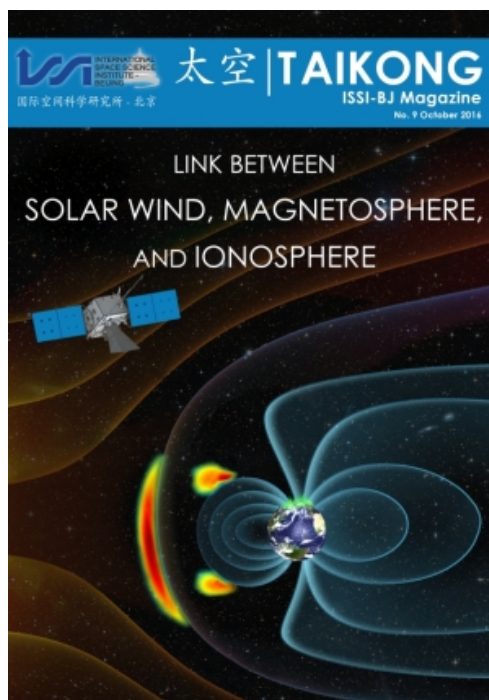
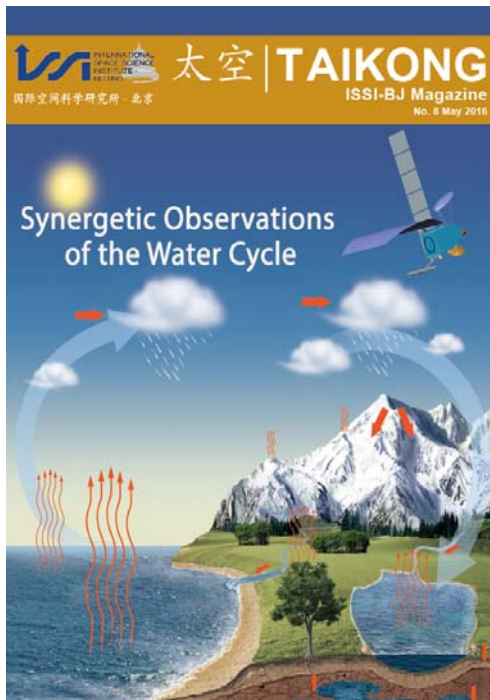
- TAIKONG No. 8 Synergetic Observations of the Water Cycle, May 2016

- TAIKONG No. 9 Link Between Solar Wind, Magnetosphere, and Ionosphere, October 2016  
*Space Sciences Series of ISSI (SSSI)*

The Space Sciences Series of ISSI books are coherent reports of the findings, discussions, and ideas that result from Workshops regularly held at ISSI Bern and ISSI-BJ.

In the period of 2016–2017, two topical volumes were edited and issued first in Space Science Reviews, to be then published in 2018 as part of the SSSI:

- (1) Gamma Ray Bursts – A Tool to Explore the

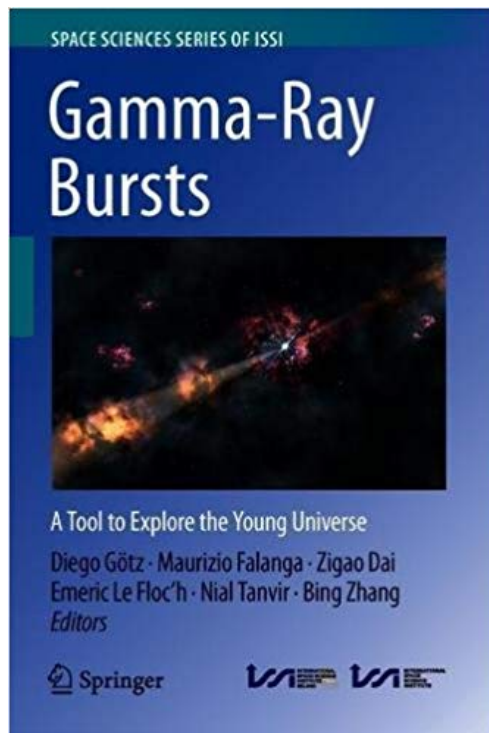
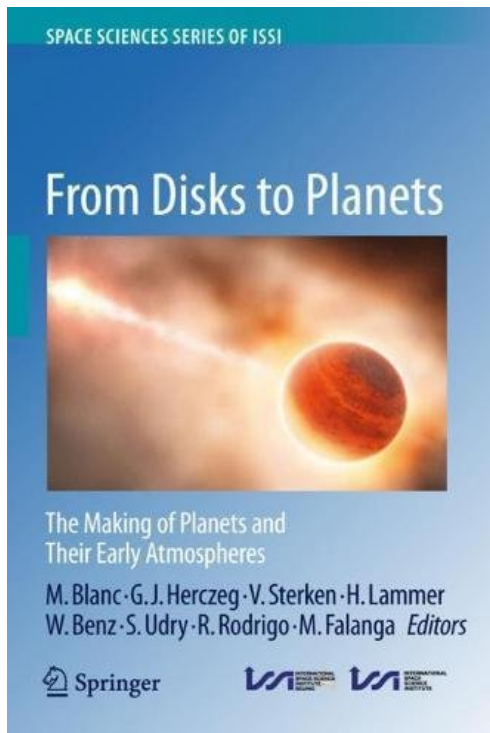


Cover pages of the TAIKONG magazines which published the summaries of the forums dedicated to the candidate space science missions

Young Universe, Götz, D., Falanga, M., Dai, Z., Le Floch, E., Tanvir, N., Zhang, B. (Eds.), Space Science Reviews, Volume 202, Issue 1-4, Springer 2016.

(2) From Disks to Planets: The Making of Planets

and Their Early Atmospheres, Blanc, M., Herczeg, G.J., Sterken, V., Lammer, H., Benz, W., Udry, S., Rodrigo, R., Falanga, M. (Eds.), Space Science Reviews, Volume 205, Issue 1-4, Springer 2016.



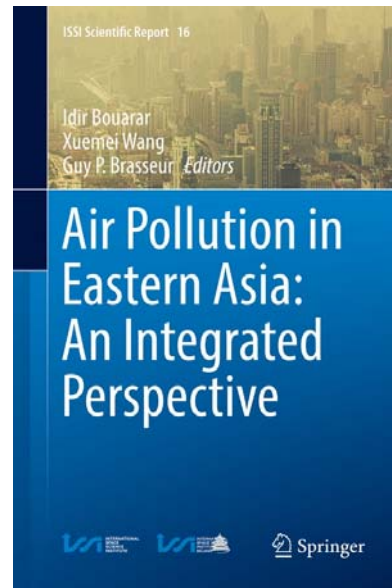
Cover pages of the two volumes of Space Science Series of ISSI first issued as Space Science Reviews in 2016, to be then published in 2018

*ISSI Scientific Report Series*

The ISSI Scientific Report Series publish results of ISSI-BJ Working Groups or Teams.

In the period of 2016–2017, one volume of the ISSI Scientific Reports Series was published as an outcome of the joint ISSI/ISSI-BJ International Team:

Air Pollution in Eastern Asia: An Integrated Perspective, Bouarar, Idir, Wang, Xuemei, Brasseur, Guy P. (Eds.), ISSI Scientific Report Series, Volume 16, Springer 2017.



Cover page of the volume of ISSI Scientific Report Series published in 2017