

First Circular
Workshop on
Astronomical distance determination in the space age
Beijing, 23–27 May 2016

Conveners

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| Richard de Grijs | Kavli Institute for Astronomy and Astrophysics/Peking University, China; and Discipline Scientist at ISSI-BJ |
| Giuseppe Bono | Università di Roma Tor Vergata, Italy |
| Barry Madore | Carnegie Institution for Science, USA |
| Noriyuki Matsunaga | The University of Tokyo, Japan |
| Sherry Suyu | Academia Sinica Institute of Astronomy and Astrophysics, Taiwan |
| Jianmin Wang | Max-Planck-Institut für Astrophysik, Garching, Germany |
| Maurizio Falanga | Institute for High-Energy Physics, Beijing, China |
| | ISSI-BJ, Beijing, China |

Local Organisation

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Context of the Workshop

Knowing the distance of an astrophysical object is key to understanding its formation and evolution: without an accurate distance, we do not know how bright it is, how large it is, or even when it existed. Astronomical distance measurements are challenging tasks, and indeed the typical information we have about Galactic and extragalactic sources are its position (perhaps as a function of time) and its brightness (as a function of wavelength and time).

The first modern milestone in the estimate of nearby distances dates back to the *Hipparcos* space mission (in the 1990s), which provided absolute trigonometric parallaxes at milliarcsecond-level precision across the whole sky, for more than 100,000 sources. Around the same time, and to the surprise of many scientists, the Fine Guide Sensor onboard the *Hubble Space Telescope* (which was designed to guide the telescope) was used as a scientific instrument and provided exquisite trigonometric parallaxes for a handful of primary distance indicators (Cepheids, RR Lyrae, δ Scuti variables). In addition, during the past 10–15 years, the use of ground-based 8–10 m-class optical and near-infrared telescopes and space observatories have provided an unprecedented wealth of accurate photometric and spectroscopic data for stars and galaxies in the Local Group ($D < 1$ Mpc) and in the Local Volume ($D < 25$ Mpc). Moreover, interferometric radio observations have also achieved 10 micro-arcsecond astrometric accuracy.

Objectives of the Workshop

This ISSI-BJ workshop will 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 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 modellers working on a large variety of spatial scales, and spanning a wide range of expertise.

We will specifically address future efforts in this field, both theoretically and observationally. We plan to address the impact that accurate cosmic distances will have, together with the new and unprecedented near-infrared spectroscopic opportunities offered by the *James Webb Space Telescope*, on metallicity gradients in nearby galaxies. This is a critical time in the context of firming up the astronomical distance scale: VLBI (very long baseline interferometry) sensitivity is being expanded allowing, for example, direct measurement of distances throughout the Milky Way and to Local Group ($D < 1$ Mpc) galaxies. The field will benefit tremendously in the *Gaia* era, which is now truly upon us. The first science verification data obtained with *Gaia* will soon be made available publicly (late 2015). In addition, the next-generation “extremely large telescopes” (ELTs) will play a crucial role in cosmic distance determination, since they will allow us to determine the Hubble constant only using primary distance indicators. Significant modeling efforts are currently underway to prepare the community for use of the Thirty Meter Telescope (USA, Japan, China, India), the European ELT (ESO) and the Giant Magellan Telescope (California, South Korea, Taiwan).

Space-based observatories, in particular, are allowing major advances to be made, and this will only increase in the next decade. In addition to the European *Hipparcos* and *Gaia* missions, Asian scientists, in particular our Japanese colleagues, are leading the field in relevant space mission. Nano-, micro- and (full) *JASMINE*, as well as the Japanese space interferometry missions *VSOP/VSOP-2* complement Russian efforts related to *eRosita*, in addition to US and European space missions like the *Hubble* and *Spitzer Space Telescopes*, *WFIRST*, *Herschel*, *WMAP* and *Planck*. These space- and ground-based facilities will have an immediate bearing on the astronomical distance scale. Nevertheless, many uncertainties remain at the level of at least 5–10%, particularly in terms of our understanding of the physics underlying many of the methods commonly used for distance determination.

The Workshop will cover the following main themes:

We aim to divide the meeting into 5 main sessions, including:

1. Structure of the Milky Way and the Local Group
2. Pulsating variables from optical to infrared wavelengths
3. Distance benchmarks out to the smooth Hubble flow
4. Type Ia Supernovae (SNe Ia) as standardizable candles
5. Cosmological constraints

Product

Following the Workshop, Springer will publish its output as a volume in the Space Science Series of ISSI-BJ, in parallel with the publication of the papers in Space Science Reviews. It is expected that a total of about 6 sections and around 14 multi-authors review style and quality papers, submitted to the usual refereeing process will be published in the book. Papers will be

based on talks presented at the Workshop and will reflect the discussions that will be held among the participants during the Workshop.

Location

The Workshop will be held at the International Space Science Institute-Beijing, China.

Attendance

This will be by invitation only with about 40–45 participants, including young scientists. Under its special programme for supporting young scientists, ISSI-BJ will invite around five early career scientists, within two years of their PhD, to take a full part in the Workshop.

Funding, Hotel & Visa

ISSI-Beijing will provide the subsistence costs (hotel and a per diem to cover meals) for all participants (excl. self-support participants) but not the travel costs. There will be no registration fee for the Workshop. The hotel will be booked by ISSI-BJ. Therefore, in order to make the according hotel reservation, we kindly ask you to send your arrival and departure dates in Beijing as soon as possible directly to Lijuan En enlijuan@issibi.ac.cn. In addition, in order to obtain the necessary visa to enter China, we highly recommend that you apply for a **tourist visa** – the application process is less complicate and a lot faster. If you want to apply for a business visa and therefore, need an official invitation letter, please send Lijuan En by e-mail the scanned copy of your passport. Furthermore, the following personal and passport data are needed from you:

- surname:
- given name:
- title:
- gender:
- date of birth:
- nationality:
- passport no.:
- name of your institute:
- arrival date and departure date (for booking hotel):
- the country and city you will apply for the visa:
- 1st time to China?:

You will then receive an invitation letter, which you can use for your visa application at your local Chinese Embassy. It is important that you file your visa application well in time. Once all the forms have been received in good order, the Chinese Embassy typically needs 4–5 working days to process the visa. Please be advised that all visitors to China are required to have a passport with at least six months of remaining validity and blank visa pages.

Schedule

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| Invitations and First Circular: | late January | 2016 |
| Second Circular and final program: | 19 April | 2016 |
| Hotel deadline: | 29 April | 2016 |
| Workshop: | 23 – 27 May | 2016 |