# Astronomy at Peking University
# The Year in Review 2016


The Kavli Institute for Astronomy and Astrophysics

School of Physics, Department of Astronomy

Astronomy at Peking University
The Year in Review 2016

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# Director's Corner

## A Longer Perspective

As I sit down to write this piece again, it is hard to imagine that I have already crossed the halfway mark of my term as director. It seems just like yesterday when I arrived at an institute mired with instability, facing an uncertain future. Through the hard work and tireless dedication on the parts of many, plus a bit of luck, the fundamentals of a healthy institute are in place: a strong, diverse faculty; a growing postdoc program; steady scientific output; a stable, vibrant academic environment; and increased visibility and influence, at home and abroad. We are also in sound financial shape, thanks both to the steady influx of research grants, large and small, and to increased support from the Kavli Foundation as well as from Peking University. With KIAA having reached a reasonable state of equilibrium, I can finally take a deep breath and look further ahead. What are the most strategic directions that we should develop? Which are likely to have the biggest impact? Where should we place greater emphasis in the future? As new opportunities increasingly present themselves, it is vital that we make smart decisions.

KIAA is playing an increasingly active role in major national astronomical facilities. This began with the wide-field optical telescope, *LAMOST*, notably in application of its survey data to studies of Milky Way structure and quasar statistics. With the recent completion of the 500-meter FAST radio telescope (the largest in the world), China has the potential to make unique contributions to pulsar timing studies, which offer the most promising route toward detecting gravitational waves arising from the mergers of supermassive black holes. To this end, KIAA has just established a Partner Group with the Max Planck Institute for Radio Astronomy in Bonn (Germany), with the intention of spearheading pulsar timing studies using FAST and other radio dishes in China. At the same time, KIAA has a keen interest in

pushing another key science capability of FAST, namely investigations of neutral atomic hydrogen gas, particularly in external galaxies. In the more immediate future, China has launched a major national effort to develop the 12-meter Large Optical–infrared Telescope (LOT). When completed, LOT will enjoy the status of being the largest optical–infrared telescope in the world. Here, too, a number of KIAA members are deeply involved in the early phases of science definition and strategic planning.

China's aspirations to ascend the scientific world stage cannot be accomplished by erecting megastructures alone. It must be accompanied by the equally daunting task of building institutional mechanisms that can grow and sustain a community of good talent, who alone can translate the nation's technical investments into impactful discoveries. This is hard. There is no blueprint to engineer great scientists. Nevertheless, a solid foundation can be laid by cultivating the essential elements that any healthy scientific community must have: domestic cooperation, an effective platform for training young people, and international collaboration. The "10+10" astronomy program, a new initiative launched by the China Scholarship Council to promote academic exchange and student training between Chinese and US universities, provides a powerful vehicle to realize these goals. A network of 10 Chinese universities, representing a large segment of our astronomy community, has much to benefit from interaction with their US counterparts (the campuses of the University of California, Caltech, and the University of Hawai'i), who have a distinguished heritage in astronomy and access to powerful observational facilities. At the same time, 10+10 may help facilitate greater collaboration among Chinese institutes and serve as a catalyst for domestic initiatives. Many details of the 10+10 program remain to be ironed out, and it is still too early to know how well it will work. But one thing is clear: KIAA has been a key player in every aspect of this complex program. This example illustrates well the depth of KIAA's commitment to furthering all instruments necessary for an effective scientific enterprise, within our institute and beyond.

While I always encourage my faculty to participate in community service and be engaged in national projects, we should not forget that KIAA's primary mandate lies in research and education. As a small institute, we should also be wary of spreading ourselves too thin or fall in the pitfall of trying to do everything yet nothing particularly well. Moving forward, the trick is to get the balanceright. Only time will tell whether our efforts will bear fruit, but the dedication and sincerity of our efforts no one can doubt.

Luis C. Ho
Director, KIAA

# Featured science

## PKU Astronomy Highlights 2016

1. *First KIAA Governing Board meeting*: The KIAA Governing Board held its first board meeting on 16 January 2016 at the KIAA. The GB was presented with a detailed status on the Institute's structure, management, finances, and strategic plan. The GB spoke highly of the progress KIAA has made, and discussed practical measures to tackle the challenges.

2. *China–US Universities Astronomy Collaboration Summit*: The Summit, held at Peking University on 7 June 2016, was co-organized by the Chinese Scholarship Council, Peking University, the University of California at Santa Barbara, and the University of California at Santa Cruz. It is one of the series of educational exchange activities of the Seventh Conference of the China–US High-Level Consultation on People-to-People Exchange (CPE). KIAA was a co-organizer at Peking University.

*3. National Key Program for Science and Technology Research and Development Grant*: The project *"Black hole–Host Lifecycle Evolution* (BHOLE)", led by Luis C. Ho, was awarded the National Key Program for Science and Technology Research and Development Grant by the Ministry of Science and Technology of China. The BHOLE project is a collaboration of 17 core investigators from six institutions in China (KIAA, Institute of High-energy Physics, National Astronomical Observatories of the Chinese Academy of Sciences, Shanghai Astronomical Observatory, Nanjing University, and the University of Science and Technology of China).

4. *Top Ranked Postdoctoral Program at PKU*: Two KIAA postdocs, Shu Wang and Yuanpei Yang, were among the six PKU postdocs in all disciplines to win a prestigious award from the Innovative Postdoc Support Programme; two postdocs, Kohei Hayashi and Yao Su, won a PKU Boya Postdoctoral Fellowship; Jessy Jose and Xiangkun Liu won PKU Outstanding Postdoc Awards. A total of 8 out of the 15 postdocs at KIAAwere awarded grant funding from the China Postdoctoral Science Foundation, the highest fraction of any department at PKU and much higher than the 10–30% success rates of other departments in the sciences.

*5. Other Grants*: A total of three new NSFC grants, including an NSFC General Grant, an NSFC Key Project, and an Astronomy Joint Grant, as well as one Youth Thousand Talents Grant.

*6. Honors and Awards*: Yingjie Peng received the Youth Thousand Talents Award and won the 2016 MERAC Prize; a discovery of Xuebing Wu's team was selected as one of the Top 10 Advances in Science in 2015 in China, and one of the Top 10 Achievements in Science and Technology in 2015 among Universities in China; Luis Ho was appointed as the chair of Scientific Advisory Committee of 12m Optical Infrared Telescope Construction, hosted by the National Astronomical Observatories, Chinese Academy of Sciences.

*7. Publications*: A total of 214 papers published or accepted in refereed journals.

*8. Faculty Recruitment*: After a wide-ranging international search, we recruited Jing Wang from the Australia Telescope National Facility and Sourav Chatterjee from Northwestern University (USA) as new Assistant Professors at KIAA. They will start to work at KIAA from 2017.

*9. Faculty Mid-term Tenure-track Review:* Three of KIAA's faculty underwent a mid-term tenure-track review, following the rigorous process required by PKU.

*10. Postdoc Recruitment*: We recruited four KIAA Postdoctoral Fellows in 2016 (Shu Wang, KoheiHayash, AlessiaLongobardi, Jongsuk Hong) and 4 PI Postdocs (Yang Huang, Jincheng Guo, Subhash Bose and KexinGuo).

*11. KIAA–CAS Postdoctoral Fellowship*: We received special funding from the Chinese Academy of Sciences to enhance collaboration between the CAS and PKU. Two KIAA–CAS Postdoctoral Fellows were recruited in 2016 (Yuanpei Yang and Su Yao).

*12. KIAA–ICRAR Postdoctoral Fellowship*: KIAA and the International Center of Radio Astronomy Research (ICRAR), an unincorporated joint venture between Curtin University and the University of Western Australia, signed a memorandum to support early-career researchers by awarding two fellowship positions annually starting in 2017.

*13. Construction of a Next-generation Spectrograph Facility for Hale Telescope at Palomar Observatory*: Construction of a new spectrograph facility for Hale Telescope at Palomar Observatory, led by KIAA, is in progress.

14. *Max Planck Partner Group*: a Max-Planck Gesellschaft (MPG) Partner Group in pulsar astronomy, with as head Kejia Lee, a faculty member at KIAA, was formed. The partner group programme aims at strengthening the collaboration between MPG institutes and other institutes. It supports junior scientists carrying out research in their home country.

15. *Visiting Scholars*: We hosted a total of 39 visiting scholars from 33 institutions worldwide. We continued the Kavli Visiting Scholar programme. This initiative, generously supported by special funds from the Kavli Foundation, aims to bring senior colleagues from other Kavli astrophysics institutes to stay in residence at KIAA for extended visits, to facilitate interaction and establish scientific collaborations within the Kavli network.

*16. Prominent Visitors:* Among the

many visitors we had throughout the year, particularly notable were Edward Stone from Caltech (to attend the China–US Universities Astronomy Collaboration Summit held at PKU and deliver a public lecture), Claire Max from UC Santa Cruz (to attend the China–US Universities Astronomy Collaboration Summit and to have discussion with faculty and postdocs at the KIAA), Director of the China office of the US National Science Foundation (NSF) Nancy Sung (to discuss possible collaboration with the Chinese astrophysics community), a Chilean delegation including the President of the Chilean Astronomical Society, Ezequiel Treister, Director of the Department of Astronomy of Universidad de Chile, Guido Garay, and many others.

*17. Conferences*: KIAA faculty organized a total of 11 meetings, including

- The 2016 Beijing–Nanjing Bilateral Astrophysics Workshop, Beijing, 9–10 May 2016;
- A workshop on 'Astronomical Distance Determination in the Space Age', International Space Science Institute–Beijing, 23–27 May 2016;
- The China–US Universities Astronomy Collaboration Summit, 7 June 2016;
- The PKU–XAO Astronomical Bilateral Meeting, Urumqi (Xinjiang), 10–13 June 2016;
- The *FAST* Pulsar Symposium 5, Zunyi (Guizhou), 2–6 July 2016;
- The First Ali Six-point-five-meter Telescope Workshop, KIAA, Beijing, 3 July 2016;
- The Black hole–Host Lifecycle Evolution (BHOLE) workshop: Gas, Dust and Star Formation of AGN Host Galaxies, 30 September 2016;
- The conference 'Planetary Nebulae: Multi-Wavelength Probes of Stellar and Galactic Evolution' (IAU Symposium 323), 10–14 October 2016;
- The KIAA–PKU Astrophysics Forum: Future Large Optical–Infrared Facilities in China, KIAA, Beijing, 10–11 November 2016;
- A workshop on follow-up surveys of *Planck* Galactic Cold Clumps, KIAA, Beijing, 13–16 December 2016;
- The 8th Korea–China–Kazakhstan meeting, Kunming (Yunnan), 19–21 December 2016.

*18. Documentary premiere*: On 30 November 2016, the documentary *Science of Heaven* – a narrative about the history and future of Chinese astronomy – was released officially at the KIAA. The documentary was professionally produced with NSFC funding; the premiere was attended by some 70 audience members, many from the television, film production, embassy and news communities.

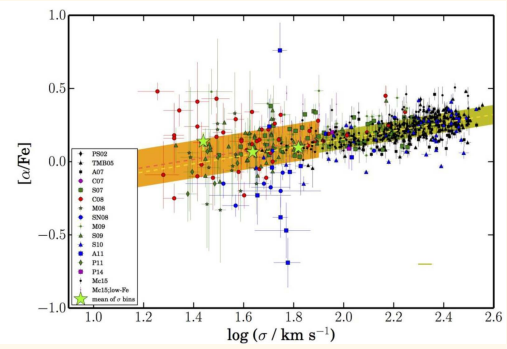
*19. Administration:* We have hired an IT manager (part-time), renovated the fourth floor, converted the space into offices, compiled the faculty handbook, and renewed the postdoc handbook.

# Featured science

## The influence of environment on the chemical evolution in low-mass galaxies

Yiqing Liu

Galaxies are the basic units of cosmic structures. Studying galactic star-formation histories is important for understanding the evolution of ordinary (baryonic) matter in the Universe. Most early-type galaxies (ETGs) stopped forming stars long ago, and they record the star-formation processes and quenching scenarios at early epochs. A powerful tracer of these early processes is the α-to-iron abundance ratio ([α/Fe]), which is an indicator of the star-formation timescale ($t_{SF}$) under the assumption of a universal stellar initial mass function and constant supernova properties. Galaxies with shorter $t_{SF}$ would have higher [α/Fe], and [α/Fe] is sensitive to $t_{SF}$ when $t_{SF}$ is relatively short.




Empirically, among massive ETGs, there is a tight, positive correlation between [α/Fe] and the central velocity dispersion (σ). This indicates that more massive ETGs have shorter $t_{SF}$ and stopped their star formation earlier, which suggests mass-dependent quenching mechanisms. Instead of mass, low-mass ETGs are presumably quenched by environmental processes or by feedback from supernova explosions and stellar winds, which makes the behaviour of their [α/Fe]–σ relation intriguing.

In our recent study, we assembled [α/Fe] and sigma measurements from the literature of 708 ETGs across a wide range in mass and environment to investigate [α/Fe] at low masses. The results are shown in the figure. The [α/Fe]–σ relation at low masses generally follows the tight correlation in the high-mass range, but it has significantly larger intrinsic scatter. However, the large scatter is essentially caused by ETGs from the highest and lowest density environments.

For the low-mass quenched

galaxies located in moderate-density environments (green symbols), which comprise the majority of our sample, both the relation and its intrinsic scatter are similar to those of massive ETGs. On the other hand, the [α/Fe] of low-mass galaxies from the most massive relaxed galaxy clusters (red symbols) and galaxy groups (blue symbols), which are the environments with the highest and lowest densities in our sample, are elevated and suppressed, respectively, by average amounts. This suggests that low-mass ETGs quenched their star formation earlier in very dense environments, and that they have more extended star-formation histories in low-density environments. Moreover, subsamples from extreme environments have large intrinsic scatter in their [α/Fe] distributions, implying stochasticity in their chemical evolution.

In summary, we find a universal and tight [α/Fe]–σ relation for ETGs across a wide mass range, on average, indicating a mass-dependent $t_{SF}$ for most ETGs. However, the low-mass ETGs depart from this standard relation with large intrinsic scatter in extreme environments. The higher and lower mean [α/Fe] suggest earlier quenching in very dense environments and more extended star-formation histories in low-density environments, and the large scatter implies stochasticity in their chemical evolution.

# Featured science

## Mapping the Magellanic system in 3D to trace the interaction history

Smitha Subramanian

The two patchy objects seen in the southern night sky were called the *Cape Clouds* for hundreds of years. They were of importance to the navigators of that time for locating the South Pole, where there is no star corresponding to Polaris near the North Pole. Later, these objects became known as the *Clouds of Magellan*, connected with the name of the Portuguese explorer, Ferdinand Magellan. Modern astronomers refer to these objects as the Magellanic Clouds, including the Large Magellanic Cloud (LMC) and the Small Magellanic Cloud (SMC). Herschel recognized them as stellar systems and in early 20$^{th}$ Century, the velocity measurements of bright nebulae confirmed them to be external galaxies. Since then, these objects have played a significant role in our understanding of different astrophysical phenomena.

These galaxies are in the midst of interacting with each other and with the Milky Way. The signatures of

their interactions are seen as gaseous features around them, in the form of the Magellanic Bridge, the leading arm and the trailing Magellanic Stream. The interaction between the Magellanic Clouds and the Milky Way is representative of the environmental effects that galaxies experience elsewhere in the Universe. This makes the study of this nearest (located at a distance of ~ 50–60 kpc) interacting system, known as the Magellanic system (Fig. 1), more exciting in the context of galaxy formation and evolution through mergers/interactions.

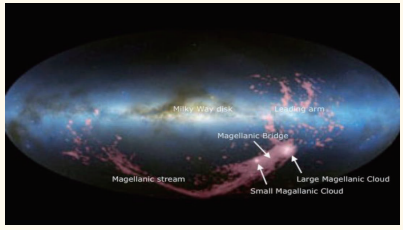



**Figure 1**: Combined optical and radio image of the Magellaic system. (*Credit: David Nidever et al., NRAO/AUI/NSF and Meilinger, Leiden–Argentine–Bonn Survey, Parkes Observatory, Westerbork Observatory, Arecibo Observatory.*)

Earlier, these galaxies were believed to have completed multiple orbits around the Milky Way, but revised proper motion estimates from the *Hubble Space Telescope* suggest that they are on their first passage around the Milky Way. This suggests that the mutual tidal interactions between the Clouds have a more significant role in the formation of the Magellanic system than the role of interaction with the Milky Way. The formation of the Magellanic Bridge from tidally stripped material from the SMC and the presence of old/intermediate-age stellar populations in the MagellanicBridge and the Magellanic Stream are predicted by most theoretical models aimed at explaining the formation of the Magellanic system based on the mutual interactions between the Magellanic Clouds. Though theoretically predicted, observationally this scenario is not well established owing to a lack of studies based on continuous and homogeneous data of the entire system. Identification of the model which best describes the interaction history of these galaxies is essential to understand their fate (e.g. whether or not they will merge with the Milky Way, or whether the Magellanic Stream will be accreted by the Milky Way and fuel the next-generation stars) and eventually to provide insights into the processes in the early Universe which led to the formation of present-day massive galaxies.

A recent study, with Prof. Richard de Grijs (KIAA/PKU), Ning-Chen Sun (KIAA/PKU), and our collaborators in the *VISTA Magellanic Cloud survey* (VMC) team, provides observational evidence of the formation of the MagellanicBridge from tidally stripped material from the inner regions of the SMC. This study was based on the deep near-infrared photometric data from the *VISTA* (Visible and Infrared Survey Telescope for Astronomy) Survey of the Magellanic Clouds. The VMC survey is an ongoing, continuous and homogeneous survey of the Magellanic system in the $YJK_s$ near-infrared bands using the 4.1 m *VISTA* telescope located at Paranal Observatory in Chile. We used red clump (RC) stars, which are burning helium in their core and by virtue of their evolutionary stage they have constant luminosity. This property makes them good distance indicators and we used these stars to map the three-dimensional structure of a ~20 square-degree region of the SMC. We found a foreground population of these stars (in the form of two clumps in the Colour–Magnitude diagram: see Fig. 2), ~12 kpc in front of the main body of the SMC, specifically in the eastern regions, in the direction of the Magellanic Bridge. The most likely explanation for

the origin of these foreground stars is tidal stripping from the SMC during the recent encounter with the LMC. The distance from the centre of the SMC ($r$=2–2.5 kpc), at which the signatures become evident/detectable in the form of distinct RC features matches the tidal radius at the pericentric passage of the SMC. The number ratio of the bright-to-faint RC stars can be used to constrain the mass of the tidally stripped component. A future detailed chemical and kinematic study to obtain the abundance and velocity information of these stars would provide better constraints to the tidal stripping scenario.

We are also working on a project to search for stellar counterparts of the Magellanic Stream using deep near-infrared VMC data. To date, stellar populations are not observed in the Magellanic Stream, but theoretical models predict their existence. On completion, these results will aid in the production of accurate models describing the formation of the Magellanic system.

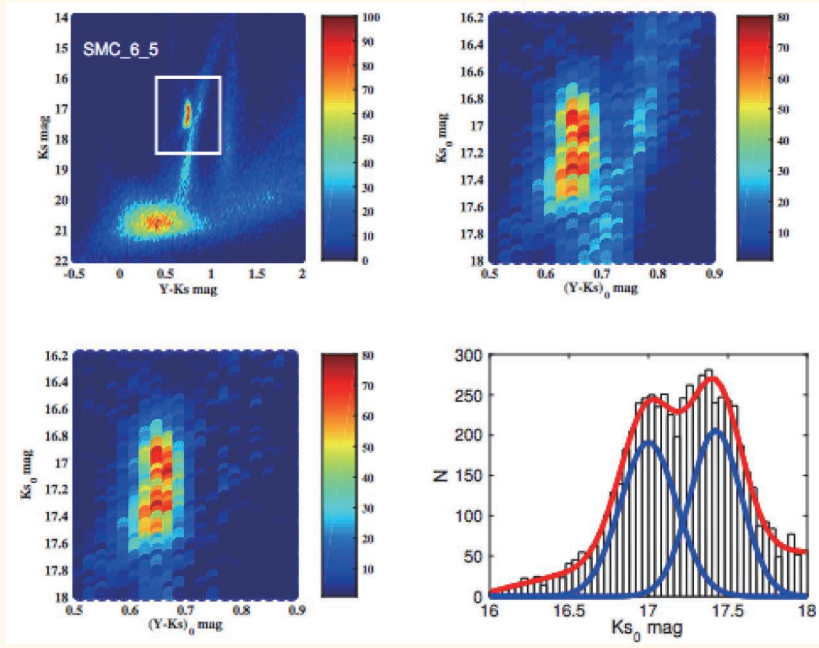



**Figure 2**: The top left panel shows the observed ($Y$–$K_s$) versus $K_s$ colour–magnitude diagram (CMD) of a 1.5 square degree region in the eastern SMC. The white box shows the location of the RC stars. The top right and the bottom left panels show the RC region in the CMD, with red giant branch (RGB) stars and after subtraction of the RGB stars. The bottom right panel shows the $K_s$-band distribution of the RC stars, both the total profile and the individual components. The two peaks in the distribution are separated by ~0.43 mag, which corresponds to a difference in distance of ~12 kpc.

# Featured science

## Discovering the Most Powerful Supernova Ever Recorded

Subo Dong

An international team of astronomers led by Subo Dong, Youth Qianren Professor at the Kavli Institute for Astronomy and Astrophysics at Peking University, discovered a cosmic explosion about 200 times more powerful than a typical supernova—events which already rank amongst the mightiest outbursts in the Universe—and more than twice as luminous as the previous record-holding supernova. At its peak intensity, the explosion—called ASASSN-15lh—shone with 570 billion times the luminosity of the Sun. This luminosity level is approximately 20 times the entire output of the 100 billion stars comprising our Milky Way galaxy. The record-breaking blast is thought to be an outstanding example of a 'superluminous supernova,' a recently discovered, extremely rare variety of explosion unleashed by certain stars when they die.

As described in a new study published in the 15 January 2016 issue of *Science*, ASASSN-15lh is amongst the closest superluminous supernovae ever beheld, at a distance of around 3.8 billion light-years.

ASASSN-15lh was first glimpsed in June 2015 by twin telescopes with 14 cm (diameter) lenses at Cerro Tololo, Chile, while conducting the *All Sky Automated Survey for SuperNovae* (ASAS-SN), an international collaboration headquartered at The Ohio State University (USA). These two tiny telescopes sweep the skies to detect suddenly appearing objects like

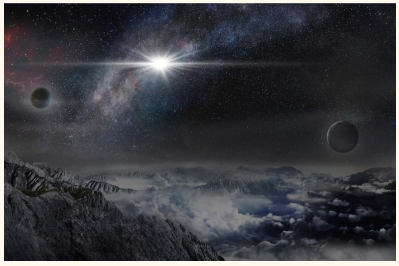


Figure 1: Artist's impression of the record-breaking powerful, superluminous supernova ASASSN-15lh as it would appear from an exoplanet located about 10,000 light-years away in the host galaxy of the supernova. (*Credit: Beijing Planetarium/Jin Ma*)

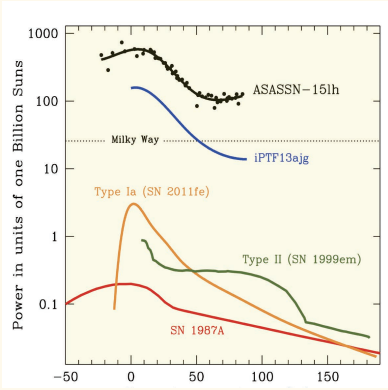



**Figure 2:** Light curves of ASASSN-15lh and other supernovae for comparison. At maximum, ASASSN-15lh is about 200 times more powerful than a typical Type Ia supernova, and it is more than twice as luminous as the previous record-holding Type I superluminous supernova.

ASASSN-15lh that are intrinsically very bright, but which are too far away for human observers to notice.

Dong and colleagues immediately put out word about the sighting of ASASSN-15lh so as to facilitate collection of as much data as possible. Multiple, far larger ground-based telescopes across the globe, as well as NASA's Swift satellite, have since taken part in an intense observing campaign that continues to this day.

In just the first four months after it went kablooie, so much energy beamed out of ASASSN-15lh that it would take our Sun in its current state more than 90 billion years to equal its emission. By examining this bright, slowly fading afterglow, astronomers have gleaned a few basic clues about the origin of ASASSN-15lh. Using the 2.5 meter du Pont telescope in Chile, Dong's colleagues Ben Shappee and Nidia Morrell at the Carnegie Observatories (USA) took the first spectrum of ASASSN-15lh to identify the signatures of chemical elements scattered by the explosion. This spectrum puzzled the ASAS-SN team members, since it did not resemble any of spectra from the 200 or so supernovae the project had discovered to date.

Inspired by suggestions from José Prieto at the Universidad Diego Portales in Chile and Krzysztof Stanek at Ohio State, Dong realized that ASASSN-15lh might in fact be a superluminous supernova. He found a close spectral match for ASASSN-15lh in a 2010 superluminous supernova, and if they were indeed of the same kind, then ASASSN-15lh's distance would be confirmable with additional observations. Nearly 10 days passed as three other telescopes, stymied by bad weather and instrument mishaps, attempted to gather these necessary spectra. Finally, Saurabh Jha from Rutgers University (USA) was able to use the 10 meter Southern African Large Telescope to secure the observations of elemental signatures verifying ASASSN-15lh's distance and extreme potency. The ongoing observations have further revealed that ASASSN-15lh bears certain features consistent with 'hydrogen-poor' (Type I) superluminous supernovae, which are one of the two main types of these epic explosions, so named for lacking signatures of the chemical element hydrogen in their spectra. ASASSN-15lh has likewise shown a rate of temperature decrease and radius expansion similar to some previously discovered Type I superluminous supernova.

Yet in other ways, in addition to its brute power, ASASSN-15lh stands apart. It is a lot hotter, and not just brighter, than its apparently nearest of supernova kin. The galaxy it calls

home is also without precedent. Type I superluminous supernovae seen to date have all burst forth in dim galaxies both smaller in size and which churn out stars much faster than the Milky Way. Noticing the pattern, astronomers hoped that this specific sort of galactic environment had something to do with superluminous supernovae, either in terms of the creation of the exotic stars that spawn them or in setting these stars off. Exceptionally, however, ASASSN-15lh's galaxy appears even bigger and brighter than the Milky Way. On the other hand, ASASSN-15lh might in fact reside in an as-yet-unseen, small, faint neighboring galaxy to its presumed, large galactic home.

One of the best hypotheses is that superluminous supernovae's stupendous energy comes from highly magnetized, rapidly spinning neutron stars called magnetars, which are the leftover, hyper-compressed cores of massive, exploded stars. But ASASSN-15lh is so potent that this compelling magnetar scenario just falls short of the required energies. Instead, ASASSN-15lh-esque supernovae might be triggered by the demise of incredibly massive stars that go beyond the top tier of masses most astronomers would speculate are even attainable.

At this point, we do not know what could be the power source of ASASSN-15lh. ASASSN-15lh may lead to new thinking and new observations of the whole class of superluminous supernova. KIAA and Peking University are supporting expansion of the ASAS-SN network to a site in China and the Chinese Academy of Sciences' South America Center for Astronomy is funding an upgrade of the ASAS-SN Chilean node. We expect to make more exciting discoveries in the years to come.

*This research is partly supported by the Pilot-B program of the Chinese Academy of Sciences.*

# Featured science

## Theories of modified gravity

Zuhui Fan

The observed cosmic acceleration poses a great challenge to our understanding of the Universe. It requires either the introduction of a dark energy component (which is associated with an equivalent negative pressure) into the matter content of the Universe, or modification of the general theory of relativity pertaining to gravity on cosmological scales. Either choice can have profound impacts, both physically and cosmologically.

Among different theories of modified gravity invoked to explain the accelerating expansion of the Universe, *f(R)* theory is a representative flavor. Unlike in general relativity where space–time bends to minimize its curvature *R*, in *f(R)* theory an additional function of *R* is introduced and the minimization is done for *R+f(R)*. With a suitable choice of *f(R)*, this theory might explain the cosmic acceleration while still passing solar system tests of the

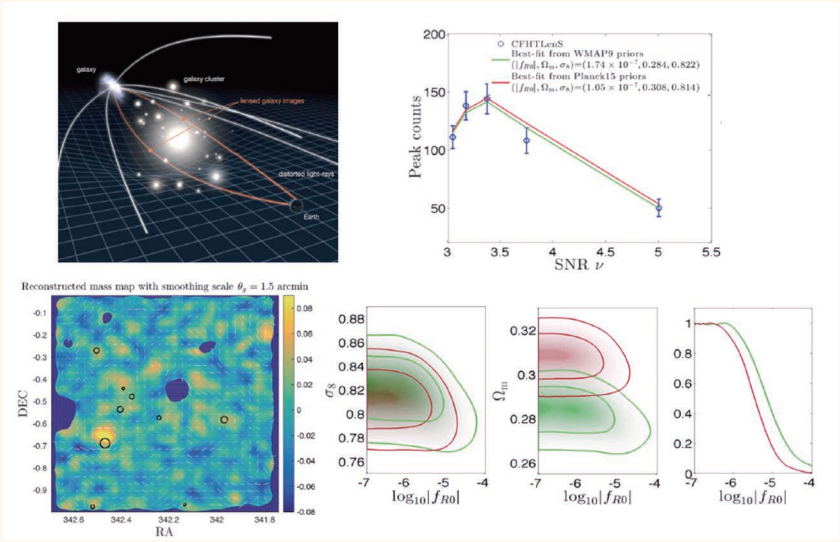



**Figure 5:** (top left) Illustration of the gravitational lensing effect; (bottom left) Reconstructed convergence map from CFHTLenS; (top right) Peak counts distribution from CFHTLenS; (bottom right) Constraints on $\log|f_{R0}|$. (*Liu X., et al. 2016, Phys. Rev. Lett., 117, 051101*)

law of gravity owing to the 'chameleon effect.' However, structure formation on cosmological scales can be affected significantly. Therefore, observations of large-scale structure are critical to scrutinize the underlying mechanism driving the global cosmic acceleration, and thus to deepen our view of fundamental physics and cosmology.

Originating from light deflection by large-scale structures in the Universe (see Fig. 1, top left-hand panel), the weak lensing (WL) effect has been recognized as one of the key cosmological probes. With CFHTLenS WL observations (http://www.cfhtlens.org), a team led by Prof. Zuhui Fan and composed of members from Peking University, Durham University (UK), the National Astronomical Observatories, Chinese Academy of Sciences, and Shanghai Normal University carried out detailed WL peak analyses and obtained stringent constraints on the Hu–Sawicki *f(R)* gravity theory.

High peaks in WL maps are closely related to massive haloes along lines of sight. The bottom left-hand panel of Fig. 1 shows an example of the WL convergence map we obtained from our CFHTLenS data. Peaks are seen very clearly, and they have good correspondence with known clusters, shown as black circles. Their abundance is therefore sensitive to halo formation and evolution, which in turn is sensitive to the law of gravity. Compared to cosmological studies using optical, X-rays, or Sunyaev–Zel'dovich clusters, which rely heavily on baryonic observable–mass relations, WL peak statistics are much less affected by baryonic physics, the major systemic effect affecting normal cluster studies. On the other hand, WL peak studies suffer from their own systematics. How to predict accurately the cosmological dependence of the WL peak abundance is a challenging task. Considering carefully the noise from the intrinsic shapes of the source galaxies, we have developed an analysis pipeline for cosmological studies using WL high peaks, from theoretical modeling, mock simulation calibrations, to a fast computing platform.

By applying it using CFHTLenS with priors from *WMAP* and Planck cosmic microwave background observations, the team has derived tight constraints on the Hu–Sawicki *f(R)* theory, for the first time, from the WL high peak abundance. In the right-hand panels of Fig. 1 we show the peak counts from CFHTLenS at the top, and the constraints on the $\log|f_{R0}|$ parameter at the bottom. We obtain a tight constraint for $\log|f_{R0}|<5.16$ ($2\sigma$ and *Planck* prior). No derivations from the general theory of relativity are detected.

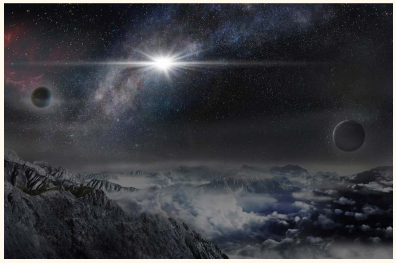
Our study demonstrates clearly the promising potential of WL peak analyses. With ongoing and future large observations with much improved data quantity and quality, we expect that WL peak analyses will result in much better cosmological constraints. Low statistical errors in future observations require tighter systematic controls of cosmological observables. We have been continuously working toward improving our theoretical modeling and carefully studying different systematic effects. We are also exploring more information from WL peak analyses by incorporating the redshifts of source galaxies tomographically to fully realize the power of WL peak statistics in future cosmological studies.

News:
http://www.sciencemag.org/news/2016/07/attempt-explain-away-dark-energy-takes-hit

# News items 2016

## 15 January 2016:

## Record-Shattering Cosmic Blast Could Help Crack the Case of Extreme Supernova Explosions



Artist's impression of the record-breaking, powerful, superluminous supernova ASASSN-15lh as it would appear from an exoplanet located about 10,000 light years away in the host galaxy of the supernova. (*Credit: Beijing Planetarium/Jin Ma*)

*'Records are made to be broken,'* as the expression goes, but rarely are records left so thoroughly in the dust. Stunned astronomers have witnessed a cosmic explosion about 200 times more powerful than a typical supernova—events which already rank amongst the mightiest outbursts in the Universe—and more than twice as luminous as the previous record-holding supernova.

At its peak intensity, the explosion—called ASASSN-15lh—shone with 570 billion times the luminosity of the Sun. If that statistic does not impress, consider that this luminosity level is approximately 20 times the entire output of the 100 billion stars comprising our Milky Way galaxy.

The record-breaking blast is thought to be an outstanding example of a 'superluminous supernova,' a recently discovered, extremely rare variety of explosion unleashed by certain stars when they die. Scientists are frankly at a loss, though, regarding what sorts of stars and stellar scenarios might be responsible for these extreme supernovae.As described in a new study published in Science, ASASSN-15lh is amongst the closest superluminous supernovae ever beheld, at around 3.8 billion light years away. Given its uncanny brightness and closeness, ASASSN-15lh might offer key clues in unlocking the secrets of this baffling class of celestial detonations.

*"ASASSN-15lh is the most powerful supernova discovered in human history,"* said study lead author Subo Dong, an astronomer and a Youth Qianren Research Professor at the Kavli Institute for Astronomy and Astrophysics (KIAA)

Two of the 14 cm(diameter) lens telescopes in use for the All Sky Automated Survey for SuperNovae (ASAS-SN) that discovered ASASSN-15lh. Since this photo was taken, two more telescopes have been added to the ASAS-SN station in Cerro Tololo, Chile. (*Credit: Wayne Rosing*)

at Peking University. *"The explosion's mechanism and power source remain shrouded in mystery because all known theories meet serious challenges in explaining the immense amount of energy ASASSN-15lh has radiated."*

ASASSN-15lh was first glimpsed in June 2015 by twin, telescopes with 14 cm (diameter) lenses at Cerro Tololo, Chile, conducting the All Sky Automated Survey for SuperNovae (ASAS-SN), an international collaboration headquartered at The Ohio State University. These two tiny telescopes sweep the skies to detect suddenly appearing objects like ASASSN-15lh that are intrinsically very bright, but are too far away for human observers to notice.

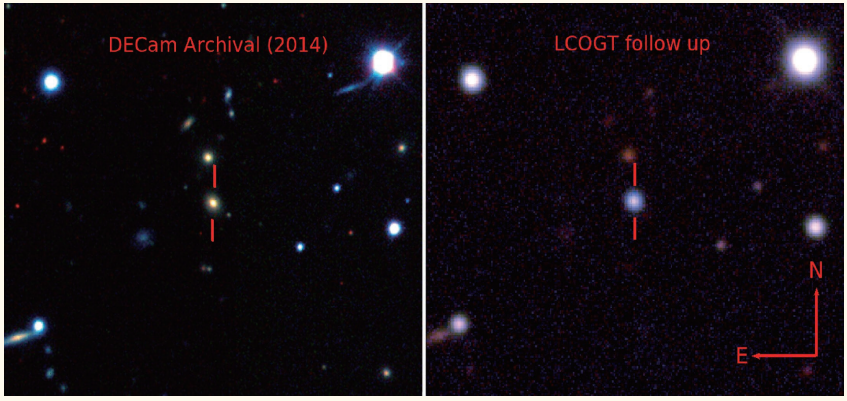
*"ASAS-SN is the first astronomical project in history to frequently scan the entire optical sky for optical transients,"* said Krzysztof Stanek, professor of astronomy at the Ohio State University and the co-Principal Investigator of ASAS-SN. "*Every time in science we open up a new discovery space, exciting findings should follow. The trick is not to miss them.*"

Dong and colleagues immediately put out word about the sighting of ASASSN-15lh in order for as much data as possible to be gathered. Multiple, far larger ground-based telescopes across the globe, as well as NASA's Swift satellite, have since taken part in an intense observing campaign that continues to this day.

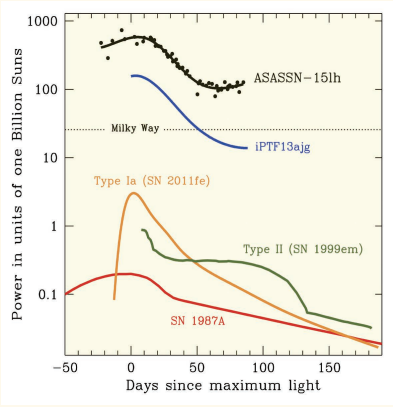
In just the first four months after it went *kablooie,* so much energy beamed out of ASASSN-15lh that it would take our Sun in its current state more than 90 billion years to equal its emissions. By examining this bright, slowly fading afterglow, astronomers have gleaned a few basic clues about the origin of ASASSN-15lh.

Using the 2.5 meter du Pont telescope in Chile, Dong's colleagues Ben Shappee and Nidia Morrell at the Carnegie Observatories in the United States took the first spectrum of ASASSN-15lh to identify the signatures of chemical elements scattered by the explosion. This spectrum puzzled the ASAS-SN team members, since it did not resemble any of spectra from the 200 or so supernovae the project had discovered to date.

Inspired by suggestions from Jose Prieto at the Universidad Diego Portales in Chile and Stanek, Dong realized that ASASSN-15lh might in fact be a superluminous supernova. Dong found a close spectral match for ASASSN-15lh in a 2010 superluminous




Pseudo-color images showing the host galaxy before the explosion of ASASSN-15lh taken by the Dark Energy Camera (*left*), and the supernova by the Las Cumbres Observatory Global Telescope Network (LCOGT) 1-meter telescope network *(right). (Credit: The Dark Energy Survey, B. Shappee and the ASAS-SN team)*




The light curves of ASASSN-15lh and other supernovae, for comparison. At maximum, ASASSN-15lh is about 200 times more powerful than a typical Type Ia supernova, and it is more than twice as luminous as the previous record-holding Type I superluminous supernova, iPTF13ajg. (*Credit: the ASAS-SN team*)

supernova, and if they were indeed of a kind, then ASASSN-15lh's distance would be confirmable with additional observations. Nearly 10 days passed as three other telescopes, stymied by bad weather and instrument mishaps, attempted to gather these necessary spectra. Finally, Dong's colleague Saurabh Jha from Rutgers University (USA) was able to use the 10 meter Southern African Large Telescope (SALT) to secure the observations of elemental signatures verifying ASASSN-15lh's distance and extreme potency.

*"Upon seeing the spectral signatures from SALT and realizing that we had discovered the most powerful supernova yet, I was too excited to sleep the rest of the night,"* said Dong, who had received word of the SALT results at 2 a.m. in Beijing on 1 July 2015.

The ongoing observations have further revealed that ASASSN-15lh bears certain features consistent with 'hydrogen-poor' (Type I) superluminous supernovae, which are one of the two main types of these epic explosions so named for lacking signatures of the chemical element hydrogen in their spectra. ASASSN-15lh has likewise shown a rate of temperature decrease and radius expansion similar to some previously discovered Type I superluminous supernova.

Yet in other ways, besides its brute power, ASASSN-15lh stands apart. It is way hotter, and not just brighter, than its apparently nearest of supernova kin. The galaxy it calls home is also without precedent. Type I superluminous supernova seen to date have all burst forth in dim galaxies both smaller in size and that churn out stars much faster than the Milky Way.

Noticing the pattern, astronomers hoped this specific sort of galactic environment had something to do with superluminous supernovae, either in the creation of the exotic stars that spawn them or in setting these stars off. Exceptionally, however, ASASSN-15lh's galaxy appears even bigger and brighter than the Milky Way. On the other hand, ASASSN-15lh might in fact reside in an as-yet-unseen, small, faint neighboring galaxy of its presumed, large galactic home.

To clear up where exactly ASASSN-15lh is located, as well as numerous other mysteries regarding it and its hyper-kinetic ilk, the research team has been granted valuable time this year on the *Hubble Space Telescope*. With Hubble, Dong and colleagues will obtain the most detailed views yet of the aftermath of ASASSN-15lh's stunning explosion. Important insights into the true wellspring of its power should then come to light.

One of the best hypotheses is that superluminous supernovae's stupendous energy comes from highly magnetized, rapidly spinning neutron stars called magnetars, which are the leftover, hyper-compressed cores of massive, exploded stars. But ASASSN-15lh is so potent that this compelling magnetar scenario just falls short of the required energies. Instead, ASASSN-

15lh-esque supernovae might be triggered by the demise of incredibly massive stars that go beyond the top tier of masses most astronomers would speculate are even attainable.

*"The honest answer is at this point that we do not know what could be the power source for ASASSN-15lh," said Dong. "ASASSN-15lh may lead to new thinking and new observations of the whole class of superluminous supernova, and we look forward to plenty more of both in the years ahead."*

## 18 January 2016:

# First KIAA Governing Board meeting held at KIAA

The KIAA Governing Board held the first board meeting on 16 January 2016 at the KIAA. In attendance were the chair of the governing board Jie Wang (Peking University), co-chair Robert E. Williams (Space Telescope Science Institute), Luis C. Ho (KIAA, Peking University), Anthony N. Lasenby (Kavli Institute for Cosmology, University of Cambridge), Simon D. M. White (Max Plank Institute for Astrophysics), and Xiaolin Chen (Peking University). Executive Vice President of Science Programs of the Kavli Foundation, Miyoung Chun, and Associate Director of the KIAA, Xuebing Wu, also attended the meeting.

Vice President of PKU Jie Wang gave opening remarks to explain the goals and responsibilities of the Governing Board and to express his expectation for the important role it will play in the KIAA's future development. Luis C. Ho, Director of the KIAA, gave comprehensive reports on the status of astronomy in China, the structure and composition of the KIAA, recent developments, and new initiatives and challenges facing the institute. Xuebing Wu gave a financial report. The Governing Board members had an extensive discussion on the reports. They spoke highly of the progress the KIAA has made and discussed the practical measures to tackle the challenges.

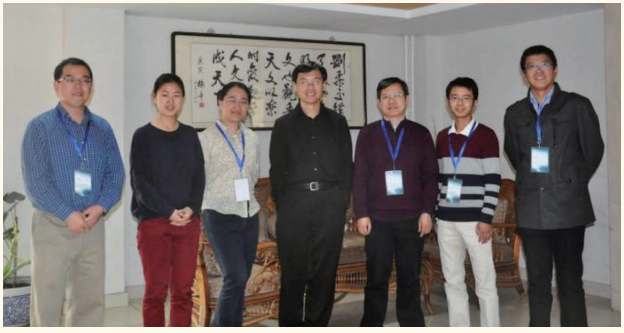
At the same time, two Science Program Officers from the Kavli Foundation, Christopher Martin and Sharif Taha, had closed-door meetings and separate lunch talks with KIAA faculty, postdocs, and graduate students to assess the performance of the institute and the management style of the current leadership.

## 23 January, 26 February 2016:

# Discovery of Wu's Team Listed as one of *Top 10 Achievements in Science and Technology in 2015* among Universities in China, as well as one of *Top 10 Advances in Science in 2015 in China*

The discovery of the most luminous quasar with an ultramassive black hole in the distant Universe, made by a team led by KIAA Associate Director Xue-Bing Wu, originally published in the journal Nature on 26 February 2015, has been selected as one of the Top 10 Achievements in Science and Technology in 2015 among Universities in China. The 10 achievements were selected by the Science and Technology Committee of the Ministry of Education of China. Since 1998, this selection has played an important role in enhancing science innovation in Chinese universities.In addition, the Ministry of Science and Technology of China selected this discovery as one of the Top 10 Advances in Science in 2015 in China.

- News on the webpage of Ministry of Education of China: http://www.moe.edu.cn/jyb_xwfb/gzdt_gzdt/s5987/201512/t20151223_225831.html
- New on the webpage of Peking University: http://pkunews.pku.edu.cn/xwzh/2015-12/24/content_292253.htm
- Xinhua.net: http://news.xinhuanet.com/tech/2016-02/25/c_1118161313.htm
- Renmin.net: http://scitech.people.com.cn/n1/2016/0225/c1007-28150883.html
- Science and Technology Daily: http://www.wokeji.com/jbsj/yb/201602/t20160226_2263761.shtml



## 28 January 2016:

# Multiple generations of stars in star clusters may resemble adopted rather than natural children

Among the most striking objects in the Universe are glittering, dense swarms of stars known as globular clusters. Astronomers had long thought that globular clusters formed their millions of stars in bulk at around the same time, with each cluster's stars having very similar ages, much like twin brothers and sisters. Yet recent discoveries of young stars in old globular clusters have scrambled this tidy picture.

Instead of having all their stellar progeny at once, globular clusters can somehow bear second or even third sets of thousands of sibling stars. Now a new study led by Chengyuan Li and Richard de Grijs at the Kavli Institute for Astronomy and Astrophysics (KIAA) at Peking University might explain these puzzling, successive stellar generations. Using observations by the Hubble Space Telescope, the research team has—for the first time—found young populations of stars within globular clusters that have apparently developed courtesy of star-forming gas flowing in from outside of the clusters themselves. This method stands in contrast to the conventional idea of the clusters' initial stars shedding gas as they age in order to spark future rounds of star birth.

The KIAA-led research team proposes that globular clusters can sweep up stray gas and dust they encounter while moving about their respective host galaxies. The theory of newborn stars arising in clusters as they 'adopt' interstellar gases actually dates back to a 1952 paper. More than a half-century later, this once speculative idea suddenly has key evidence to support it.

**Published paper**: Li, de Grijs, et al., 2016, *Formation of new stellar populations from gas accreted by massive young star clusters, Nature,* 529, 502–504.

**Selected press coverage:**

- The Kavli Foundation: http://www.kavlifoundation.org/kavli-news/stellar-parenting-giant-star-clusters-make-new-stars-adopting-stray-cosmic-gases
- PKU News: http: //pkunews.pku.edu.cn/xxfz/2016-01/28/content_292792.htm
- Northwestern University: http://www.northwestern.edu/newscenter/stories/2016/01/globular-clusters.html
- Space.com: http: //www.space.com/31750-star-formation-second-generation-stellar-clusters.html
- Interview with Richard de Grijs by the Australian Broadcasting Corporation (ABC news): http://www.abc.net.au/news/2016-01-28/globular-clusters-may-pull-gas-from-galaxies-to-make-new-stars/7117826

## 13 April 2016:

# Yingjie Peng Wins 2016 MERAC Prize and 2016 Chinese Youth Qianren Honour

The European Astronomical Society (EAS) has announced the awardees of its 2016 prizes. The 2016 MERAC Prize for the Best Doctoral Thesis in Observational Astrophysics has been awarded to Yingjie Peng, currently a KIAA faculty member, for his thesis on the simplicity of the evolving galaxy population and the origin of the Schechter form of the galaxy stellar mass function.

There are annually three MERAC Prizes awarded by the European Astronomical Society. The prizes of € 20,000 each are for each of the three categories: Theoretical Astrophysics, Observational Astrophysics, and New Technologies (Instrumental/Computational). All three awardees are invited to give a plenary lecture at the European Week of Astronomy and Space Science (EWASS) to be held in Athens, Greece on 4–8 July 2016, and will they also give a lecture in Switzerland under the patronage of the Fondation MERAC.

Yingjie Peng's PhD thesis focused on an analysis of high-quality data from large sky surveys both locally and at high redshift, and introduced a novel phenomenological, observationally based approach to study the formation and evolution of the galaxy population. The goal was to use the observational material as directly as possible in order to identify the simplest empirical 'laws' for the evolution of the population. This approach has successfully explained the origin of the Schechter form of the stellar mass function and reproduced many observed essential features of the evolving galaxy population over cosmic time. The associated papers describing this simple and innovative approach have become some of the most highly cited papers in galaxy formation and evolution.

The PhD thesis of Yingjie Peng was carried out at the Institute for Astronomy at ETH Zurich, Switzerland, between October 2007 and September 2012, under the supervision of Prof. Simon Lilly.

- European Astronomical Society press release: http://eas.unige.ch/merac_prizes.jsp; http://eas.unige.ch/documents/eas_prizes_2016.pdf
- PKU news: http://pkunews.pku.edu.cn/xwzh/2016-04/14/content_293401.htm
- West China City Daily: http://wccdaily.scol.com.cn/shtml/hxdsb/20160428/329493.shtml
- Yingjie Peng has also been awarded a 2016 Youth Qianren Honour in China: http: //www.1000plan.org/qrjh/article/64754

## 10 May, 8 June, 16 November 2016:

# 10 PKU postdocs won the Chinese Postdoctoral General Grant in Astronomy; two postdocs at KIAA won the 9th special fund of the National Science Foundation

The Chinese Postdoctoral Foundation announced the awardees of the postdoc general grant this year. PKU (KIAA & DoA) has been awarded 6 of the 11 postdoc general grants in the field of astronomy.

The awardees in astronomy at PKU are as follows:

- First-class (4 postdocs including 3 KIAA/DoA postdocs): **Alexander Kolodzig, Smitha Subramanian** Hari Sharma, **Bingqiu Chen.**
- Second-class, first round (7 postdocs including 3 KIAA/DoA postdocs): **Petchara Pattarakijwanich, Yanxia Xie, Xiangkun Liu.**
- Second-class, second round (4 KIAA/DoA postdocs): S**ubhash Bose, Zhijia Tian, Yuanpei Yang, Yang Huang.**

The China National Science Foundation announced the awardees of the 9th special fund; two postdocs at KIAA, **Jessy Jose** and **Haoran Yu**, were listed.

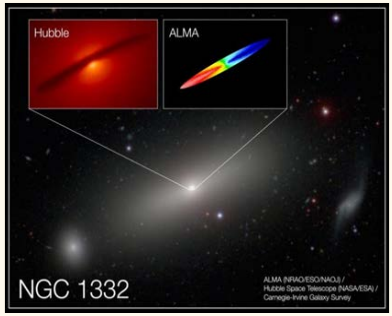
## 16 May 2016:

# *ALMA* Measures Mass of Black Hole with Extreme Precision

Supermassive black holes, some weighing millions to billions of times the mass of the Sun, dominate the centers of their host galaxies. To determine the actual mass of a supermassive black hole, astronomers must measure the strength of its gravitational pull on the stars and clouds of gas that swarm around it.

Using the Atacama Large Millimeter/submillimeter Array (*ALMA*), a team of astronomers from the Kavli Institute for Astronomy and Astrophysics (KIAA) at Peking University, the University of California Irvine, and other universities has delved remarkably deep into the heart of a nearby elliptical galaxy, NGC 1332, to study the motion of a disk of cold interstellar gas encircling the supermassive black hole at its center. These observations provide one of the most accurate mass measurements to date for a black hole outside of our Galaxy, helping set the scale for these cosmic behemoths.

The *ALMA* observations reveal details of the disk's structure on the order of 16 light-years across. They also measure the disk's rotation well within the estimated 80 light-year radius of the




This combined image of NGC 1332 shows the central disk of gas surrounding the supermassive black hole at the center of the galaxy. New *ALMA* observations traced the motion of the disk, providing remarkably precise measurements of the black hole's mass: 660 million times the mass of our Sun. The main image is from the Carnegie–Irvine Galaxy Survey. The box at the top left is from the *Hubble Space Telescope* and shows the galaxy's central region in infrared light and the dusty disk appears as a dark silhouette. The *ALMA* image, top right box, shows the rotation of the disk, enabling astronomers to calculate its mass. The red region in the *ALMA* image represents emission that has been redshifted by gas rotating away from us; the blue represents blue-shifted gas, rotating toward us. The range of colors represent rotational speeds up to 500 kilometers per second. [*Credit: A. Barth (UC Irvine), ALMA (NRAO/ESO/NAOJ); NASA/ESA Hubble; Carnegie-Irvine Galaxy Survey.*]

black hole's 'sphere of influence', the region where the black hole's gravity is dominant. Near the disk's center, *ALMA* observed the gas traveling at more than 500 kilometers per second. By comparing these data with simulations, the astronomers calculated that the black hole at the center of NGC 1332 has a mass 660 million times greater than our Sun, plus or minus ten percent. This is about 150 times the mass of the black hole at the center of the Milky Way, yet still comparatively modest relative to the largest black holes known to exist, which can be many billions of solar masses.

*ALMA's* close-in observations were essential, the researchers note, to avoid confounding the black hole measurement with the gravitational influence of other material—stars, clouds of interstellar gas, and dark matter—that comprises most of the galaxy's overall mass.

Astronomers use various techniques to measure the mass of black holes. All of them, however, rely on tracing the motion of objects as close to the black hole as possible. In the Milky Way, powerful ground-based telescopes using adaptive optics can image individual stars near the galactic center and precisely track their trajectories over time. Though remarkably accurate, this technique is feasible only within our own Galaxy; other galaxies are too distant to distinguish the motion of individual stars.

To make similar measurements in other galaxies, astronomers either examine the aggregate motion of stars in a galaxy's central region, or trace the motion of gas disks and mega-masers, natural cosmic radio sources. Previous studies of NGC 1332 with ground- and space-based telescopes gave wildly different estimates for the mass of this black hole, ranging from 500 million to 1.5 billion times the mass of the Sun. The new *ALMA* data confirm that the lower estimates are more accurate. Crucially, the new *ALMA* observations have higher resolution than any of the past observations. *ALMA* also detects the emission from the densest, coldest component of the disk, which is in a remarkably orderly circular motion around the black hole.

Many past black hole measurements made with optical telescopes, including the Hubble Space Telescope, focused on emission from the hot, ionized gas orbiting in the central regions of galaxies. Ionized-gas disks tend to be much more turbulent than cold disks, which leads to lower precision when measuring a black hole's mass. As noted by the authors of this study, *ALMA* can map out the rotation of gas disks in galaxy centers with even sharper resolution than the *Hubble*

*Space Telescope*. This observation demonstrates a technique that can be applied to many other galaxies to measure the masses of supermassive black holes to remarkable precision.

**Original Source:**

https://public.nrao.edu/news/pressreleases/2016-gr-domain-smbh

**Published paper:**

Barth A., et al., 2016, Measurement of the Black Hole Mass in NGC 1332 from *ALMA* Observations at 0.044 arcsecond Resolution, ApJL, 822, L28

**Selected media coverage:**

- UC Irvine News: https://news.uci.edu/research/uci-astronomers-determine-precise-mass-of-a-giant-black-hole/
- *ALMA* Press Release: http://almaobservatory.org/en/press-room/press-releases/959-alma-measures-mass-of-black-hole-with-extreme-precision
- EureKAlert | AAAS Public Release: http://www.eurekalert.org/pub_releases/2016-05/nrao-amm050516.php
- 'Top story' on the NSF Science360 website: https://news.science360.gov/obj/story/6d76289b-0acc-45ca-8356-f97d37e307cf/astronomers-determine-precise-mass-giant-black-hole

## 9 June 2016:

# China–US Universities Astronomy Collaboration Summit held at Peking University

The China–US Universities Astronomy Collaboration Summit, on the theme "*Our Universe, a World without Boundaries*", was held in Beijing on 7 June 2016.The Summit was co-organized by the Chinese Scholarship Council, Peking University, the University of California, Santa Barbara, and the University of California, Santa Cruz. It is one of the series of educational exchange activities of the Seventh Conference of China–US High-Level Consultation on People-to-People Exchange (CPE), which was attended by Chinese Vice Premier Liu Yandong and US Secretary of State John Kerry on the morning of 7 June 2016 at the National Museum.

Senior leaders of the participating universities, as well as officials from the China Scholarship Council, attended the summit, including Henry Yang, Chancellor of UC Santa Barbara, Robert Bley-Vroman, Chancellor of University of Hawaii at Manoa, Reed Dasenbrock, Vice Chancellor of University of Hawaii at Manoa, Tyrus Miller, Vice Provost and Dean of Graduate Studies of UC Santa Cruz, Liu Jinghui, Secretary-General of China Scholarship Council, Lin Jianhua,


President of Peking University, Chen Jun, President of Nanjing University, Peter William Mathieson, President of Hong Kong University, Wu Yueliang, Vice President of University of Chinese Academy of Sciences, Huang Zhen, Vice President of Shanghai Jiaotong University, Zhou Zuoyu, Vice President of Beijing Normal University, Ma Jun, Vice President of Sun Yat-Sen University, Zhan Xinli, Vice President of Xiamen University, Han Shenghao, Vice President of Shandong University, and Jiang Zhihong, Vice President of Macau University of Science and Technology.

During the Summit, a new astronomy collaboration program MoU between China and the US was signed by Liu Jinghui, Secretary-General of China Scholarship Council, Henry Yang, Chancellor of UC Santa Barbara and Robert Bley-Vroman, Chancellor of University of Hawaii at Manoa, representing universities from China and the US.

The Summit was hosted by Wang Jie, Vice President of Peking University. It included an exchange of ideas and discussion on collaborations between Chinese and US universities, collaborations between universities and national institutes, as well as astronomy collaborations in the context of the *Thirty Meter Telescope*. The collaboration program is designed to promote research exchanges in astronomy between Chinese and US universities. The collaboration program, at full-strength, will involve the exchange of literally dozens of astronomers from undergraduate to senior levels.

**Highlights from a Peking University perspective include:**

- Chinese Vice Premier Liu Yandong and US Secretary of State John Kerry

attended the Seventh Conference of the China–US High-Level Consultation on People-to-People Exchange (CPE).

- Lin Jianhua, President of Peking University, gave a welcome speech at the Summit.
- Luis C. Ho, Director of the Kavli Institute for Astronomy and Astrophysics, Peking University, gave a speech on "*The Status of Chinese Astronomy*."
- Alex Filippenko, Professor at UC Berkeley, gave a speech on "*The Accelerating Expansion of the Universe*."
- Edward Stone, Vice Provost for Special Projects of the California Institute of Technology, gave a public talk at Peking University on "*Voyager in Interstellar Space and The Universe in High Definition*."

**PKU News**: http://pkunews.pku.edu.cn/xwzh/2016-06/08/content_294037.htm
**Chinese Science News**: http://n.roboo.com/news/detail.htm?id=e6da01c1160fd3a31e2c58f65c2882ae&index=nnews
**Guang Ming online**: http://tech.gmw.cn/newspaper/2016-06/09/content_113104785.htm


## 27 June 2016:

# The DRAGON globular cluster simulations: a million stars, black holes and gravitational waves

An international team of experts from China and Europe has performed the first simulations of globular clusters with a million stars on the high-performance GPU cluster of the Max Planck Computing and Data Facility. These—up to now—largest and most realistic simulations cannot only reproduce observed properties of stars in globular clusters at unprecedented detail, but also shed light into the dark world of black holes. The computer models produce high-quality synthetic data comparable to *Hubble Space Telescope* observations. They also predict nuclear clusters of single and binary black holes. The recently detected gravitational wave signal might

have originated from a binary black hole merger in the center of a globular cluster.

Globular clusters are truly enigmatic objects. They consist of hundreds of thousands luminous stars and their remnants, which are confined to a few tens of parsecs (up to 100 light-years) – they are the densest and oldest gravitationally bound stellar systems in the Universe. Their central star densities can reach a million times the stellar density near our Sun. About 150 globular clusters orbit the Milky Way but more massive galaxies can have over 10,000 gravitationally bound globular clusters. As their stars have mostly formed at the same time but with different masses, globular clusters are ideal laboratories for studies of stellar dynamics and stellar evolution.


The dynamical evolution of globular clusters, however, is very complex. Unlike in galaxies, the stellar densities are so high that stars can interact in close gravitational encounters or might even physically collide with each other. Because of these interactions there are more tightly bound binary stars than for normal galactic field stars. Moreover, in a process called 'mass segregation' more massive stars sink to the center of the system.

The evolution of a globular cluster as a whole is further complicated by the life cycle of both individual and binary stars. In the early phases, massive stars (with more than 8 solar masses) suffer significant mass loss in a stellar wind phase and end their lifetime in core-collapse supernova explosions. The remnants of these long-gone stars are neutron stars or black holes; the latter with masses in the range of ten to fifty solar masses. They are invisible for normal electromagnetic observations and, until recently, could only be detected indirectly.

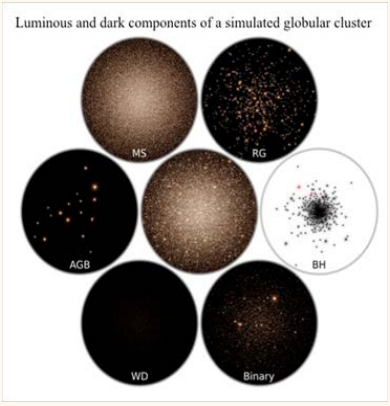
The light from globular clusters is dominated by just a few hundred very bright red giant stars. Most of the other stars in the systems have a much lower mass than our Sun and very low luminosity. This is why the Hubble Space Telescope has been a preferred instrument to observe the stellar populations of globular clusters. Color–magnitude diagrams (CMDs) obtained by *Hubble* have superior quality compared to ground-based instruments due to very small photometric errors (creating sharp structures like the main sequence or giant or white dwarf branches) and very high sensitivity. *Hubble* for the first time observed low-luminosity white dwarf features and low-mass main sequences in high quality.

It has been a long-standing challenge to follow the evolution of a massive globular cluster with self-consistent numerical simulations. For the first time a team led by international experts at Peking University, the Max-Planck Institute for Astrophysics, and the Chinese Academy of Sciences has carried out the—up to now—most

realistic simulations of the evolution of a globular cluster with initially one million stars orbiting in the tidal field of the Milky Way for about 12 billion years. The simulations carried out at the Hydra Supercomputer at the Max-Planck Computing and Data Facility (MPCDF) as part of the international DRAGON project set a new standard in globular cluster modeling.

They have been possible after significant improvements of the simulation software on the *laohu* supercomputer of the Center of Information and Computing at National Astronomical Observatories, Chinese Academy of Sciences. The code has excellent parallel performance using, simultaneously, multi-node parallelization, OpenMP on the nodes and general-purpose *Kepler* K20 graphic cards acceleration (GPGPUs) to compute the gravitational forces between the stars. A typical DRAGON star cluster simulation used 8 nodes of Hydra with 160 CPU cores and about 32k GPU threads, for a consecutive computing time of the order of one year (8000 wall-clock hours).

The evolution of the stellar population of a globular cluster can now be followed in great detail through all its dynamical and stellar evolution phases, including the loss of stars in the tidal field of the Milky Way. The evolution of single and binary stars with a large range of masses (0.08–100 solar masses) are followed through their major evolutionary phases. The DRAGON simulations have also been used to prepare synthetic CMDs as observed with *Hubble*.




In the DRAGON simulations the black holes—remnants of massive stars with masses of ten to fifty solar masses—form a dense nuclear cluster in the center of the system. In classical astronomy this black hole cluster can only be observed indirectly by its gravitational influence on the luminous and observable stars. A few dozen black holes form binaries and lose energy by gravitational radiation, a process included in our simulations.

Recently the *LIGO* collaboration has detected gravitational wave emission from a binary black hole coalescence (black hole masses of 36 and 29 solar masses) at a distance of 410 Mpc. Our DRAGON clusters produce such binary black hole mergers with similar parameters; about ten events in each cluster. Therefore, we expect that more events will be observed in the coming months or years. A more detailed prediction for gravitational wave events from our models is under way. It depends not only on the internal evolution but also the number and distribution of globular clusters in the Universe. However, we predict that globular clusters—similar to our DRAGON clusters—are a possible origin of the recently observed spectacular gravitational wave event.

The now detected black hole merger event is probably only the tip of the iceberg. The dynamical evolution of the central regions of the simulated clusters is dominated by hundreds (if not thousands) of single and binary stellar mass black holes. Future studies should examine whether such clusters of stellar mass black holes exist in centers of most globular clusters rather than the predicted intermediate mass black holes.

**Original Source:**
http://www.mpa-garching.mpg.de/328833/hl201603

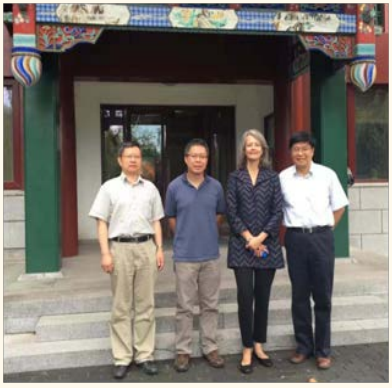
**Published papers:**


- Wang L., Spurzem R., Aarseth S., Giersz M., Askar A., Berczik P., Naab T., Schadow R., KouwenhovenM.B.N., 2016, *The DRAGON simulations: globular cluster evolution with a million stars*, MNRAS, 458, 1450
- Wang L., Spurzem R., Aarseth S., Nitadori K., Berczik P., Kouwenhoven M.B.N., Naab T., 2015, *NBODY6++GPU: ready for the gravitational million-body problem, MNRAS*, 450, 4070


## 26 August 2016:

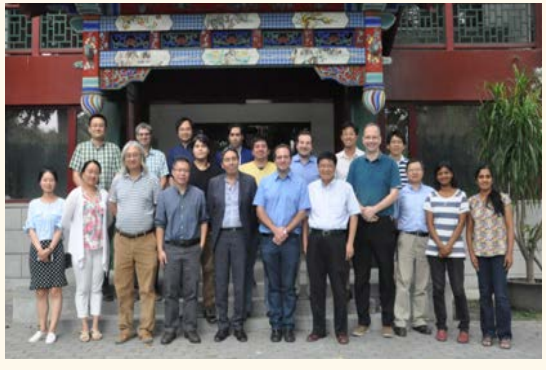
# Nancy Sung from the US National Science Foundation visited KIAA

Dr. Nancy Sung, Director of the China office of the US National Science Foundation(NSF)visited the KIAA on 19 August 2016 and discussed with Luis Ho, KIAA Director, Xuebing Wu, KIAA Associate Director, and Suijian Xue, Associate Director of the National Astronomical Observatories, Chinese Academy of Sciences about possible collaborations with the Chinese astrophysics community on one of the *Ten Big Ideas for Future NSF Investment and Windows on the Universe: The Era of Multi-messenger Astrophysics.* In addition to traditional electromagnetic-wave telescopes, neutrinos, cosmic rays, and even gravitational waves will become special windows to probe the Universe.



## 1 September 2016:

# Chilean delegation visited the KIAA



A Chilean delegation visited the KIAA and attended a special seminar with faculty and postdocs on 1 September 2016. In attendance were *Ezequiel Treister*, President of the Chilean Astronomical Society and Professor at the Department of Astronomy,Pontificia Universidad Católica de Chile, *Guido Garay*, Director of the Department of Astronomy and Professor at the Faculty of Physical Sciences and Mathematics, Universidad de Chile, *Eduardo Unda*, Executive Director of the Chilean Astronomical Society and Director of the Unity of Astronomy at the Universidad de Antofagasta, *Roberto Assef*, Associate Professor of the Astronomy Core, Universidad Diego Portales, *Maximiliano Movano*, Academic of the Universidad Católica del Norte, Astronomer Liaison Manager of the same university, and Director of the Ventarrones Project, *Suijian Xue*, Vice Director of the National Astronomical Observatory, Chinese Academy of Sciences, *Jiasheng Huang,* Chief Scientist of the CAS South American Center for Astronomy, *Luis Ho*, Director of the KIAA, *Xuebing Wu*, Associate Director of the KIAA, and a number of faculty and postdocs from the KIAA.

During the seminar, Luis Ho gave a welcome speech and introduced astronomy at the KIAA and atPeking University. Members of the Chilean delegation, Ezequiel Triester, Guido Garay and Roberto Assef talked about the status of astronomy at their respective Chilean institutions and areas of potential collaboration with the KIAA. Researchers from the KIAA, Subo Dong, Gregory Herczeg, Ran Wang, and Yingjie Peng gave highlight science talks on supernovae, star formation, high-redshift quasars, and galaxy evolution.

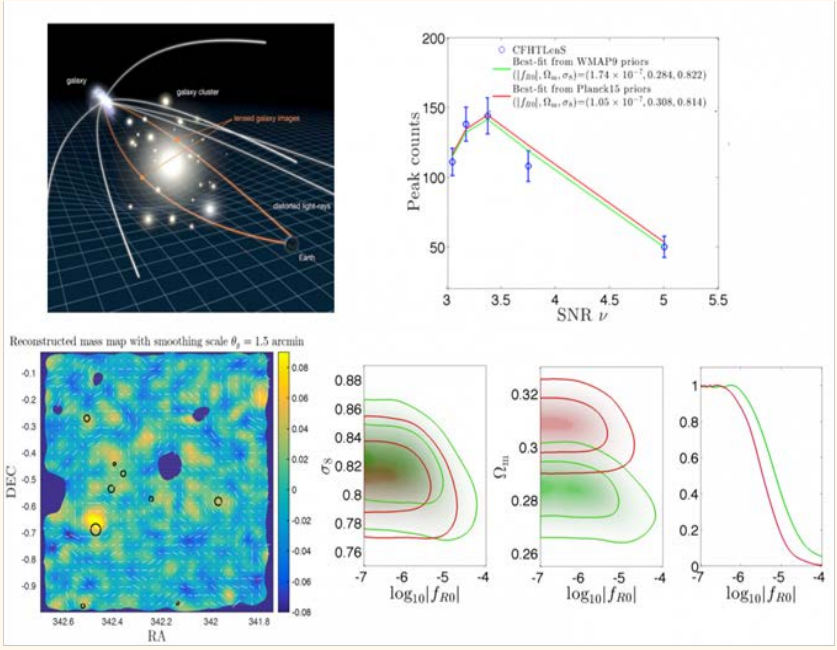
Participants agreed that the KIAA has already developed strong foundations for collaboration with the Chilean astronomical community, and they all look forward to strengthening further ties in the near future.

## 14 October 2016:

# Constraining *f*(*R*) Gravity Theory Using CFHTLenS Weak Lensing Peak Statistics

The observed cosmic acceleration poses a great challenge to our understanding of the Universe. It requires either introducing a dark energy component (which possesses an equivalent negative pressure) into the matter content of the Universe, or modifying the general relativity theory of gravity on cosmological scales. The two approaches, however, can lead to different structure formation and evolution. Therefore, observations of large-scale structures are critical in scrutinizing the underlying mechanism driving the global cosmic acceleration, and thus deepening our view of fundamental physics and cosmology.

Originating from the deflection of light by large-scale structures in the Universe, the weak lensing (WL) effect has been recognized as one of the key cosmological probes. With CFHTLenS WL observations (http://www.cfhtlens.org), a team from Peking University, Durham University (UK), the National Astronomical Observatories, Chinese Academy of Sciences, and Shanghai Normal University carried out detailed WL peak analyses and obtained stringent constraints on the Hu–Sawicki




*(Top left)* Sketch of the principles of gravitational lensing. (*bottom left*) Example of the reconstructed convergence map from the CFHTLenS shear catalog, with white lines representing the corresponding shear patterns. The dark blue regions are the masked regions. The black circles correspond to the redMaPPer clusters detected in the field, which shows a good association with weak lensing convergence peaks. *(right)* Peak results (top) and derived constraints (*bottom*) for CFHTLenS observational data. Green and red contours are the results for *WMAP9* and *Planck15* priors, respectively.

*f(R)* gravity theory.

High peaks in WL maps are closely related to massive halos along our lines of sight. Their abundance is, therefore, sensitive to halo formation and evolution, which in turn is sensitive to the law of gravity. Compared to cosmological studies using optical, X-ray, or Sunyaev–Zel'dovich clusters, which rely heavily on baryonic observable–mass relations, WL peak statistics are much less affected by baryonic physics, the major systemic effect affecting normal cluster studies. On the other hand, WL peak studies have their own systematics. How to predict accurately the cosmological dependence of WL peak abundance is a challenging task. Considering carefully the noise effect arising from intrinsic shapes of source galaxies, the team has developed an analyzing pipe line for cosmological studies using WL high peaks, from theoretical modeling, mock simulation calibrations, to a fast computing platform.

By applying it using CFHT Len S with priors from WMAP and Planckcosmic microwave background observations, the team has derived tight constraints on the Hu–Sawicki *f(R)* theory, for the first time, from WL high peak abundances. No deviations from the general relativity theory are detected. The study demonstrates clearly the promising potential of WL peak analyses. With ongoing and future large observations with much improved data quantity and quality, we expect WL peak analyses will result in much better cosmological constraints. Low statistical errors in future observations ask for tighter systematic controls in cosmological observables. The team has been continuously working toward fully realizing the power of WL analyses in future cosmological studies.

**Published paper:**

◆ Liu X., Li B., Zhao G.-B., Chiu M.-C., Fang W., Pan C., Wang Q., Du W., Yuan S., Fu L., Fan Z., 2016, *Constraining f(R) Gravity Theory Using Weak Lensing Peak Statistics from the Canada–France–Hawa'i Telescope Lensing Survey, Phys. Rev. Lett.,* 117, 051101

**Media coverage included:**

◆ http://www.sciencemag.org/news/2016/07/attempt-explain-away-dark-energy-takes-hit

## 26 October 2016:

# Max-Planck Partner Group has been formed at the KIAA and the Department of Astronomy

October 2016, a Max-Planck Gesellschaft (MPG) Partner group in pulsar astronomy was formed at the KIAA and the Department of Astronomy, Peking University. In the letter of appointment for the head of group, the Director of the Max Planck society, Dr. Martin Stratman, addressed the current work of the group as "*gained international recognition*" and supported the group to develop into an active Chinese and international

partnership.

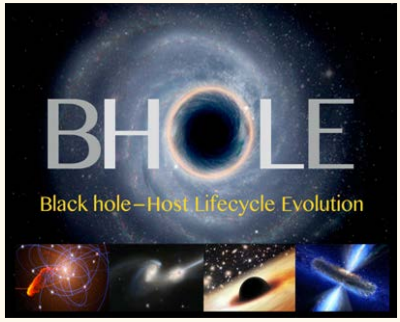
Composed of more than 100 institutes, the MPG is the major scientific research society in Germany. The partner group program aims at strengthening collaborations between MPG and other institutes. It supports junior scientists carrying out research in their home country. The head of the partner group at the KIAA is Dr. Kejia Lee, and the host institute is the Max-Planck Institute for Radio Astronomy led by Dr. Michael Kramer. After the evaluation of the partner group proposal and the proposed research by international experts, the MPG approved the proposal. The research group will focus on scientific research on radio astronomy, gravitational wave detection, and astronomical data analysis. The partner group will exchange students, hold scientific meetings, and carry out other activities to strengthen their bilateral scientific collaboration.

A pulsar is a type of compact star with very high rotational stability. Owing to its anisotropic radiation, pulsar rotation generates regular pulsed emission. By measuring the time of arrival of the pulses, we can directly probe the physical effects on the signal propagation pathand, in particular, we can directly detect ultralow-frequency gravitational waves from the mergers of supermassive black hole binaries in galaxy centres using such timing techniques. Pulsars can be also used for other applications, such as for probing the interstellar medium, measuring magnetic fields, performing deep space navigation, forming time standards, etc.

PKU News: http://pkunews.pku.edu.cn/xwzh/2016-10/27/content_295514.htm

## 8 December 2016:

# KIAA Team Awarded MOST National Key Programme for Science and Technology Research and Development Grant




The project 'Black hole–Host Lifecycle Evolution (BHOLE)' led by Luis C. Ho, won the National Key Programme for Science and Technology Research and Development Grant from the Ministry of Science and Technology of China (MOST). On 8 December 2016, the BHOLE Kick-Off Meeting was held at the National Astronomical Observatories, Chinese Academy of Sciences (NAOC). For more details, see http://kiaa.pku.edu.cn/bhole/

The BHOLE project is a collaboration of 17 core investigators from six institutions in China (the KIAA, Institute of High-Energy Physics, NAOC, Shanghai Astronomical Observatory, Nanjing University, and the University

of Science and Technology of China). Including students and postdocs, the entire research team is composed of nearly 100 people.

BHOLE is a large, five-year programme devoted to four areas related to the general theme of the co-evolution of supermassive black holes and galaxies: (1) measurement of black hole masses in active galaxies; (2) the study of the physical properties (stars, gas, dust, star-formation rates) of the host galaxies; (3) search for and systematic characterization of high-redshift quasars; and (4) theoretical investigation of the physics of the central engines (accretion disk, outflows, feedback) of active galaxies.


## 9 December 2016:

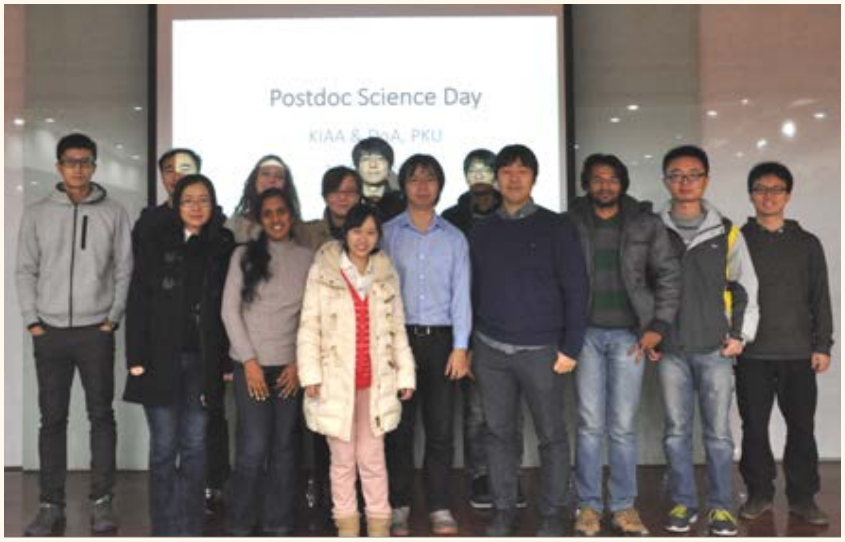
# KIAA Postdoctoral Programme Top Ranked at PKU

Peking University recognized the KIAA Postdoctoral Programme as top-ranked in 2016. Our 15 KIAA postdocs, along with 5 strong postdocs in the Department of Astronomy, research important problems in a wide range of fields, from gamma-ray bursts and supernovae, active galactic nuclei, and galactic structures, to star formation.

Our postdocs published 12peer-reviewed papers as first author in 2016, with many of these results becoming highly cited and which have been presented at domestic and international conferences. The awards and grant funding obtained by our postdocs is a recognition of their excellence in publication. Two KIAA

postdocs, Shu Wang and Yuanpei Yang, were among the six PKU postdocs in all disciplines to win a prestigious award from the Innovative Postdoc Support Programme, sponsored by the national China Postdoc Committee, which provides a total of 600,000 RMB over two years. Two postdocs, Kohei Hayashi and Yao Su, also won a PKU Boya Postdoctoral Fellowship, while another, Jessy Jose, won a PKU Outstanding Postdoc Award. Of our 15 total postdocs, 8 won grant funding from either the General or Special Fund from the China Postdoctoral Science Foundation, the highest fraction of any department at PKU and much higher than the 10–30% of other departments in the sciences. The KIAA has received most outstanding postdoc awards from PKU and the national government and has the highest rate of postdocs with successful national proposals of any department at PKU, all through a highly competitive proposal process.

The scientific output from our postdocs highlights KIAA's contributions at PKU, within China, and internationally. This output is possible because of the strong support from both PKU and the national government and from the Kavli Foundation, which when combined allows KIAA to recruit talented postdocs from domestic and international universities.



## 14 December 2016:

# Revealing the Orbital Shape Distributions of Exoplanets with China's *LAMOST* Telescope

Figure 1: The Large Sky Area Multi-Object Fiber Spectroscopy Telescope *(LAMOST)* telescope in Hebei, China. It is presently the most efficient spectroscopy machine in the world.

Using data from China's *LAMOST* telescope, a team of astronomers has derived how the orbital shapes of extrasolar planets are distributed. The work was recently published in the journal *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*. The article's lead authors are Prof. Jiwei Xie from Nanjing University and KIAA faculty member Prof. Subo Dong.

Until two decades ago, the only planetary system known to mankind was our own solar system. Most planets in the solar system revolve around the Sun on nearly circular orbits, and their orbits are almost in the same plane within about 3 degrees on average (i.e., the average inclination angle is about 3 degrees). Astronomers use a parameter called 'eccentricity' to describe the shape of a planetary orbit. Eccentricity takes a value between 0 and 1, and the larger the eccentricity, the more an orbit deviates from circular. The average eccentricity of solar system planets is merely 0.06. Hundreds of years ago, motivated by circular and co-planar planetary orbits, Kant and Laplace hypothesized that planets should form in disks, and this theory has developed into the 'standard model' of how planets form.

In 1995, astronomers discovered the first exoplanet orbiting around the Sun-like star 51 Pegasi using a technique called radial velocity analysis, and this discovery started an exciting era of exoplanet exploration. At the beginning of the 21st Century, people had discovered hundreds of exoplanets with the radial velocity technique, and most of them are giant planets comparable in mass with Jupiter. These Jovian planets are relatively rare, found around approximately one tenth of stars studied with the radial velocity technique. The shapes of their orbits shapes were a big surprise: a large fraction of them are on highly eccentric orbits, and all the giant planets found using the radial velocity approach have a mean eccentricity of about 0.3. This finding challenges the standard model of planet formation and raises a long-standing puzzle for astronomers – are the nearly circular and co-planar planetary orbits in the solar system common or exceptional?

The *Kepler* satellite, launched by NASA in 2009, has discovered thousands of exoplanets by monitoring tiny dimming in the brightness of stars when their planets happen to cross in the front of them (called 'transit'). Many

of the planets discovered by *Kepler* have sizes comparable to that of the Earth. *Kepler's* revolutionary discoveries show that Earth-sized planets are prevalent in our Galaxy. However, data from the *Kepler* satellite alone cannot be used to measure the shape of a transiting exoplanet's orbit. To do so, one way is to use the size of the planet host star as a 'ruler' to measure against the length of the planetary transit, while implementing this method needs precise information about the host star's parameters such as its size and mass. This method has previously been applied to host stars characterized with the asteroseismology technique, but the sample was limited to a relatively small number of stars with high-frequency, exquisite brightness information required by asteroseismology.

With its innovative design, the *LAMOST* telescope in China can observe spectra of thousands of celestial objects simultaneously within its large field of view, and it is currently the most efficient spectroscopy machine in the world (Figure 1). In recent years, *LAMOST* has obtained tens of thousands of stellar spectra in the sky region where the *Kepler* satellite monitors planet transits, and they include many hundreds of stars hosting transiting exoplanets. By comparing with other methods such as asteroseismology, the research team found that high-accuracy characterization of stellar parameters can be reliably obtained from *LAMOST* spectra, and they can subsequently be used to measure the orbital shape distributions of *Kepler* exoplanets.

They analyzed a large sample of about 700 exoplanets whose host stars have *LAMOST* spectra, and with the *LAMOST* stellar parameters and *Kepler* transit data, they measured the eccentricity and inclination angle distributions. They found that about 80% of the analyzed planetary orbits are nearly circular (average eccentricity less than 0.1) like those in the solar system, and only about 20% of the planets are on relatively eccentric orbits that deviate significantly from circular (average eccentricity greater than 0.3). They also find that the average eccentricity and inclination angle for the *Kepler* systems with multiple planets fit into the pattern of the solar system objects (Figure 2).

Therefore, circular orbits are not exceptional for planetary systems, and the orbital shapes of most planets inside and outside the solar system appear to be distributed in a similar fashion. This implies that the formation and evolution processes leading to the distributions of the orbital shapes of the solar system may be common in the Galaxy.

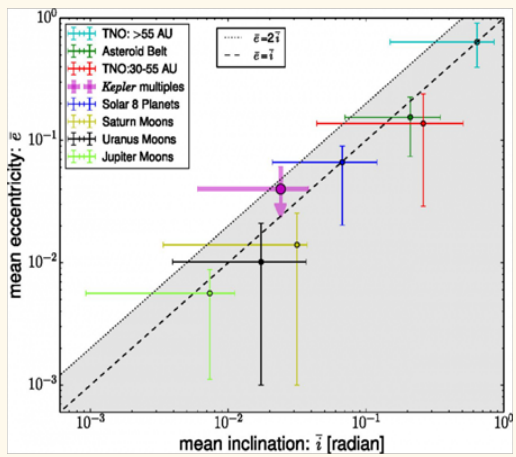



Figure 2: The mean eccentricity ($e$) and inclination ($i$) of *Kepler* multiples fit into the pattern of the solar system objects satisfying a relation $e \approx (1–2)\, i$. The dots represent the *Kepler* multiple planets (magenta), the eight planets of the solar system (blue), regular moons of Jupiter, Saturn, and Uranus (light green, yellow, and black, respectively); main-belt asteroids (green); and trans-Neptune objects (TNOs; both the classical Kuiper Belt objects with orbital semi-major axes 30–55 AU, shown in red, and the scattered disk objects with semi-major axes >55 AU, shown in cyan). (*From the published PNAS paper*)

## Chen, Xiaodian:

◆ 6 October 2016: Xiaodian Chen's most recently accepted paper in *The Astrophysical Journal* was covered as part of the daily astrobites layman's summaries:

**Getting distances from stars that touch**
by Caroline Huang | Oct 6, 2016
https://astrobites.org/2016/10/06/getting-distances-from-stars-that-touch/

***Title:*** Contact Binaries as Viable Distance Indicators: New, Competitive *(V)JHK*$_s$ Period–Luminosity Relations
***Authors:*** Xiaodian Chen, Richard de Grijs, and Licai Deng
***First Author's Institution***: Kavli Institute for Astronomy and Astrophysics and Department of Astronomy, Peking University
***Status:*** Accepted for publication in *The Astrophysical Journal*

Astronomers are always looking for new ways to measure distance. We already have a number of ways to figure out how far away various astronomical objects are, including parallax, eclipsing binaries, masers, supernovae Ia, variable stars, the Tully–Fisher and Faber–Jackson relations, just to name a few. Finding new methods, however, allows us to not only verify and improve on our previous measurements but also to get measurements of distance where it was previously impossible. Many of our distance indicators only apply under special conditions. It is difficult to get accurate geometric distances from a megamaser, for example, if the host galaxy's orientation is not edge-on. Parallax, on the other hand, can only be used on the nearest objects (usually objects in our Galaxy, out to about the Galactic Center). Cepheids are young stars and are only found in galaxies with active star formation. Together, these distance measures can be put together into a cosmic distance ladder to get distances to astronomical objects at a range of distances.

The authors of today's ***astrobite*** take a look at using contact binaries as distance indicators. Contact binaries (CBs) are binary systems where the two stars are so close that they are actually touching, causing them to share a convective envelope. Figure 1 shows an artist's rendition of a particularly famous CB,VFTS 352. As weird as they sound, they are actually pretty common—about 0.2% of the stars near us are contact binaries—making them three times as numerous as Cepheids, a variable star commonly-used as a distance indicator. They are also approximately seven magnitudes fainter than Cepheids, but unlike Cepheids, which can only be found in young populations, CBs can be found in a wide range of older populations. Astronomers have tried using contact binaries as distance indicators before, but previous attempts to relate a CB's period with its luminosity (known as a period–luminosity relation or PL relation) have used a small number of objects and contained large uncertainties.

So how do we actually get distances from these systems? The brightness of a CB changes periodically as one component eclipses another. These periods are related to the sizes of the objects in the system. Since periods

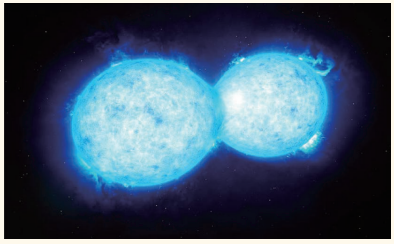


Figure 1: Artist's rendition of the hottest and most massive contact binary. (*ESO/L. Calçada* –http://www.eso.org/public/images/eso1540a/)

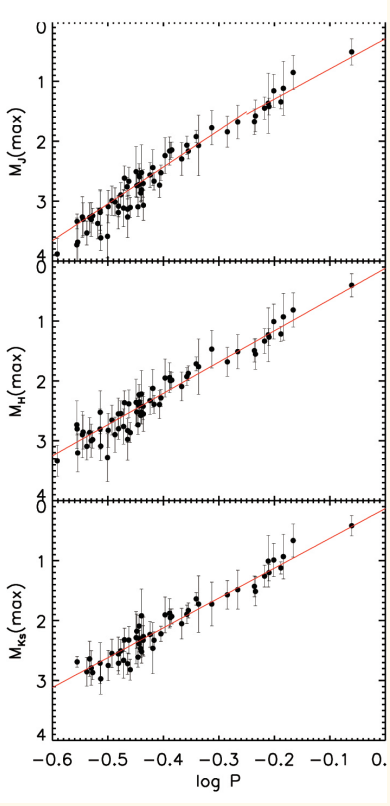



Figure 7: This shows the three near-infrared period–luminosity relations obtained for the 66 calibrating contact binaries used in the paper. The horizontal axis denotes the log of the period (in days) and the vertical axis is the absolute magnitude in the *J*, *H*, and $K_s$ bands. The PL relation is the red line that has been fit through all of the objects in their sample.

are not affected by distance, this is something we can measure accurately. In addition, both members of a contact binary have the same temperature despite having different masses because of their shared convective envelope. The temperature (color) and period of a CB can then be used to derive its luminosity. Like variable stars, these stars should also follow a PL relation. When that is compared that with the apparent magnitude we can find the distance to a CB. In order to calibrate these relations, however, independent distance determinations are necessary. The resulting relations can them be used to find distances out to other contact binaries.

The authors use 20 W UMa-type CBs with *Hipparcos* parallaxes, 4 moving-group CBs, and 42 open cluster CBs. The moving-group CBs had well-determined distances, and CBs in open clusters were assigned the same distances as their clusters. They were able to create this sample by taking their starting set of 6090 CBs and applying three selection criteria to ensure that they CBs were actually members of the open clusters they were associated with (rather than foreground or background stars). The contact binaries were required to be within the core radius of the host, have proper motion in agreement with their host cluster, and age comparable to the age of the open cluster.

Unlike variable stars, which exhibit different light curve shapes in different bands (this is caused by the temperature changes in the star at different points of its pulsation cycle), the light curve shape of a CB is very similar in different bands. This makes it easier to get magnitudes from one band and using light curves in another band, allowing them to obtain PL relations in *J*, *H*, and $K_s$, using established V-band light curves. The resulting relations have only a 0.08 magnitude scatter in H and Ks and 0.09 magnitude scatter in *J*, making them comparable with those of Cepheids, a commonly used distance indicator. The relations are shown in Figure 2. They also calculate the PL–color relations for contact binaries, and compare them with their PL relations and find that they are in good agreement with each other. These PL relations exhibit a shallower slope than an earlier PL relation from the literature, but the authors attribute this difference to the number of objects used

in the previous paper (21, compared to 66 in the current paper). The slope of the previous relation was also more dependent on the shortest-period CB, and when the authors removed it from the sample, the results were in much better agreement with their own. Finally, the authors are also able to derive a distance modulus to the Large Magellanic Cloud in agreement with the literature value.

With the number of known contact binaries growing every year, they may prove to be a valuable distance indicator. The near-infrared *(J, H, $K_s$)* PL relations of CBs have comparable scatter to Cepheids. At the same time, because of their ages, they will be able to probe older features. CBs are also significantly fainter, but orders of magnitudes more common than Cepheids are. Ultimately, each new addition to the distance ladder bring us a little closer to understanding the physics of the Universe.

## de Grijs, Richard:

◆ 12 December 2016: Experts gather in Henqin to discuss postdoctoral systems; http://www.china.org.cn/chinese/2016-12/12/content_39895904.htm; http://news.china.com.cn/txt/2016-12/12/content_39899630.htm

◆ 5 December 2016: *Dutch professor and film director produce documentary about Chinese astronomy*, news item on the website of the Netherlands embassy in China; http://china.nlembassy.org/news/2016/12/dutch-professor-and-movie-director-produce-documentary-about-chinese-astronomy.html

◆ 4 November 2016: Richard de Grijs was interviewed for a feature article in *Science* on scientific careers in China: *Foreign-born scientists find a home in China*; http://www.sciencemag.org/careers/features/2016/11/foreign-born-scientists-find-home-china

◆ 23 September 2016: Richard de Grijs was interviewed for a feature article on FAST and Chinese astrophysics, which appeared in the Science section of the Dutch newspaper NRC Handelsblad: Het nieuwe, groteoor van China; http://www.nrc.nl/nieuws/2016/09/23/het-nieuwe-grote-oor-van-china-4425483-a1523025 (in Dutch)

◆ September 2016: Richard de Grijs was featured on Armenian TV news, representing the International Astronomical Union during the opening ceremony of the *70th Anniversary Conference* of Byurakan Astrophysical Observatory.

◆ September 2016: Richard de Grijs was interviewed for a feature article in *Physics World*, special issue on China: *Rise of the physics powerhouse*; http://live.iop-pp01.agh.sleek.net/2016/08/15/rise-of-the-physics-powerhouse/pugpig_index.html

◆ 28 January 2016: Richard de Grijs was interviewed by Stuart Gary of ABC News (Australia) in relation to his group's Nature article: *Glittering globular clusters may pull gas from galaxies to make new stars*; http://www.abc.net.au/news/2016-01-28/globular-clusters-may-pull-gas-from-galaxies-to-make-new-stars/7117826

## Dong, Subo:

◆ 14 January 2016: The discovery by Subo Dong's team of the superluminous supernova ASASSN-15lh was reported by hundreds of news outlets domestically and internationally, including the *People's Daily*, Xinhua

News, CCTV, the *New York Times*, the *Washington Post*, the *Wall Street* Journal, Reuters, CNN, BBC, *Scientific American*, NPR, etc. Selected coverage:

- *Scientific American*: http://www.scientificamerican.com/article/found-the-most-powerful-supernova-ever-seen/
- Washington Post: https://www.washingtonpost.com/news/speaking-of-science/wp/2016/01/14/this-suspected-supernova-is-570-billion-times-brighter-than-our-sun/
- Reuters: http://uk.reuters.com/article/us-space-supernova-idUKKCN0US2J720160114
- Discovery: http://news.discovery.com/space/astronomy/uber-bright-supernova-is-a-stellar-mystery-160114.htm
- Nature News: http://www.nature.com/news/brightest-ever-supernova-still-baffles-astronomers-1.19176
- *Wall Street Journal*: http://www.wsj.com/articles/astronomers-report-brightest-supernova-ever-observed-1452798001
- *New Scientist*: https://www.newscientist.com/article/dn28772-weve-found-the-brightest-ever-supernova-but-cant-explain-it/

◆ Research co-led by Subo Dong and Jiwei Xie (Nanjing) on the eccentricity distribution of *Kepler* planets with *LAMOST* data was reported by several news outlets, including CCTV, and featured on the Peking University and NAOC news websites:

- http://pkunews.pku.edu.cn/xxfz/2016-09/28/content_295207.htm

**Kouwenhoven, M.B.N.:**

◆ *The DRAGON globular cluster simulations: a million stars, black holes and gravitational waves*; http://www.mpa-garching.mpg.de/328833/hl201603

**Peng, Eric:**

◆ 4 November 2016: Eric Peng was interviewed for a feature article in *Science* on scientific careers in China: *Foreign-born scientists find a home in China*; http://www.sciencemag.org/careers/features/2016/11/foreign-born-scientists-find-home-china

◆ 25 August 2016: Eric Peng was interviewed for a feature article in *Nature* on *China*: Nature, 536, S6–S8: http://www.nature.com/nature/journal/v536/n7617_supp/full/536S6a.html

**Wu, Xue-Bing:**

◆ 6 January 2016: Experts in science and technology hitting the headlines in 2015 (YeSky), http://news.yesky.com/kepu/master/211/99793211.shtml

◆ 25 February 2016: MOST announces the 2015 top 10 advances in Sciences in China, scientists discovered ultra-luminous quasars (XinhuaNet), http://news.xinhuanet.com/tech/2016-02/25/c_1118161313.htm

◆ 26 February 2016: The 2015 top 10 advances in Science in China announced, two achievements from PKU selected (PKU News), http://pkunews.pku.edu.cn/xwzh/2016-02/26/content_292895.htm

# Scientific advances

*Throughout the year, Peking University astrophysicists have numerous local opportunities to exchanges ideas, report on their research progress, and learn both from each other and from visiting scientists.*

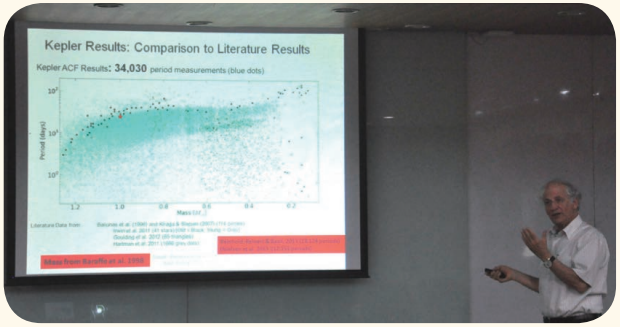
## Peking University astronomy colloquia 2016

- 14 January 2016: **Bin Luo** (Nanjing University, China), Exceptional X-ray Weak Quasars: *Implications for Accretion Flows, BLRs & Winds*
- 18 January 2016: **Muhammad Latif** (IAP, Paris, France), *Supermassive black hole formation at high redshifts*
- 19 January 2016: **Sourav Chatterjee** (CIERA, Northwestern University, USA), Numerical Modeling of Massive Star Clusters: *An Evolving Story of the Black Holes*
- 20 January 2016: **Jing Wang** (Australia Telescope National Facility, Australia), *HI in a Multi-wavelength Dissertation of Galaxies*
- 25 February 2016: **Zigao Dai** (Nanjing University, China), *Magnetar-Powered Transients*
- 3 March 2016: **Yifu Cai** (University of Science and Technology of China, Hefei, China), *Searching for particle physics signals in the cosmological collider via gravitational wave surveys*
- 10 March 2016: **Zuhui Fan** (Peking University, China), *Probing the dark Universe with weak lensing effects*
- 24 March 2016: **Yufeng Li** (Institute of High-Energy Physics, Chinese Academy of Sciences, Beijing, China), *Sterile neutrinos in particle physics and cosmology*
- 31 March 2016: **Jian Hu** (Tsinghua University, Beijing, China), *Self-interacting dark matter and supermassive black holes in the early Universe*
- 7 April 2016: **Juntai Shen** (Shanghai Astronomical Observatory, China), *Gas inflow patterns and nuclear rings in barred galaxies*
- 12 April 2016: **Evan Kirby** (California Institute of Technology, USA), Dwarf Galaxies: *Laboratories for Nucleosynthesis and Dark Matter*

- 14 April 2016: **Hong Guo** (Shanghai Astronomical Observatory, China), *The Galaxy–Halo Connection From The Velocity Field*
- 21 April 2016: **Lei Hao** (Shanghai Astronomical Observatory, China), The Co-evolution of AGN and Galaxies, *Viewed from 2D Spectroscopy*
- 28 April 2016: **Katelyn Allers** (Bucknell University, USA), *Brown Dwarfs as Exoplanet Analogs*
- 5 May 2016: **Toru Kojo** (Central China Normal University, China), Neutron star equations of state: *implications for cold, dense QCD*
- 11 May 2016: **Keiichi Umetsu** (Academia Sinica Institute of Astronomy and Astrophysics, Taiwan), Ensemble Mass Distribution of Galaxy Clusters from the CLASH Survey: *Concentration–Mass Relation, Stacked Mass Profile, and Splashback Radius*
- 12 May 2016**: Ruobing Dong** (University of California, Berkeley, USA), Spirals, Gaps, and Cavities in Protoplanetary Disks: *Are We Watching Planets Forming in Action?*
- 19 May 2016: **Chris Sneden** (University of Texas at Austin, USA), *Early Galactic Nucleosynthesis of Iron-Group Elements: New Spectroscopic Constraints*
- 26 May 2016: **Tsevi Mazeh** (Tel Aviv University, Israel), Stellar rotation and exoplanet obliquity: *What can we learn from the Kepler space mission's data gold mine?*
- 31 May 2016: **Xing Wei** (Shanghai Jiaotong University, China), *Some applications of rotating MHD*
- 2 June 2016: **Feng Yuan** (Shanghai Astronomical Observatory, China), *Black hole accretion and outflow*
- 8 June 2016: **Claire Max** (University of California, Santa Cruz, USA), Nearby Galaxy Mergers Seen with Adaptive Optics: *A Sharper Image*

- 16 June 2016: **Yin-Zhe Ma** (University of KwaZulu–Natal, South Africa), *Detection of the missing baryons with thermal and kinetic Sunyaev-Zeldovich effect*
- 23 June 2016: **Thomas Tam** (Sun Yat-Sen University, Guangzhou, China), Gamma-Ray Bursts in the Last Observing Window: *the >10 GeV Energy Band*
- 7 July 2016: **Kohta Murase** (Penn State University, USA), *Mysteries of cosmic high-energy neutrinos*
- 4 August 2016: **Aigen Li** (University of Missouri, USA), *PAHs in Astrophysics*
- 1 September 2016: **Martin Haehnelt** (University of Cambridge, UK), T*he early (feedback-regulated) growth of supermassive black holes*
- 8 September 2016: **Jingwen Wu** (National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China), Hot dust-obscured galaxies: *Catching the maximum accretion phase of super massive black holes*
- 22 September 2016: **Jiayong Zhong** (Beijing Normal University, *China), Introduction of Laboratory Astrophysics*

- 29 September 2016: **Hu Zhan** (National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China), *The Multiband Imaging and Slitless Spectroscopy Survey of China's Manned Space Program*
- 13 October 2016: **Yang Chen** (Nanjing University, China), *Multiple effect of interaction between supernova remnants and molecular clouds*
- 20 October 2016: **Niel Brandt** (Penn State University, USA), *A Good Hard Look at Growing Supermassive Black Holes in the Distant Universe*
- 27 October 2016: **Bin Hu** (Beijing Normal University, China), *Testing General Relativity with CMB and LSS data*
- 3 November 2016: **Richard N. Manchester** (CSIRO Astronomy and Space Science, Australia), *Pulsars and FRBs*: *Recent Developments*
- 8 November 2016: **Neal J. Evans II** (The University of Texas at Austin, USA), *What Determines Star Formation Rates?*
- 17 November 2016: **Lingyu Wang** (University of Groningen/Space Research Organisation Netherlands), *Star formation rates and luminosity functions in the low-redshift Universe*
- 24 November 2016: **Wei Wang** (National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China), *Supernova progenitors: clues from gamma-ray observations*
- 1 December 2016: **Houjun Mo** (University of Massachusetts Amherst, USA/Tsinghua University, Beijing, China), *Reconstructing the actual local Universe*
- 8 December 2016: **Pengfei Chen** (Nanjing University, China), *Observations and Modeling of Solar Coronal Waves*
- 15 December 2016: **Douglas N. C. Lin** (University of California, Santa Cruz, USA), P*lanting seeds for gravitational wave generators around active galactic nuclei*: *Analog of planetary systems around massive black holes*
- 29 December 2016: **Rainer Spurzem** (University of Heidelberg, Germany/National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China /KIAA, Peking University, China), *Gravitational Wave Astrophysics*: *Simulations and Observations*



# Lunch talks, 2016

- 5 January 2016: **Weiguang Cui** (ICRAR, University of Western Australia, Australia), *The nIFTy galaxy cluster comparison project*
- 8 January 2016: **Erwin Lau** (Yale University, USA), *Cosmology and Astrophysics with Galaxy Clusters, from the Numerical Perspective*
- 11 January 2016: **Dong Lai** (Cornell University, USA), *Circumbinary Planets*
- 15 January 2016: **Alexander Kolodzig** (KIAA, Peking University, China),The origin of the cosmic X-ray background: *Challenging results from angular correlation studies with XBOOTES*
- 22 February 2016: **Chenliang Huang** and **Meng Sun** (University of Virginia, USA), *Modeling of hot Jupiter HD 189733b Hα transmission spectral line & Formation and Asteroseismology of Extremely Low-mass White Dwarfs*
- 4 March 2016: **Wang Lingjun** (National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China), *Optical transients powered by millisecond magnetars*
- 9 March 2016: **Xiaoyi Dong** (Peking University, China), *Herschel observed Stripe 82 quasars and their host galaxies*: *connections between the AGN activity and the host galaxy star formation*
- 14 March 2016: **Jing Tang** (SISSA, Italy), *New PARSEC evolutionary tracks of massive stars at low metallicity*: *testing canonical stellar evolution in nearby star forming dwarf galaxies*

- 17 March 2016: **Meng Su** (MIT, USA), *Searching for Inflationary Gravitational Waves and the Ali CMB project*
- 25 March 2016: **Yu Rong** (Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China), *Using galaxy alignments to probe large scale structures*
- 5 April 2016: **Alain Omont** (Institut d'Astrophysique de Paris, Université Pierre et Marie Curie, France), *Interstellar fullerenes and diffuse interstellar bands*
- 18 April 2016: **Xian Chen** (Pontifica Universidad Católica, Chile), *What does LIGO event GW150914 teach us about stellar dynamics?*
- 29 April 2016: **Bozena Czerny** (Center for Theoretical Physics, Warsaw/Copernicus Astronomical Center, Poland), *Quasars and dark energy*
- 18 May 2016: **Ezequiel Treister** (PontificaUniversidad Católica, Chile), *The AGN Population and the Cosmic X-ray Background*

- 20 May 2016: **Hua-bai Li, Ming-chung Chu, Luis Roberto Flores Castillo and Tjonnie G. F. LI** (Chinese University of Hong Kong, Hong Kong), *Astronomy and Astrophysics at the Chinese University of Hong Kong*


- 25 May 2016: **Qiuhe Peng** (Nanjing University, China), *A unified model of supernovae driven by magnetic monopoles*
- 27 May 2016: **Simchon Faigler** (Tel Aviv University, Israel), *The BEER (BEaming, Ellipsoidal, and Reflection) algorithm: How it works, Discoveries to date, and the LAMOST-BEER collaboration*
- 30 May 2016: **Dimitris Stamatellos** (University of Central Lancashire, UK), *Giant planet migration and survival on wide orbits*
- 31 May 2016: **Wenbin Lu** (University of Texas at Austin, USA), *Tidal disruption events in the multi-wavelength era*
- 8 June 2016: **Tie Liu** (KASI, Republic of Korea), *The 'TOP-SCOPE:' Follow-up observations of Planck cold clumps with ground-based telescopes.*
- 9 June 2016: **Ian Czekala** (Harvard-Smithsonian Center for Astrophysics, USA), *The Fundamental Properties of Young Stars*
- 10 June 2016: **Yong-Zhong Qian** (Shanghai Jiao Tong University, China/University of Minnesota, USA), *Potential Effects of Accretion-Disk Neutrinos on High-Energy Neutrinos Produced in Gamma-Ray Bursts and Core-Collapse Supernovae*
- 13 June 2016: **Tsvi Piran** (Hebrew University of Jerusalem, Israel), *Electromagnetic Counterparts of Neutron Star Mergers – Past and Future*
- 15 June 2016: **Zhi Li** (Shanghai Astronomical Observatory, China), *Modeling the large-scale gas features of the Milky Way*
- 16 June 2016: **Jian Ge** (University of Florida, USA), *The Dharma Planet Survey of Rocky Planets around Nearby Solar Type Stars*
- 8 July 2016: **Gregory Taylor** (University of New Mexico,

USA), *Science at Low Frequencies with the Long Wavelength Array*

- 14 July 2016: **Greg Green** (CfA/KIPAC, USA), *Milky Way Dust in 3D*
- 25 July 2016: **Li Zeng** (Harvard University, USA), *Rocky Planet Interiors*
- 5 August 2016**: Pau Amaro-Seoane** (Albert Einstein Institute, Germany), *The Gravitational Wave Astronomy Era: From the first detections on Earth to space observatories*
- 5 September 2016: **Jia Liu** (Princeton University, USA), *Weak lensing in the nonlinear regime*
- 7 September 2016: **Michael Gully-Santiago** (KIAA, Peking University, China), *Measuring fundamental properties of young stars*
- 9 September 2016: **Zenghua Zhang** (Instituto de Astrofísica de Canarias, Spain), *Comprehensive characterisation of L subdwarfs*
- 12 September 2016: **Haifeng Yang** (University of Virginia, USA), *Polarized radiation from protoplanetary disks*
- 14 September 2016: **Yohai Meiron** (Eötvös University, Budapest, Hungary), *Triple companion in gravitational wave signals*
- 26 September 2016: **Jincheng Guo** (National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China), *White dwarfs from SDSS and LAMOST*
- 17 October 2016: **Xin Wang** (CITA, Toronto, Canada), *On the Statistical Equivalence of the Large-scale Structure*
- 24 October 2016: **Chengyuan Li** (Macquarie University, Australia), *Stellar populations in young star clusters*
- 26 October 2016: **Ken Chen** (National Astronomical Observatory of Japan, Japan), *Lighting up the Universe with the First Stars, Supernovae, and Galaxies*
- 7 November 2016: **Hui Li** (Los Alamos National Laboratory, USA), *The role of vortices in multi-dimensional protoplanetary disks*
- 14 November 2016: **Abbas Askar** (Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Poland), *MOCCA Code for Star Cluster Simulations and the SURVEY Database I Projects*
- 23 November 2016: **Ying Zu** (The Ohio State University, USA), *Galaxy Quenching, Color Conformity, and Halo Assembly Bias*
- 28 November 2016: **Ling Zhu** (MPIA, Germany), *Orbit distribution of 300 CALIFA galaxies*
- 29 November 2016: **Annie Zavagno** (Laboratoire d'Astrophysique de Marseille, France), *The interplay between ionized regions and star formation: recent progress*
- 1 December 2016: **FuyanBian** (Australian National University, Australia), *High Lyman Continuum Escape Fraction in a Lensed Compact Dwarf Galaxy at z = 2.5*
- 6 December 2016: **Suoqing Ji** (University of California, Santa Barbara, USA), *The Impact of B-fields on Thermal Instability*
- 12 December 2016: **Zheng Cai** (University of California, Santa Cruz, USA), *Cosmic Mammoth: Mapping the Most Massive Large-scale Structures in the early Universe*
- 14 December 2016: **Guang Yang** (Penn State University, USA), *Black Holes Grow More Efficiently in Massive Galaxies*

# Postdoc Pizza Lunch Talks, 2016

(Pizza lunch speakers are usually local scientists, unless otherwise stated.)

- 12 January 2016: **Gongjie Li** (Harvard–Smithsonian Center for Astrophysics, USA), *Hierarchical Three-body Dynamics – How to Flip a Binary without a Spatula*
- 1 March 2016: **Haoran Yu**, *N-body simulations and Co-array Fortran parallelization*
- 8 March 2016: **Xiangkun Liu**, *(Weak) Gravitational Lensing: a brief overview*
- 15 March 2016: **Juanjuan Ren**, *Photometric variables in the new era of surveys*
- 29 March 2016: **Smitha Subramanian Hari Sharma**, *A road map for the generation of NIR guide star catalog for TMT observations*
- 12 April 2016: **Yonghwi Kim**, *Dynamical and Kinematic features of the Gas in Disk Galaxies*
- 26 April 2016: **Bingqiu Chen**, *The stellar population structure of the Galactic disk from the LAMOST survey*
- 17 May 2016: **Yanxia Xie**, *A Brief Introduction to James Web Space Telescope and Its main Science Goals*
- 24 May 2016: **Tsevi Mazehand Simchon Faigler** (Tel Aviv University, Israel), *Binary stars, exoplanets, dynamics and recently intense data mining with Kepler and CoRoT data*
- 11 October 2016: **Yang Huang**, *The LAMOST Galactic spectroscopic surveys*
- 25 October 2016: **Haoran Yu**, *Lagrangian Space Nonlinear E-mode clustering*
- 15 November 2016: **Sungsoon Lim**, *Ultra-diffuse galaxies and their globular clusters*
- 22 November 2016: **Jessy Jose**, *Low mass stellar population in HII region environments*
- 20 December 2016: **Zhijia Tian**, *Asteroseismology of clusters with Kepler & K2*

# 2016 Graduate Students Dinner Talks

- 15 January 2016: **Siyi Feng** (Max-Planck Institute for Extraterrestrial Physics, Germany), *Chemical Substructures in the High-Mass Star-Forming Regions*
- 25 February 2016: **Meng Sun** (University of Virginia, USA), *MESA 101 – An Introduction to a Stellar Evolution Code*
- 17 March 2016: **Yanxia Xie** (KIAA/PKU), *Silicate Dust in AGN*
- 22 March 2016: **Petchara Pattarakijwanich** (KIAA/PKU), *Large Surveys in Astronomy* (with Particular Focus on SDSS and LSST)
- 31 March 2016: **Junqiang Ge** (National Astronomical Observatories, Chinese Academy of Sciences, China), *Stellar M/L Ratio Gradients of E+S0 Galaxies and Their Implication*

*for IMF Variation*

- 7 April 2016: **Zheng Zheng** (National Astronomical Observatories, Chinese Academy of Sciences, China), *Environmental Dependence of Galaxy Metallicity and Age Gradients*
- 28 April 2016: **Yujing Qin** (Shanghai Astronomical Observatory, China/University of Arizona, USA), *Multi-Wavelength Galaxy Profile Fitting, and Combining Structural Decomposition with Stellar Population Synthesis*
- 30 May 2016: **Wenbin Lu** (University of Texas, USA), *Models of Fast Radio Bursts*
- 10 June 2016: **Tie Liu** (KASI, Republic of Korea), *Studying High-Mass Star Formation from Observations*
- 29 November 2016: **Yang Huang** (KIAA/PKU), *The Milky Way's Rotation Curve Out to 100 kpc and Its Constraint on the Galactic Mass Distribution*


# Peer–reviewed publications

## Articles in peer-reviewed journals published or accepted for publication in 2016 by members of the Peking University astronomy community

1. Ai Y.L., Dou L.M., **Fan X.H.**, **Wang F.**, **Wu X.-B.**, Bian F., 2016, Exploratory *Chandra* Observation of the Ultraluminous Quasar SDSS J010013.02+280225.8 at Redshift 6.30, ApJL, 823, L37
2. **Ai Y.L., Wu X.-B., Yang J.Y., Yang Q., Wang F., Guo R.**, Zuo W.W., **Dong X.Y.**, Zhang Y.-X., Yuan H.-L., Song Y.-H., Wang J.G., Dong X.B., Yang M., Wu H., Shen S.-Y., Shi J.-R., He B.-L., Lei Y.-J., Li Y.-B., Luo A.-L., Zhao Y.-H., Zhang H.-T., 2016, The Large Sky Area Multi-object Fiber Spectroscopic Telescope Quasar Survey: Quasar Properties from the First Data Release, AJ, 151, 24
3. Babak S., Petiteau A., Sesana A., Brem P., Rosado P.A., Taylor S.R., Lassus A., Hessels J.W.T., Bassa C.G., Burgay M., Caballero R.N., Champion D.J., Cognard I., Desvignes G., Gair J.R., Guillemot L., Janssen G.H., Karuppusamy R., Kramer M., Lazarus P., **Lee K.J.**, Lentati L., Liu K., Mingarelli C.M.F., Osłowski S., Perrodin D., Possenti A., Purver M.B., Sanidas S., Smits R., Stappers B., Theureau G., Tiburzi C., van Haasteren R., Vecchio A., Verbiest J.P.W., 2016, European Pulsar Timing Array limits on continuous gravitational waves from individual supermassive black hole binaries, MNRAS, 455, 1665
4. Bañados E., Venemans B. P., Decarli R., Farina E. P., Mazzucchelli C., Walter F., Fan X., Stern D., Schlafly E., Chambers K. C. Rix H-W.,**Jiang, L.**,McGreer I., Simcoe R., Wang F., Yang J., Morganson E., De Rosa G., Greiner J., Baloković M., Burgett W. S., Cooper T., Draper P. W., Flewelling H., Hodapp K. W., Jun H. D., Kaiser N., Kudritzki R.-P., Magnier E. A., Metcalfe N., Miller D., Schindler J.-T., Tonry J. L., Wainscoat R. J., Waters C., Yang Q., 2016, The PAN-STARRS1 Distant $z$>5.6 Quasar Survey: More Than 100 Quasars within the First Gyr of the Universe, ApJS, 227, 11
5. Banzatti A., Pontoppidan K.M., Salyk C., **Herczeg G.J.**, van Dishoeck E.F., Blake G.A., 2017, The depletion of water during dispersal of planet-forming disk regions, ApJ, in press (arXiv:1611.06230)
6. Barth A.J., Boizelle B.D., Darling J., Baker A.J., Buote D.A., **Ho L.C.**, Walsh J.L., 2016, Measurement of the Black Hole Mass in NGC 1332 from *ALMA* Observations at 0.044 Arcsecond Resolution, ApJ, 822, L28
7. Barth A.J., Darling J., Baker A.J., Boizelle B.D., Buote D.A., **Ho L.C.**, Walsh J.L., 2016, Toward Precision Black Hole Masses with *ALMA*: NGC 1332 as a Case Study in Molecular Disk Dynamics, ApJ, 823, 51
8. Bassa C.G., Janssen G.H., Karuppusamy R., Kramer M., **Lee K.J.**, Liu K., McKee J., Perrodin D., Purver M., Sanidas S., Smits R., Stappers B.W., 2016, LEAP: the Large European Array for Pulsars, MNRAS, 456, 2196

9. Bassa C.G., Janssen G.H., Stappers B.W., Tauris T.M., Wevers, T., Jonker P.G., Lentati L., Verbiest J.P.W., Desvignes G., Graikou E., Guillemot L., Freire P.C.C., Lazarus P., Caballero, R.N., Champion D.J., Cognard I., Jessner A., Jordan C., Karuppusamy R., Kramer M., Lazaridis K., **Lee K.J.**, Liu K., Lyne, A.G., McKee J., Osłowski S., Perrodin D., Sanidas S., Shaifullah, G., Smits R., Theureau G., Tiburzi C., Zhu W.W., 2016, A millisecond pulsar in an extremely wide binary system, MNRAS, 460, 2207
10. Bothwell M.S., Maiolino R., Cicone C., **Peng Y.**, Wagg J., 2016, Galaxy metallicities depend primarily on stellar mass and molecular gas mass, A&A, 595, A48
11. Caballero R.N., **Lee K.J.**, Lentati L., Desvignes G., Champion D.J., Verbiest J.P.W., Janssen G.H., Stappers B.W., Kramer M., Lazarus P., Possenti A., Tiburzi C., Perrodin D., Osłowski S., Babak S., Bassa C.G., Brem P., Burgay M., Cognard I., Gair J.R., Graikou E., Guillemot L., Hessels J.W.T., Karuppusamy R., Lassus A., Liu K., McKee J., Mingarelli C.M.F., Petiteau A., Purver M.B., Rosado P.A., Sanidas S., Sesana A., Shaifullah G., Smits R., Taylor S.R., Theureau G., van Haasteren R., Vecchio A., 2016, The noise properties of 42 millisecond pulsars from the European Pulsar Timing Array and their impact on gravitational-wave searches, MNRAS, 457, 4421
12. **Cai M.X.**, Gieles M., Heggie D.C., Varri A.L., 2016, Evolution of star clusters on eccentric orbits, MNRAS, 455, 596
13. Cao T.-W., Yang M., Wu H., Zhang T.-M., Shi J.-R., Zhang H.-T., Yang F., Zhao J.-K., Zhou X., Fan Z., Jiang Z.-J., Ma J., Wang J.-L., Wu Z.-Y., Zou H., Zhou Z.-M, Nie J.-D., Luo A-L., **Wu X.-B.**, Zhao Y.-H., 2016, Spectral identification of the *u*-band variable sources in two *LAMOST* fields, Astrophys. Space Sci., 361, 293
14. Carson D., Barth A.J., Seth A.C., et al. (incl. **Ho L.C.**), 2017, Stellar Populations of Nuclear Star Clusters in Nearby Late-type Spiral Galaxies from *Hubble Space Telescope* Wide Field Camera 3 Imaging, ApJ, in press
15. **Chen B.Q., Liu X.W.**, Xiang M.S., Yuan H.B., **Huang Y.**, Shi J.R., Fan Z., Huo Z.Y., **Wang C.**, **Ren J.J.**, **Tian Z.J.**, **Zhang H.W.**, Liu G.C., Cao Z.H., Zhang Y., Hou Y.H., Wang Y.F., 2016, The *LAMOST* spectroscopic survey of globular clusters in M31 and M33. II. Metallicities, ages and masses, AJ, 152, 45
16. **Chen B.-Q., Liu X.-W.**, Yuan H.-B., Robin A.C., **Huang Y.**, Xiang M.-S., **Wang C., Ren J.-J., Tian Z.-J., Zhang H.-W.**, 2017, Constraining the Galactic structure parameters with the XSTPS-GAC and SDSS photometric surveys, MNRAS, 464, 2545
17. **Chen X., de Grijs R.**, Deng L., 2016, Contact Binaries as Viable Distance Indicators: New, Competitive *(V) JHK*$_s$ Period–Luminosity Relations, ApJ, 832, 138
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# Awards (2016)

*The Peking University astronomy community is forcefully making headway beyond its campus. Highlights of awards and honors received in 2016 are included in this chapter.*

**de Grijs, Richard:**

- Inclusion on the Elsevier/Scopus Most Influential Chinese Scholars in 2015 list
- Erskine Award (2017), University of Canterbury (New Zealand)

**Fan, Zuhui:**

- Excellent graduate teaching award, Peking University

**Jose, Jessy; Liu, Xiangkun:**

- Excellent postdoc award, Peking University

**Peng, Eric:**

- 2016 Tsang Hin-Chi Excellence in Teaching Award ( 曾宪梓优秀教育奖 )

**Peng, Yingjie:**

- MERAC Prize in Observational Astrophysics, European Astronomical Society (EAS).

There are annually three MERAC Prizes. Prizes of €20,000 (personal award) plus €100,000 (research grant) are awarded in each of three categories: Theoretical Astrophysics, Observational Astrophysics and New Technologies. The Observational Astrophysics Prize was awarded to Yingjie Peng for his Ph.D. thesis on the simplicity of the evolving galaxy population and the origin of the Schechter form of the galaxy stellar mass function. See http://eas.unige.ch/merac_prizes.jsp

Group picture of the three MERAC Prize laureates taken at EWASS 2016 in Athens, Greece.

- Inclusion in the Top 10 Stories 2015 in *Astronomy Now*, UK: **No. 5**, *The Great Galaxy Shutdown*, http://astronomynow.com/category/top-stories-2015/

**Wu, Xuebing:**

- *LAMOST* Fellowship Outstanding Scholar (National Astronomical Observatories, Chinese Academy of Sciences)

**Yu, Qingjuan:**

- Inclusion in the *Elsevier*/Scopus Most Influential Chinese Scholars in 2015 list
- Supervisor, Peking University Outstanding Doctoral Dissertation student (**Zhang, Congyao**)

# Grants awarded in 2016

*Members of the Peking University astronomy community engage in a wide variety of high-level scientific pursuits. This chapter recognizes the leading roles many of our community members play, as evidenced by competitive grant awards.*

**Bose, Subhash:**

- China Postdoctoral Science Foundation (*Second Class General Financial Grant*), Observation and characterization of Core-collapse Supernovae, RMB 50,000 (2017–2018)

Core-collapse supernovae (SNe) exhibit a wide variation in observable parameters, as they originate from progenitors of diverse nature and widely varying explosion energy. The circumstellar environment and history of pre-SN evolution also plays a key role in diversifying their properties. The advent of modern observational technologies and systematic surveys has led us to discover more rare and unique kinds of events which often challenge our contemporary understanding of these explosions. In this program we will perform rigorous observations of newly discovered core collapse supernovae and characterize their progenitor properties and explosion parameters. Direct detection from *HST* archival images is limited to nearby ($\lesssim$25 Mpc) supernovae. By constraining the progenitor mass from modeling of the observed parameters, we can probe much more distant SNe and a larger volume, which will give us a clearer picture of SNe II mass limits. The ejecta of core-collapse SNe interacting with pre-existing circumstellar materials (CSM) can excite the outer layer of cooler ejecta, imprinting their signatures in observed spectra. These interaction signatures can be useful to probe the extragalactic circumstellar environment. There is significant scope to perform an extensive study of weak ejecta–circumstellar medium interactions. Another vital aspect of the program is to perform strategic observation of SNe II and use the data for distance estimation by applying the Expanding Photosphere Method (EPM). Redshift-independent distance estimation on extragalactic scales is vital in astrophysical and cosmological studies. The derived distances will also be used for the study of SNe themselves and to perform statistical analyses of the large collective sample of SNe.

**Chen, Bingqiu:**

- China Postdoctoral Science Foundation *(First Class General Financial Grant), Galactic disk structure based on the LAMOST Spectroscopic Survey,* RMB 80,000 (2017–2018)

LSS-GAC, the *LAMOST* Spectroscopic Survey of the Galactic Anticenter and a major component of the *LAMOST* Experiment for Galactic Understanding and Exploration (LEGUE) proposed by the *LAMOST* Galactic Surveys Working Group, offers a unique opportunity to address questions which are key to revealing the true multi-dimensional structure and the formation and evolution history of the Galactic disk, and of the Galaxy as a whole. In this project, we aim to study the puzzles that can be tackled with the LSS-GAC including the disk formation of the

Milky Way and other late type spirals, secular evolution and (in) stabilities to gravitational perturbations of the disk, the origin of the thick disk, and the structures and substructures of the outer disk, including truncations, warps, the Monoceros Ring and other anti-center stellar (sub) structures.

### de Grijs, Richard:

- National Natural Science Foundation of China (NSFC)–Chinese Academy of Sciences (CAS) Joint Programme, *Stellar variability and rotation provide unprecedented insights into the origins of Galactic stellar populations,* RMB 500,000 (2017–2019); **PI**

Almost all stars exhibit signs of variability on a wide range of timescales. Signatures of pulsation and rotation are among the most important observational diagnostics that provide unique insights into the fundamental physical characteristics of the stellar populations making up, e.g., the disks of galaxies like the Milky Way and its constituent components, the open and globular star clusters. One the one hand, pulsational variability is most easily studied for the most massive, well-behaved pulsators, the Cepheid variables. On the other, the effects of stellar rotation on a stellar population's photometry are best traced for stars with masses in excess of 1.5–2 solar masses. Here, we aim at cultivating and consolidating individual collaborative efforts between university- and Chinese Academy of Sciences-based researchers into a comprehensive programme that will (i) transcend our one-on-one collaborations and (ii) allow us to punch well above our weight to achieve a major international impact. Our science case consists of two main components on the theme of stellar variability, which are complementary to one another but focus each on fundamental science associated with our understanding of the formation and evolution of the Milky Way galaxy and its constituent populations. First, we propose to undertake a careful analysis of classical Cepheid variables in highly obscured regions in the northern Galactic disk based on data from the KISOGP survey and complementary time-series observations obtained at Xinglong Observatory. Our survey is fully complementary to that currently undertaken by the Gaia mission, whose data cannot be used to determine distances to stars in the regions where our Cepheids reside, mainly owing to the prevailing high extinction. We will estimate distances as accurately as 10%, allowing us to determine the detailed three-dimensional structure of our 'home' region in the Galactic disk once and for all. Second, the key to understanding the ubiquitous presence of extended main-sequence turn-off regions in intermediate-age and old star clusters is a much-improved understanding of the rotation properties of the clusters' member stars. At present, the distribution of stellar rotation rates in star clusters is completely unknown, but knowing it accurately holds the key to resolving the current, very active debate in this field. Here we aim at characterizing stellar rotation rates in star clusters as a function of (i) stellar spectral type, (ii) cluster age and (iii) cluster metallicity, with emphasis on spectroscopic observations with the Xinglong Observatory 2.16 m telescope.

- NSFC Key Project, *Studies of the stellar content in star clusters and individual stellar properties,* RMB 3.8M (2017–2020); **co-PI**

As the smallest self-gravitating stellar systems, star clusters are

theoretically regarded as populations of stars with identical ages and chemical compositions, otherwise known as simple stellar populations (SSPs). This concept has widely been used in all fields of astrophysics. Observationally, the total number of member stars ranges from thousands to hundreds of thousands, or even millions, and the general physical properties of the system agree with the classical theoretical picture. However, recent observations and detailed analysis show that these simple stellar systems are not simple at all, with ages and/or chemical compositions varying systematically from the nominal values. Such phenomena become rather a general pattern in all kinds (in terms of morphology and parameters) of clusters in the local universe. Star clusters also comprise objects that are not following the classical route of stellar evolution, such as blue straggler and subdwarf stars. Time-domain observations open a new window to study stellar problems, specifically in the context of stellar pulsation and eclipsing binary systems.

### Dong, Subo:

◆ Chinese Academy of Sciences South America Center for Astronomy, China–Chile Joint Research Program, US$ 150,000 (2 years); **PI**

Cerro Tololo Interamerican Observatory Expansion of the All-sky Automated Survey for Supernovae (ASAS-SN) has been approved for funding; co-I: José L. Prieto (Universidad Diego Portales, Santiago).

### Ho, Luis:

◆ Ministry of Science and Technology of China, National Development Key Project, *The Cosmological Evolution of Supermassive Black Holes and Galaxies,* RMB 42M (2016–2021); **PI**, co-I's include **Linhua Jiang, Yingjie Peng, Ran Wang, Xue-Bing Wu,** and **Qingjuan Yu.**

BHOLE (Black hole–Host Lifecycle Evolution) is a large, long-term program funded by the Ministry of Science and Technology of China, devoted to four areas related to the general theme of the co-evolution of supermassive black holes and galaxies: (1) measurement of black hole masses in active galaxies, (2) study of physical properties (stars, gas, dust, star-formation rate) of their host galaxies, (3) search for and systematic characterization of high-redshift quasars, and (4) theoretical investigation of the physics of the central engine (accretion disk, outflows, feedback) of active galaxies. The project is a collaboration of 17 core investigators from six institutions in China (KIAA, Institute of High Energy Physics, National Astronomical Observatories Chinese Academy of Sciences, Shanghai Astronomical Observatory, Nanjing University, and University of Science and Technology of China). For more details, see: http://kiaa.pku.edu.cn/bhole/.

### Jiang, Linhua:

◆ Chinese Academy of Sciences South America Center for Astronomy, China-Chile Joint Research Program, US $ 150,000 (2 years); **co-PI**

This is a short-term program that is being used to spectroscopically identify high-redshift galaxies at the epoch of cosmic reionization, using telescopes located in Chile.

### Jose, Jessy:

◆ China Postdoctoral Science Foundation ($9^{th}$ *Special*

*Grant), Cluster formation and evolution within filamentary environments,* RMB 150,000 (2017–2018)

The project aims to identify and characterize the embedded protostars/clusters associated with infrared dark filamentary clouds in Galactic star forming regions. We plan to compare the characteristic spacing and masses of its members with the predictions of filament fragmentation theories to understand the fragmentation process and star-formation activity in filamentary environments.

### Kolodzig, Alexander:

◆ China Postdoctoral Science Foundation (*First Class General Financial Grant), Large-scale structure studies with the cosmic X-ray background: Capturing the missing link of low luminous X-ray sources,* RMB 80,000 (2017–2018)

A fundamental question of galaxy evolution is which mechanisms trigger and fuel Active Galactic Nuclei (AGN) and how these mechanisms depend on their environment. The best way to study this question for the bulk of the AGN population is through large-scale structure (LSS) studies based on X-ray surveys. With this information, we can derive the average dark matter halo (DMH) mass of AGN, and the distribution of AGN within a DMH (One-Halo-Term) as a function of redshift and AGN luminosity and compare them directly with predictions by semi-analytic-models for different triggering/fueling mechanisms of AGN. In order to improve our knowledge for the bulk of the AGN population the expansion towards lower luminosities is most important. The aim of my research program is to investigate how angular correlation studies of the unresolved cosmic X-ray background (CXB) can be used to study the triggering/fueling mechanisms of low-luminosity AGN. I will exploit three main facts: (1) The spatial density of AGN is well-known in comparison to their clustering properties. (2) Current X-ray telescopes have a high angular resolution. (3) X-ray surveys are becoming larger than deeper. My proposed investigations represent a feasibility study of using LSS studies with the CXB to derive clustering properties of two major X-ray source populations: AGN and galaxy clusters. I will enhance and deepen my previous study with pioneering measurements of angular correlations of the CXB: expansion to larger angular scales and higher energy bands, and systematic modeling of One-Halo-Term. I also intend to verify and improve my previous results by performing angular correlation studies with the Stripe82 survey (31 $deg^2$), conducted with a different instrument (*XMM-Newton*) for a different sky area

### Lee, Kejia:

◆ co-PI, *Pilot B program,* Chinese Academy of Sciences, RMB 20M (5 years)

The *Pilot B* programme aims to develop the necessary software and hardware to use the FAST radio telescope for performing the pulsar timing array project in order to detect gravitational waves. We will also form the Chinese pulsar timing array collaboration. In addition, the project prepares the necessary human resources and will educate the future generation of radio astronomers to secure the scientific rewards of FAST.

◆ co-PI, national 973 basic research program (2015CB 857100), "*Large sample radio astronomy*", RMB 24M (5 years)

This programme has two major missions, initial engineering studies for the Qitai 110 m radio telescope (QTT) key technology and science applications and case studies to build the road map for the QTT science project.

◆ PI, National Natural Science Foundation of China, Key Project: *Searching for FRBs,* RMB 3M (5 years)

To detect fast radio bursts, we need to develop the necessary real-time signal processing software and hardware. In this programme, we also train students to acquire basic skills in digital signal processing, microwave design, as well as high performance computing.

◆ Co-PI, *Max-Planck Gesellschaft partner group on radio astronomy*, €200,000 (3 years, with a possible extension of 2 years)

Aims: to build connections between the KIAA and the MIPfR, and to promote communication among the radio astronomy communities in China, Europe, and other countries. The major topic is gravitational wave detection with the pulsar timing array in the context of the international pulsar timing array.

**Liu, Xiangkun:**

◆ China Postdoctoral Science Foundation (*Second Class General Financial Grant), Influence of systematic errors on weak lensing peak analyses,* RMB 50,000 (2017–2018)

Having emerged as one of the most important probes in cosmological studies, weak lensing peak statistics is an efficient way to probe the nonlinear regime of structure formation, and thus it can provide an important complement to the cosmic-shear two-point correlation analysis. Although some current lensing analyses have demonstrated the feasibility of using peak statistics to obtain powerful cosmological constraints, many systematics are far from fully understood. In this project, based on large sets of numerical simulations, we will carry out detailed analyses to better understand the different systematics involved in weak lensing peak analyses, mainly focusing on projection effects of large-scale structures and the complex mass distribution of dark matter haloes. In addition, we will also perform joint cosmological analyses and further explore the complementarity between peak and two-point correlation analysis.

**Peng, Eric:**

◆ Chinese Academy of Sciences South America Center for Astronomy, China–Chile Joint Research Program, *Star Formation Processes in Large Galaxy Cluster Survey Fields*, US$ 150,000 (2 years); **PI**

How star formation is regulated and quenched is one of the central issues in the field of galaxy evolution. Nearby galaxy clusters are the closest regions where we can study star formation across the full range of galaxy mass and environment. The Virgo and Fornax clusters are the main mass concentrations within 20 Mpc, and have historically played a central role in our understanding of galaxies. We are purchasing an Hα filter for the Dark Energy Camera (DECam) mounted on the 4 m Blanco Telescope at the Cerro Tololo Inter-American Observatory (CTIO). With this filter, we will survey the Virgo

and Fornax clusters, producing the first deep, high-resolution maps of star formation and ionized gas over the entirety of these landmark galaxy overdensities. This new capability will complement our ongoing work on older stellar populations, which we plan to continue through the support of this program. Adding an Hα filter to DECam will immediately make DECam the most powerful survey machine for ionized gas in the local Universe.

### Peng, Yingjie:

- Youth 1000 Talents Plan (Youth Qianren), RMB 2,000,000

Understanding galaxy formation and evolution is one of the most important issues in modern cosmology. The continuity approach is an effective way to reconstruct the evolutionary sequence of the galaxy population that is observed with large sky surveys at different epochs. It can be used to study the evolution of the distribution function of the galaxy population. Meanwhile gas regulation is one of the keys to understanding galaxy formation and evolution, since it depicts the dynamical interplay of the key physical processes in galaxies: inflow, star formation, outflow, and metal production. It can be used to explore the evolution of the various scaling relations of the galaxy population. The combination of these two approaches will result in a powerful, simple full analytical framework to study the evolving galaxy population.

### Spurzem, Rainer:

- National Natural Science Foundation of China (NSFC) General Programme, *Multiple Stellar Populations and Dynamical Evolution of Globular Clusters*, RMB 660,000 (2017–2020); **PI**

Dense star clusters are spectacular and distinct self-gravitating stellar systems in our Galaxy and across the Universe, in many respects. They populate disks and spheroids of galaxies as well as the empty space between galaxies in clusters. The evolution of dense star clusters is not only governed by the aging of their stellar populations and simple Newtonian dynamics. The stellar densities become so high that stars can interact and collide, stellar evolution and binary stars change the dynamical evolution, black holes can accumulate in their centres and merge with relativistic effects becoming important. Recent high-resolution imaging has revealed even more complex structural properties with respect to multiple stellar populations, binary fractions and compact objects as well as the still controversial existence of intermediate-mass black holes in clusters of intermediate mass. From simulations it has become clear that they harbour a few hundred or more stellar mass black holes – some of them give rise to relativistic mergers and gravitational wave emission just like the one recently observed by LIGO. Dense star clusters therefore are the ideal laboratory for the study of stellar evolution and Newtonian as well as relativistic dynamics. The purpose of this project is the detailed investigation of dynamics and evolution of globular clusters; as most important new feature we will study the coupled evolution of first generation (FG) and second generation (SG) stars in globular clusters (GCs) in the framework of an in situ formation of both populations. The initial concentration of SG stars at the centre of the GC, suggested by recent formation theories and supported by observations, will have a significant impact on the evolution and general properties of the GC and in the mixing of the stellar populations. For this study we will

perform a large set of direct summation *N*-body simulations using different parameters for the initial distribution and fraction of FG and SG stars, for the fraction of binaries among FG and SG stars and for the initial rotation of the FG and SG components. In this context we will study the early as well as the long-term evolution and spatial mixing of FG and SG stars and the distribution and evolution of binary systems (including stellar mass binary black holes – potential gravitational wave (GW) sources) in the GC. These detailed models will be calibrated by and compared with star-by-star observations of globular clusters in the Milky Way and the Local Group; radio astronomy will help to constrain the number of neutron stars remaining in the cluster. In the following a larger set of models for extragalactic globular clusters will be simulated to predict integrated light and gravitational wave emission from binary black holes.

◆ Sino–German Centre for the Development of Science, *Systematic Study of Stellar Populations in Star Clusters*, RMB 253,000 + €35,000, with Zhongmu Li (Dali University)

Star clusters are important objects in astrophysical studies. Each cluster is thought of as simple stellar populations that consist of stars composed of the same metallicity and with the same age. However, this widely accepted image has been challenged by some observational colour–magnitude diagrams (CMDs) with extended main-sequence turn-offs (eMSTOs), observed with the *Hubble Space Telescope* (*HST*), which suggest the possibility of composite stellar populations consisting of stars with various ages in such clusters. Although many works tried to study such peculiar CMDs, there is no certain answer. This project aims to study the stellar populations of star clusters in detail, via the advanced stellar population synthesis (ASPS) technique built by Prof. Zhongmu Li and the dynamical simulation led by Prof. Rainer Spurzem. Single stars, binary stars, rotating stars, and star formation history will be considered simultaneously in ASPS. This will enable us to check the effect of each factor on CMDs in detail and then determine the basic parameters such as distance modulus, colour excess, age, binary fraction, rotator fraction, and star formation history via a homogeneous method. With the help of dynamical simulations of star clusters, we will be able to combine the advanced stellar population synthesis and dynamical studies of star clusters for the first time. This will give a clear answer to the stellar population types and some basic parameters of a series of star clusters, and establish a database of star clusters, which will be helpful for future studies. In order to make the result more reliable, a part of star clusters will be investigated via both photometry and spectroscopy methods. Because the Chinese team is good at advanced stellar population synthesis, and the German team is good at dynamical simulation of star clusters, scientists from two countries are able to unfold the stellar populations of star clusters through cooperation. The two research teams will be able to exchange their experiences and both will benefit from this project.

### Subramanian, Smitha:

◆ China Postdoctoral Science Foundation (*First Class General Financial Grant), Mapping the Magellanic System in 3D to trace the interaction history*, RMB 80,000 (2017–2018)

Encounters between galaxies in the form of mergers and/or

interactions, which were common in the early Universe, occur in the local Universe as well. The study of the structure of interacting galaxies will provide information about the nature of these interactions and help us understand galaxy evolution. This project aims to study the three-dimensional structure of such a nearby (50–60 kpc) interacting system known as the Magellanic system using multi-band photometric data. This study will provide observational constraints to identify theoretical models which best describe the interaction history of the Magellanic Clouds, and hence to understand the role of the Milky Way in the formation of the Magellanic system, which is highly debated.

### Xie, Yanxia:

◆ China Postdoctoral Science Foundation (*Second Class General Financial Grant), The Dust Properties in AGN Torus and ISM Studies in AGN Host Galaxies,* RMB 50,000 (2017–2018)

This project focuses on deciphering the dust grain size and chemical composition in AGN dust tori, as well as estimating the cold dust content in AGN host galaxies. We proposed to model more than 100 mid-infrared quasar spectra and far-infrared SEDs using the Draine & Laor (1993) and Draine & Li (2007) radiation transfer recipes, which take into account various grain sizes, dust chemical compositions, as well as the masses of different dust species. Better constraints to these parameters will greatly advance our knowledge of the dust properties in AGN tori as well the total ISM in AGN host galaxies. This work will pave the way for investigating how AGN activity affects the evolution of their host galaxies.

### Yu, Qingjuan:

◆ NSFC General Programme, *Mergers of galaxy clusters and AGN feedback*, RMB 680,000 (2017–2020); **PI**

Mergers of galaxy clusters are one of the fundamental and important processes at the basis of the formation and evolution of galaxy clusters. Feedback from active galactic nuclei (AGN) has also become one fundamental and important physical process in understanding the thermal dynamics in the intracluster medium (ICM) and the coevolution of galaxies and massive black holes in recent years. By using numerical simulations and semi-analytical methods, we plan to involve AGN feedback into the merging processes of galaxy clusters and study the statistics of the difference in the distributions of different kinds of matter within galaxy clusters as a probe to cosmology and the physical processes occurring in the ICM. This research will deepen our understanding of the formation and evolution of the large-scale structure, cosmic velocity fields, the rate of galaxy cluster mergers, and even the rate of galaxy mergers and black hole mergers, and the relation of the physical processes occurring in the vicinity of a massive black hole with the large-scale structure of the Universe.

# The Peking University astronomy community and its impact beyond the campus

*Many Peking University astrophysicists play leading roles or hold high honors in external organizations. This chapter summarizes the main highlights of their impact beyond the campus gates.*

**de Grijs, Richard:**

- Deputy Editor, *The Astrophysical Journal Letters* (American Astronomical Society)
- Discipline Scientist (Astrophysics), International Space Science Institute–Beijing
- Fellow, Higher Education Academy (UK)
- Fellow and China representative, Institute of Physics (UK)
- President, IAU Commission H4, "*Stellar Clusters Throughout Space and Time*"
- Founding director, East Asian Regional Office of Astronomy for Development, IAU (until September 2016); Member, Task Force 1 on "*Astronomy for Universities and Research*"
- Convener, Thirty Meter Telescope (TMT) International Science Development Team (ISDT): *Stars, Stellar Physics and the ISM*
- Member, TMT ISDT: *Milky Way and Nearby Galaxies*
- Ambassador for China, Open Researcher and Contributor ID (ORCID)
- Guest professor, Shanghai Astronomical Observatory, China
- Joint professor, China West Normal University, Nanchong (Sichuan), China; Science Advisory Committee member, China West Normal University (Department of Astronomy)
- Visiting professor, Qiannan Normal College for Nationalities, Duyun City (Guizhou), China
- Member of the Editorial Board, *astro EDU* (International Astronomical Union)

**Dong, Subo:**

- Member, Thirty Meter Telescope (TMT) International Science Development Team: *Exoplanets*

**Herczeg, Gregory:**

- Convener, Thirty Meter Telescope (TMT) International Science Development Team: *Formation of Stars and Planets*
- Member, TMT Science Advisory Committee

**Ho, Luis:**

- Advisory Panel Member, Academia Sinica Institute for Astronomy and Astrophysics
- Editorial Committee Member, *Annual Reviews of Astronomy and Astrophysics*
- Associate Editor, *The Astrophysical Journal Letters* (American Astronomical Society)
- Board Member, East Asian Observatory
- Advisory Committee Member, Key Laboratory for Galaxies and Cosmology, Chinese Academy of Sciences
- Advisory Committee Chair, Key Laboratory for Optical Astronomy, Chinese Academy of Sciences
- Advisory Committee Member, Chinese Academy of Sciences
- Member, FAST Science Advisory Committee
- Thirty Meter Telescope (TMT) International Science Development Team: *Supermassive Black Holes*

◆ Science Advisory Committee Chair and Board Member, Chinese Large Optical–Infrared Telescope

◆ Advisory Committee Member, Southern University of Science and Technology

◆ Advisory Committee Member, Laboratory of Space Research, University of Hong Kong

**Jiang, Linhua:**

◆ Member, Thirty Meter Telescope (TMT) International Science Development Teams: *Supermassive Black Holes; Early Universe, Galaxy Formation and the IGM*

◆ Scientific coordinator (Chinese team), DESI (Dark Energy Spectroscopic Instrument)

**Jose, Jessy:**

◆ Member, Thirty Meter Telescope (TMT) International Science Development Team: *Formation of Stars and Planets*

**Kouwenhoven, M.B.N.:**

◆ Visiting professor, Qiannan Normal College for Nationalities, Duyun City (Guizhou), China

◆ Adjunct professor, Rizal Technological University, Philippines

**Lee, Kejia:**

◆ Member, SKA pulsar working group

**Peng, Eric:**

◆ Co-chair, Telescope Access Program

◆ Member, Thirty Meter Telescope Science Advisory Committee

◆ Convener, Thirty Meter Telescope (TMT) International Science Development Team: *Milky Way and Nearby Galaxies*

◆ China representative, Canada–France–Hawai'i Telescope Science Advisory Committee

◆ China representative, Maunakea Spectroscopic Explorer Science Executive Committee

**Peng, Yingjie:**

◆ Member, MOONS (Multi-Object Optical and Near-infrared Spectrograph for VLT) Science Team

**Subramanian, Smitha:**

◆ Member, Thirty Meter Telescope (TMT) International Science Development Team: *Milky Way and Nearby Galaxies*

**Wu, Xue-Bing:**

◆ Vice President, Beijing Astronomical Society

◆ Chair, *LAMOST* User Committee (National Astronomical Observatories, Chinese Academy of Sciences)

# Scientific dissemination

*Peking University astrophysicists actively engage with their respective communities through conference organization and high-profile contributions, in addition to disseminating their latest research achievements through talks at external institutes. A summary of their main achievements is included in this chapter.*

## Conference organization and SOC membership

7–11 March 2016: **Protoplanetary DISCussions**, Edinburgh, UK

- SOC: **Herczeg, Gregory**

25 March 2016: **Gezhi Forum** ( 格致论坛 ), School of Physics, Peking University, Beijing, China

- SOC: **Dong, Subo**

9–10 May 2016: **Beijing–Nanjing bilateral workshop in astrophysics**, KIAA Beijing, China

- SOC: **Herczeg, Gregory; Kouwenhoven, M.B.N.** (co-chair); **Liu, Fukun** (co-chair); **Li, Zhuo; Peng, Yingjie; Wang, Ran**


The *Beijing–Nanjing bilateral workshop in astrophysics* was held on 9–10 May 2016 at the Kavli Institute for Astronomy and Astrophysics at Peking University and was jointly organized with the PKU Department of Astronomy, Nanjing University, and Purple Mountain Observatory.

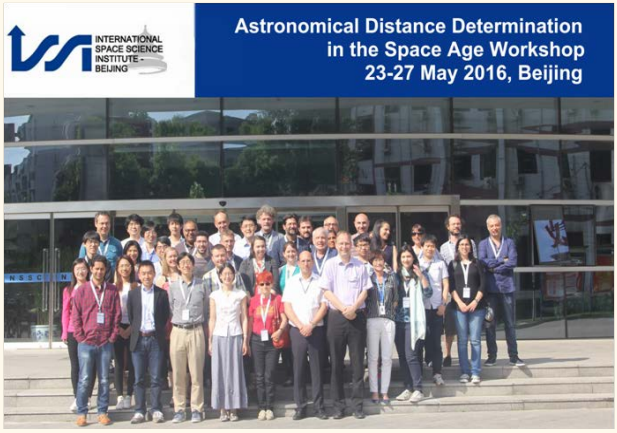
This workshop aimed to strengthen ties between our institutes, encourage new friendships, and provide a platform for future collaborations. Topics covered during the workshop:

- The Sun, the solar system, and exoplanets;
- Stars and stellar populations: evolution and dynamics;
- Supermassive black holes and AGN;
- Large-scale structure, galaxy formation and evolution;
- High-energy astrophysics and compact objects.

23–27 May 2016: **Astronomical Distance Determination in the Space Age**, International Space Science Institute–Beijing, China

- SOC: **de Grijs, Richard** (chair)

This ISSI-BJ workshop highlighted 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 modelers working on a large variety of spatial scales, and spanning a wide range of expertise. We specifically addressed future efforts in this field, both theoretically and observationally.

23–27 May 2016: **M87 Workshop**, Taipei, Taiwan

- SOC: **Ho, Luis** (co-chair)

10–13 June 2016: **Xinjiang Astronomical Observatory–Peking University Bilateral Astrophysics Workshop**, Urumqi (Xinjiang), China

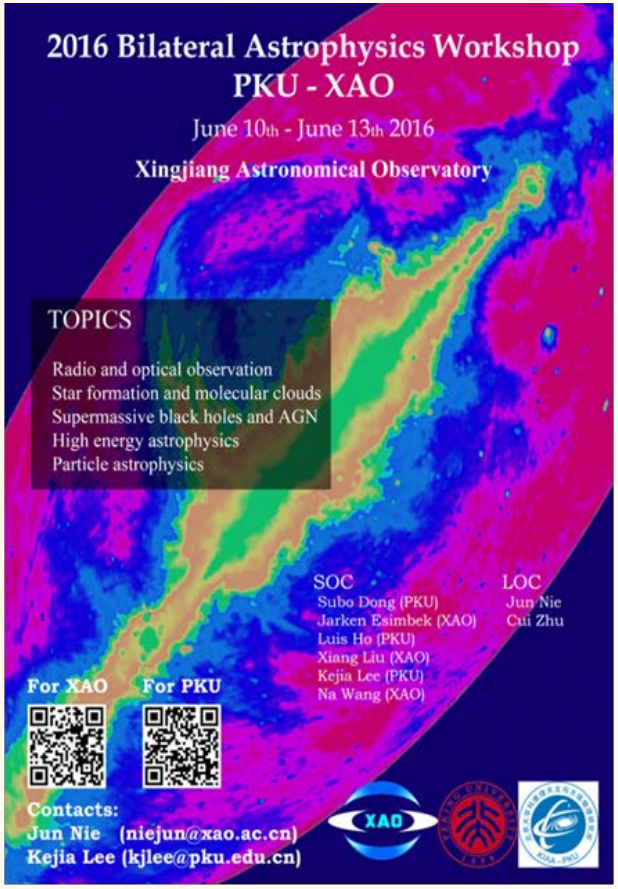
- SOC: **Dong, Subo; Ho, Luis; Lee, Kejia** (co-chair)

In order to prompt collaboration and improve communication between Peking University (PKU) and Xinjiang Astronomical Observatory (XAO), we organized a bilateral meeting between both institutions from 10th June 2016 to 13th June 2016 in Urumqi, Xinjiang.

19–23 June 2016: **ISC (International Supercomputing Conference) 2016, High Performance Computing Annual Conference**, Frankfurt, Germany

- Birds-of-Feather (BoF) committee: **Spurzem, Rainer**

The BoF Committee reviews all BoF proposals submitted and selects the sessions to be presented at the ISC. This Germany-based conference issues every year the Top-500 list of fastest



supercomputers in the world, which appears every 6 months in turns with the US-based SC (Supercomputing).

20 June–1 July 2016: **International Pulsar Timing Array Conference**, Cape Town, South Africa

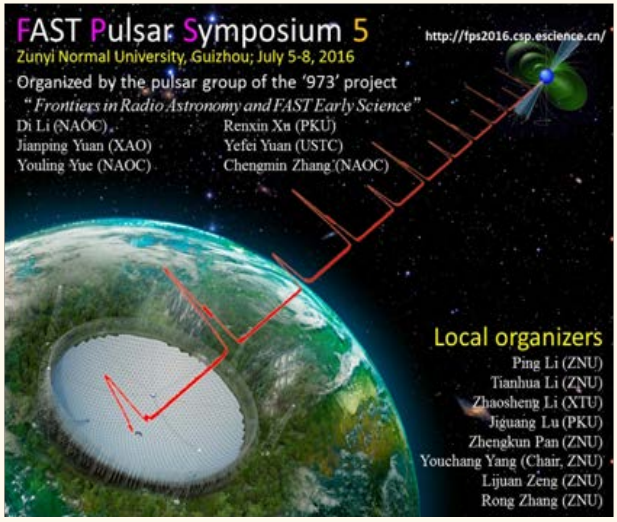
◆ SOC: **Lee, Kejia**

2–6, 5–8 July 2016: **FAST Pulsar Symposium 5**, Zunyi (Guizhou), China

◆ SOC: **Xu, Renxin**

The detection of the first celestial radio source was achieved in the 1930s by Karl Jansky. Ever since, there has never been a lack of excitement in the radio window; in particular, we have had the unique chance to get to know, study, and explore the dark and violent side of universe. The Xingjiang Qitai Radio Telescope (QTT) is now officially in the planning phase. It is designed to be a fully steerable 110 m single dish telescope capable of high-frequency observations, to serve the global astronomical community, and to promote radio astronomical research in China. Meanwhile, It will also boost related technology developments.

The QTT science case covers a very broad range of topics, from the moon to black holes, from molecular clouds to stellar graveyards (compact stars), from our neighborhood (planets) to the farthest reaches (high-redshift galaxies), to the whole Universe. A clear definition of science program not only helpful for the design and engineering processes of the telescope, but also, and just because of it, it will make the telescope a cutting-edge scientific instrument. It is absolutely necessary to bring related world-wide scientists on board to plan the detailed science case for QTT in its design phase




3 July 2016**: First AST (Ali Six-point-five-meter Telescope) Workshop**, KIAA/Peking University, Beijing, China

◆ SOC: **Jiang, Linhua** (chair)

AST is a 6.5m optical and near-infrared telescope. It will be constructed by 2023, and it will be located in Ali, China. It will have a series of powerful instruments that are capable of doing science ranging from exoplanets to distant objects in the early Universe. AST is in a planning phase. In order to bring together Chinese astronomers and seek close collaboration for AST, KIAA at PKU hosted the first AST workshop.

18–22 July 2016: **The Multi-Messenger Astrophysics of the Galactic Centre** (IAU Symposium 322), Palm Cove (Queensland), Australia

◆ SOC: **Ho, Luis**

1–5 August 2016: **Evolution Cycles in X-ray Binaries and Active Galaxies,** Kuche (Xinjiang), China
- SOC: **Ho, Luis**

8–12 August 2016: **Hidden Monsters: Obscured AGN and Connections to Galaxy Evolution**, Dartmouth (NH), USA
- SOC: **Ho, Luis**

16–19 August 2016: **Runaway and Hypervelocity stars**, Bamberg, Germany
- SOC: **Yu, Qingjuan**

12–16 September 2016: **5th Byurakan International Summer School,** Byurakan, Armenia
- SOC: **de Grijs, Richard**

22–24 September 2016: **East-Asian AGN Workshop 2016**, Seoul, Republic of Korea
- SOC: **Wu, Xue-Bing**

26–28 September 2016: **Perspectives of GPU Computing in Sciences (GPU2016)**, Rome, Italy
- SOC: **Spurzem, Rainer**

30 September 2016: **Black hole–Host Lifecycle Evolution (BHOLE) workshop: Gas, Dust and Star Formation of AGN Host Galaxies**, KIAA/Peking University, Beijing, China
- SOC: **Ho, Luis** (chair)

crucial component relevant to the growth of both black holes and galaxies is the gas content of the host galaxy. Gas, both neutral and molecular hydrogen, also offers an effective tool to quantify the global kinematics, and hence the gravitational potential, of the host galaxy. This provides an alternative, effective method to study the scaling relation between black hole mass and host galaxy mass. Gas is also the fuel for star formation and AGN activity in galaxies. AGN feedback can drive gas outflows and regulate star formation in galaxies. The focus of this workshop was to bring together these different themes to discuss and explore the interplay between gas, dust and star formation of AGN host galaxies in the galaxy population, and make plans for future observations with variety of facilities including *ALMA* and the 500m FAST radio telescope.

10–14 October 2016: **Planetary Nebulae: Multi-Wavelength Probes of Stellar and Galactic Evolution** (IAU Symposium 323), Peking University, Beijing, China
- SOC: **Liu, Xiaowei** (co-chair)

24–26 October 2016: **Reverberation Mapping of AGN**, Lijiang (Yunnan), China
- SOC: **Ho, Luis**

10–11 November 2016: **2016 KIAA–PKU Astrophysics Forum: Future Large Optical-Infrared Facilities in China**, Beijing, China
- SOC: **Ho, Luis** (co-chair); **Jiang, Linhua**

Astronomy is an empirical science, driven by progress in observational facilities. With the rapid development of telescope facilities on the ground and in space during the past decade, coupled with increased participation in large international projects such as *TMT* and *SKA*, the Square Kilometre Array, China is poised to play a dominant role in astronomy on the world stage. A major current weakness, however, is the lack of general-purpose, large-aperture

optical–infrared facilities. To remedy this urgent situation, the community, under the auspices of the National Astronomical Observatories, Chinese Academy of Sciences, have proposed the construction of a 12 m optical–infrared telescope in Ali, Tibet. In a parallel effort, a consortium of universities is evaluating the feasibility of developing a 6.5 m optical–infrared telescope.

The theme for this year's KIAA/PKU Astrophysics Forum was *Future Large Optical-Infrared Facilities in China*. We organized a forum to discuss the two proposed large telescope projects, an opportunity for everyone in China to actively participate in the early planning of the two projects, to join in various science and technical working groups, and to learn, propose, and discuss science cases for the two telescopes. The forum provided a platform for national and international collaborations among individuals and institutions.

Topics covered in the workshop included:

- Key science drivers;
- Key technical specifications of the telescopes;
- Instrumentation requirements;
- Site survey;
- International collaboration;
- Detailed planning for the 12 m telescope project.

18–26 November 2016: **1st South Africa–China bilateral workshop on '*Cosmology with large surveys*'**, Durban, South Africa

- SOC: **Fan, Zuhui; Spurzem, Rainer**

5–7 December 2016: **2nd Australia–China Workshop on Astrophysics**, Suzhou, China

- SOC: **Jiang, Linhua**

13–16 December 2016: **Workshop on follow-up surveys of Planck Galactic Cold Clumps**, KIAA, Peking University, China

- SOC: **Wu, Yuefang** (chair); **Liu, Qi**

19–21 December 2016: **8th Korea–China–Kazakstan meeting,** Kunming (Yunnan), China

- SOC: **Spurzem, Rainer** (chair)

# Contributions to conferences

**de Grijs, Richard:**

◆ 4–8 January 2016: 227$^{th}$ *American Astronomical Society Winter Meeting 2016*, Kissimmee (FL), USA; Session chair, Chambliss poster award judge

◆ 29 February–4 March 2016: *Regional coordinators conference*, Office of Astronomy for Development (International Astronomical Union), Cape Town, South Africa; invited senior partner

◆ 23–27 May 2016: *Astronomical Distance Determination in the Space Age*; invited speaker

◆ 2–3 June 2016: *Kavli Institutes Assembly*, New York (NY), USA; invited participant

◆ 28–30 June 2016: *VISTA Survey of the Magellanic Clouds annual meeting*, Keele University, UK; invited speaker


◆ 19–23 September 2016: 70$^{th}$ *Anniversary Conference*, Byurakan Astronomical Observatory, Byurakan, Armenia; invited speaker, session chair, official welcome on behalf of the International Astronomical Union

◆ 12–13 October 2016: *Sino–Europe Forum on Education Policy Think Tanks*, National Center for Education Development Research (Chinese Ministry of Education), Beijing, China; invited speaker

◆ 2 November 2016: *Sino–European Research Conference*, European Union Delegation to China, Beijing, China; keynote speaker, workshop organizer, panel chair, science competition judge

◆ 10–12 December 2016: *International Symposium on Postdoctoral Systems*, Zhuhai (Guangdong), China; invited speaker

◆ 19–21 December 2016: 8$^{th}$ *Korea–China–Kazakstan meeting*, Kunming (Yunnan), China; invited speaker, session chair

**Dong, Subo:**

◆ 25 March 2016: *Gezhi Young Physicists Forum*, Peking University, Beijing, China; invited speaker

◆ 9–10 May 2016: *Beijing–Nanjing bilateral workshop in astrophysics*, KIAA Beijing, China

◆ 12–13 June 2016: *Xinjiang Astronomical Observatory–Peking University Bilateral Astrophysics Workshop*, Urumqi (Xinjiang), China

◆ 8–12 August 2016: *Supernovae Through the Ages*, Easter

Island, Chile

◆ 3–7 October 2016: *ISSI Workshop on Supernovae*, Bern, Switzerland; invited review

◆ 10–11 November 2016: *2016 KIAA/PKU Astrophysics Forum,* Beijing, China; invited speaker

**Fan, Zuhui:**

◆ 19–26 November 2016: *1st South Africa–China bilateral workshop on 'Cosmology with large surveys'*, Durban, South Africa

**Herczeg, Gregory:**

◆ 7 March 2016: *Chicagoland Exoplanet Meeting*, Northwestern University, Evanston (IL), USA; invited speaker

◆ 17–19 April 2016: *JCMT Users' Meeting*, National Astronomical Observatory of Japan, Mitaka, Tokyo, Japan; invited speaker

◆ 19 May 2016: *Peking University–Chinese University of Hong Kong Bilateral Meeting*, Peking University, Beijing, China; invited speaker

◆ 24–26 May 2016: *2016 Thirty Meter Telescope Forum*, Kyoto, Japan; invited speaker

◆ 8 October 2016: *NAOC 12m Forum*, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China; invited speaker

◆ 10–11 November 2016: *2016 KIAA/PKU Astrophysics Forum,* Beijing, China; invited speaker

**Ho, Luis:**

◆ 16–18 February 2016: *Starburst-AGN Connection: Toward the Minor-Merger Driven Unified Model for Nuclear Activities*, Tokyo, Japan; invited speaker

◆ 23–27 May 2016: *M87 Workshop*, Taipei, Taiwan; invited speaker

◆ 24–25 May 2016: *The Chinese Large Ground-Based Optical Telescope*, Nanjing, China; invited speaker

◆ 4–7 July 2016: *19th CAS GuoShou Jing Symposium on Galaxies and Cosmology*, Beijing, China; invited speaker

◆ 1–5 August 2016: *Evolution Cycles in X-ray Binaries and AGN*, Kuche (Xinjiang), China; invited speaker

◆ 24–26 October 2016: *Reverberation Mapping of AGN*, Lijiang (Yunnan), China; invited speaker

◆ 19–26 November 2016: *Cosmology with Large Surveys*, Durban, South Africa; invited speaker

**Jiang, Linhua:**

◆ 10–11 November 2016: *2016 KIAA/PKU Astrophysics Forum,* Beijing, China; invited speaker

◆ 5–7 December 2016: *2nd Australia–China Workshop on Astrophysics*, Suzhou, China; invited speaker

**Jose, Jessy:**

◆ 9–13 May 2016: *Annual Meeting of Astronomical Society of India*, Srinagar, India

◆ 18–22 July 2016: *Role of feedback in cluster evolution*, Sesto, Italy

**Kim, Yonghwi:**

◆ 1–3 February 2016: *5th Survey Science Group Workshop*, Jeongsun, Gangwon-do, Republic of Korea

◆ 24–28 October 2016: *7th East-Asian Numerical Astrophysics Meeting (EANAM)*, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China

◆ 31 October–4 November 2016: *7th KIAS Workshop on Cosmology and Structure Formation*, Korea Institute for Advanced Study (KIAS), Seoul, Republic of Korea; keynote speaker

**Kolodzig, Alexander:**

◆ 11–13 April 2016: *2nd Anisotropic Universe Workshop*, Amsterdam, Netherlands

◆ 15–18 June 2016: *Hot spots in the XMM sky*, Mykonos Island, Greece

**Kouwenhoven, M.B.N.:**

◆ 18–24 April 2016: *MODEST-16*, Bologna, Italy; invited speaker

◆ 9–10 May 2016: *Beijing–Nanjing bilateral workshop in astrophysics*, KIAA Beijing, China; session chair

◆ 27–29 June 2016: *Star Clusters – Dynamics and Observations*, Heidelberg, Germany; invited speaker, session chair

**Li, Li-Xin:**

◆ 9–10 May 2016: *GRBs and Frontiers of Physics* (973 conference), Guilin, China; invited speaker

**Li, Zhuo:**

◆ 8–9 January 2016: *Fermi's message for Ice Cube*? Nanjing, China; invited speaker

◆ 17–18 April 2016: *Micro-TDE*, Nanjing, China; invited speaker

◆ 9–10 May 2016: *GRBs and Frontiers of Physics* (973 conference), Guilin, China

◆ 10–13 June 2016: *High-energy neutrino origins*, Urumqi (Xinjiang), China; invited speaker

◆ 11–16 July 2016: *High-energy neutrino astronomy*, Tsukuba, Japan; invited speaker

◆ 15–18 August 2016: *Multi-messenger study with LHAASO*, Tianjin, China; invited speaker

**Liu, Xiangkun:**

◆ 4–7 July 2016: *Frontiers of Galaxy Formation and Cosmology,* Beijing, China

◆ 18–19 October 2016: *Academic Forum for Young Astronomers*, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China

**Longobardi, Alessia:**

◆ 10–14 October 2016: *Planetary Nebulae: Multiwavelength probes of stellar and galactic evolution* (IAU Symposium 323), Peking University, Beijing, China

**Peng, Eric:**

◆ 18–19 September 2016: *China Large Optical Telescope Science Workshop*, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China; invited speaker

◆ 10–13 October 2016: *Dwarfs 2016,* European Southern Observatory, Garching, Germany; invited speaker, session chair

◆ 10–11 November 2016: *2016 KIAA/PKU Astrophysics Forum*, Beijing, China; invited speaker

◆ 28 November–2 December 2016: *China–South Africa*

*Bilateral Workshop*, South African Astronomical Observatory, Cape Town, South Africa; invited speaker

**Peng, Yingjie:**

◆ 7–9 March 2016: *Alvio Renzini's 75th Anniversary Meeting*, Nagano, Japan; invited speaker

◆ 4–8 July 2016: *European Week of Astronomy and Space Science 2016*, Athens, Greece; invited plenary speaker (MERAC prize lecture)

◆ 20–23 July 2016: *10th Jing–Guang–Xia Astrophysics workshop*, Xiamen (Fujian), China; invited speaker

◆ 19–23 September 2016: *The Changing Face of Galaxies,* Hobart (Tasmania), Australia; invited speaker

◆ 30 October–4 November 2016: *7th KIAS (Korea Institute for Advanced Study) workshop*, Republic of Korea; invited speaker

◆ 18–19 October 2016: *2016 Beijing Astronomical Society Forum for Young Astronomers*, Beijing, China; invited speaker

**Shangguan, Jinyi:**

◆ 20–23 July 2016: *10th Jing–Guang–Xia Astrophysics workshop*, Xiamen (Fujian), China

◆ 25–29 July 2016: *Interstellar Physics and Chemistry workshop*, Chengdu (Sichuan), China

◆ 22–24 September 2016: *East-Asian AGN workshop 2016*, Seoul, Republic of Korea

**Spurzem, Rainer:**

◆ 18–22 April 2016: C*OSMIC-LAB: Star Clusters as Cosmic Laboratories for Astrophysics*, Dynamics and Fundamental Physics (MODEST 16), Bologna, Italy; invited speaker

◆ 24–27 May 2016: *On the secular evolution of self-gravitating systems over cosmic age*, Paris, France; invited speaker

◆ 1–12 August 2016: *Astrophysics from LIGO's First Black Holes*, *Fast Response Program*, Kavli Institute for Theoretical Physics, Santa Barbara (CA), USA; invited participant/speaker

◆ 24–27 October 2016: *EANAM7 Computational Astrophysics*, National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China; invited speaker

**Subramanian, Smitha:**

◆ 9–13 May 2016: *Annual Meeting of Astronomical Society of India*, Srinagar, India

◆ 23–27 May 2016: *Astronomical Distance Determination in the Space Age*; invited speaker

◆ 28–30 June 2016: *VISTA Survey of the Magellanic Clouds annual meeting*, Keele University, UK; invited speaker

**Sun, Ning-Chen:**

◆ 28–30 June 2016: *VISTA Survey of the Magellanic Clouds annual meeting*, Keele University, UK; invited speaker

◆ 5–9 December 2016: *631. WE-Heraeus-Seminar on 'Stellar aggregates over mass and spatial scales'*; Bad Honnef, Germany

**Wang, Ran:**

◆ 27 June–1 July 2016: *Illuminating the Dark Ages*: *Quasars and Galaxies in the Reionization Epoch* (5th MPIA summer conference), Heidelberg, Germany

**Wu, Xinji:**

◆ 11–13 June 2016: *Xinjiang Astronomical Observatory–Peking*

*University Bilateral Astrophysics Workshop*, Urumqi (Xinjiang), China; invited speaker

◆ 20–23 July 2016: *10th Jing–Guang–Xia Astrophysics Meeting*, Xiamen, China; invited speaker

**Wu, Xue-Bing:**

◆ 9–10 May 2016: *2016 Beijing–Nanjing Bilateral Astrophysics Workshop*, Peking University, Beijing, China

◆ 10–12 May 2016: *International Symposium on Optoelectronic Technology and Applications* (Session 7), Beijing, China; invited speaker

◆ 18–19 May 2016: *Workshop on LAMOST Phase 2 Science*, Beijing, China

◆ 24–25 May 2016: *Xiangshan Meeting, China's large optical/near-IR telescope*, Nanjing, China; invited speaker

◆ 11–13 June 2016: *Xinjiang Astronomical Observatory–Peking University Bilateral Astrophysics Workshop*, Urumqi (Xinjiang), China

◆ 28–30 June 2016: *The extreme Universe: from compact objects to cosmology*, Hong Kong, China

◆ 4–7 July 2016: *19th CAS GuoShouJing Symposium on Galaxies and Cosmology*, Beijing, China

◆ 13–15 July 2016: *2016 LAMOST Users' Meeting,* Beijing, China; invited speaker

◆ 20–23 July 2016*: 10th Jing–Guang–Xia Astrophysics Meeting*, Xiamen, China

◆ 14–15 August 2016: *2016 workshop on 2m telescope operation*, Kunming, China; invited speaker

◆ 16–18 August 2016: *Frontiers in high energy astrophysics*, Yuxi, China

◆ 22–24 September 2016: *2016 East-Asian AGN workshop*, Seoul, Republic of Korea

◆ 27–30 September 2016: *10th East Asian Meeting on Astronomy*, Seoul, Republic of Korea; invited speaker

◆ 23–26 October 2016: *AGN reverberation mapping workshop*, Lijiang, China

◆ 1–3 November 2016: *2016 Annual Meeting of the Chinese Astronomical Society*, Wuhan, China

◆ 14–18 November 2016: *LIA Origins workshop*, *Probing baryons in the Universe*, Sèvres, France; invited speaker

◆ 21–26 November 2016: *South Africa–China bilateral workshop*, *Cosmology with large surveys*, Durban, South Africa; invited speaker

◆ 5–8 December 2016: *11th Sino–German Workshop on Galaxy Formation and Cosmology*, Guangzhou, China; invited speaker

**Xie, Yanxia:**

◆ 25–29 July 2016: *The Physics and Chemistry of the Interstellar Medium*, Chengdu (Sichuan), China

◆ 20–23 July 2016: *10th Jing–Guang–Xia Astrophysics Meeting*, Xiamen, China

◆ 1–3 November 2016: *2016 Annual Meeting of the Chinese Astronomical Society*, Wuhan, China

**Yao, Su:**

◆ 1–3 November 2016: *2016 Annual Meeting of the Chinese Astronomical Society*, Wuhan, China

**Yu, Qingjuan:**

◆ 7–12 February 2016: *Dynamics and Accretion at the Galactic*

*Center*, Aspen (CO), USA

◆ 11–13 April 2016: *Black Holes and Friends 2 workshop,* Shanghai, China; invited speaker

◆ 9–10 May 2016: *Beijing–Nanjing bilateral workshop in astrophysics*, KIAA Beijing, China; invited speaker

◆ 19 June–10 July 2016: *Emergence, Evolution and Effects of Black Holes in the Universe: The Next 50 Years of Black Hole Physics*, Aspen (CO), USA

◆ 20–23 July 2016: *10th Jing–Guang–Xia Astrophysics workshop*, Xiamen (Fujian), China; session chair

◆ 16–19 August 2016: *Runaway and Hypervelocity stars*, Bamberg, Germany; session chair

◆ 14–18 November 2016: *LIA Origins workshop: Probing Baryons in the Universe*, Sèvres, France

# Seminars and colloquia

### de Grijs, Richard:

◆ *February 2016*: University of Tokyo, Japan

◆ *March 2016*: University of Nevada at Las Vegas, Las Vegas (NV), USA

◆ *May 2016*: Tsinghua University/Institution of Engineering and Technology (IET) China, Beijing, China

◆ *July 2016*: (1) Bangor University, Wales, UK; (2) University of Heidelberg, Germany

◆ *September 2016*: Byurakan Astrophysical Observatory, Armenia

◆ *October 2016*: Purple Mountain Observatory, Nanjing, China

◆ *November 2016*: Mini workshop, Comparing PhD training in the Netherlands and China (keynote speaker), Netherlands embassy, Beijing, China

◆ *December 2016*: China West Normal University, Nanchong (Sichuan), China

### Dong, Subo:

◆ *January 2016*: (1) Universidad de Chile, Santiago, Chile; (2) Pontificia Universidad Católica de Chile, Santiago, Chile

◆ *February 2016*: (1) Department of Astrophysical Sciences, Princeton University, USA; (2) Institute for Advanced Study, Princeton, USA

◆ *April 2016*: University of Science and Technology of China, Hefei (Anhui), China

◆ *June 2016*: Center for Astrophysics, Tsinghua University, Beijing, China

◆ *December 2016*: South African Astronomical Observatory, Cape Town, South Africa

### Ho, Luis:

◆ *February 2016*: National Astronomical Observatory of Japan, Japan

◆ *March 2016*: (1) Tsinghua University, Beijing, China; (2) University of Science and Technology, Hefei (Anhui), China

◆ *May 2016*: Chinese University of Hong Kong, Hong Kong

### Jose, Jessy:

◆ *January 2016*: SN Bose Center for Basic Sciences, Kolkata, India

◆ *October 2016*: (1) National Central University, Taipei, Taiwan; (2) National Astronomical Research Institute of Thailand,

Chiangmai, Thailand

**Kim, Yonghwi:**

◆ *June 2016*: Seoul National University, Seoul, Republic of Korea

◆ *December 2016*: Korea Institute for Advanced Study (KIAS), Seoul, Republic of Korea

**Kolodzig, Alexander:**

◆ *March 2016*: European Southern Observatory, Garching, Germany

◆ *December 2016*: (1) Max-Planck-Institutfür Astrophysik, Garching, Germany; (2) Leibniz Astrophysical Institute Postdam, Germany

**Kouwenhoven, M.B.N.:**

◆ *June 2016*: (1) Yunnan Astronomical Observatories, Chinese Academy of Sciences, Kunming, China; (2) South University of Science and Technology of China, Shenzhen, China

**Li, Li-Xin:**

◆ *July 2016*: Institute of High Energy Physics, Chinese Academy of Sciences, Beijing, China

**Li, Zhuo:**

◆ *May 2016*: University of Science and Technology of China, Hefei (Anhui), China

**Liu, Xiangkun:**

◆ *May 2016*: Observatoire de Sauverny, Switzerland

◆ *October 2016*: Yunnan University, Kunming (Yunnan), China

**Peng, Eric:**

◆ *January 2016*: (1) Universidad de Chile, Santiago, Chile; (2) Universidad de Concepción, Concepción, Chile; (3) Pontificia Universidad Católica, Santiago, Chile

◆ *March 2016*: University of California, Santa Cruz, USA

◆ *June 2016*: Shanghai Jiaotong University, Shanghai, China

**Peng, Yingjie:**

◆ *March 2016*: National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China

◆ *June 2016*: Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing, China

◆ *December 2016*: (1) Tsinghua Center for Astrophysics, Beijing, China; (2)University of Science and Technology of China, Hefei, China

**Subramanian, Smitha:**

◆ *July 2016*: Astronomisches Rechen-Institut, University of Heidelberg, Germany

**Wu, Xue-Bing:**

◆ *April 2016*: MBA science lecture series, GuangHua School of Management, Peking University, Beijing, China

◆ *November 2016*: South African Astronomical Observatory, Cape Town, South Africa

# Student highlights 2016

### Chen, Xiaodian:

◆ PhD thesis, *Open cluster variables as distance tracers*; defended successfully on 7 June 2016. Supervisors: **de Grijs, Richard;** Deng, Licai (National Astronomical Observatories, Chinese Academy of Sciences; NAOC)

◆ Destination: Postdoctoral researcher, NAOC

*Associated papers:*

◆ **Chen X., de Grijs R.**, Deng L., 2017, New open cluster Cepheids in the VVV survey tightly constrain near-infrared period–luminosity relations, MNRAS, 464, 1119

◆ **Chen X., de Grijs R.**, Deng L., 2016, Contact Binaries as Viable Distance Indicators: New, Competitive *(V) JHK*$_s$ Period-Luminosity Relations, ApJ, in press (arXiv:1609.02267)

◆ **Chen X.**, Deng L., **de Grijs R.**, Zhang X.B., Xin Y., Wang K., Luo C.Q., Yan Z.Z., Tian J.F., Sun J.J., Liu Q., Zhou Q., Luo Z.Q., 2016, Physical parameter study of eight W Ursae Majoris-type contact binaries in NGC 188, AJ, 152, 129

◆ **Chen X., de Grijs R.**, Deng L., 2015, A search for open cluster Cepheids in the Galactic plane, MNRAS, 446, 1268

### Wang, Long:

◆ PhD thesis, *Long-term dynamical evolution of globular clusters*; defended successfully on 17 May 2016. Supervisors: **Kouwenhoven, M.B.N.; Spurzem, Rainer**

◆ Destination: Postdoctoral researcher, RIKEN, Japan

*Associated papers:*

◆ **Wang L., Spurzem R.**, Aarseth S., Giersz M., Askar A., Berczik P., Naab T., Schadow R., **Kouwenhoven M.B.N.**, 2016, The DRAGON simulations: globular cluster evolution with a million stars, MNRAS, 458, 1450

◆ **Zheng X.C., Kouwenhoven M.B.N.**, **Wang L.**, 2015, The dynamical fate of planetary systems in young star clusters, MNRAS, 453, 2759

◆ **Wang L., Spurzem R.**, Aarseth S., Nitadori K., Berczik P., **Kouwenhoven M.B.N.**, NaabT., 2015, NBODY6++GPU: Ready for the gravitational million-body problem, MNRAS, 450, 4070

◆ **Wang L., Kouwenhoven M.B.N., Zheng X.C.**, Church R.P., Davies M.B., 2015, Close encounters involving free-floating planets in star clusters, MNRAS, 449, 3545

◆ **Wang L.**, Berczik P., **Spurzem R., Kouwenhoven M.B.N.**, 2014, The Link Between Ejected Stars, Hardening and Eccentricity Growth of Super Massive Black Holes in Galactic Nuclei, ApJ, 780, 164

### Xu, Cai:

◆ PhD thesis, *Dynamical Evolution of Planetary Systems in Star Clusters*; defended successfully at NAOC on 17 May 2016. Supervisors: **Spurzem, Rainer; Kouwenhoven, M.B.N.**

◆ Destination: Postdoctoral researcher, Leiden University, Netherlands

*Associated papers:*

◆ Cai M., **Meiron Y., Kouwenhoven M.B.N.**, Assman P., **Spurzem R.**, 2015, Block Time Step Storage Scheme for Astrophysical *N*-body Simulations, ApJS, 219, 31

**Zhang, Congyao:**

◆ PhD thesis, *Mergers of galaxy clusters and their implications in structure formation*; defended successfully on 8 June 2016. Supervisor: **Yu, Qingjuan**

◆ Awarded an *Outstanding PhD Dissertation Prize* by Peking University

◆ Destination: Postdoctoral researcher, Max-Planck Institute for Astrophysics, Garching, Germany

*Associated paper:*

◆ **Zhang C., Yu Q.**, Lu Y., 2016, A Baryonic effect on the merger timescale of galaxy clusters, ApJ, 820, 85

# Peking University Youth Astronomy Society: Achievements in 2016

1. **Spring Recruitment** took place between 11 and 13 March 2016. More than 80 new members were recruited.
2. **Spring Stargazing Event**. On 1 May 2016, 63 students went to Gubeikou town to observe celestial spring-time objects.
3. **Visiting the Ancient Observatory with the Star Moon Sky Astronomy Society of RUC**. 15 students from both schools attended this activity on 14 May 2016.
4. **A public Lecture of Prof. Edward C. Stone** was held on 6 June 2016. The YAS helped publicize the event in advance and arranged the lecture hall. The topic of the lecture was "Voyager in Interstellar Space and The Universe in High Definition," and it attracted a full house of eager audience.
5. **Observation in Gubeikou.** 6 YAS core members conducted visual observations on 1 July 2016.
6. **Social Practice during the summer vacation**. From 2 to 10 August 2016, a group of 9 students travelled to south-west China and visited several major astronomical sites including the Five-hundred-meter Aperture Spherical radio Telescope and the Gaomeigu observation site.
7. **Mid-autumn Festival Celebration**. More than 100 students joined us on the Jingyuan lawn to admire the full moon and its craters.
8. **Autumn Recruitment**. The YAS presented itself on the campus and recruited 210 new members between 23 and 25 September 2016. Part of the event was broadcast live online.
9. **Observations with the Tsinghua Astronomy Society**. From 1 to 3 October 2016, 6 students from both the YAS and TAS headed to Shangdu Lake in Inner Mongolia, observing, communicating, and exchanging ideas and experiences.
10. **Autumn Stargazing Event**. On 5 October 2016, 52 students went to Gubeikou town to appreciate the autumn's starry night.

11. **Observation on Mount Dongling.** 5 YAS core members drove to Mount Dongling on 8 October 2016 and observed deep-sky objects and took astronomical photographs.
12. **Sunspot observations organized with the SESS student union** took place on the afternoon of 23 October 2016 on the Jingyuan lawn and attracted more than 30 students.
13. **Visiting Beijing Planetarium with the Star Moon Sky Astronomy Society of the RUC.** 28 students went there on 20 November 2016 and watched two dome films.


# Peking University astronomy summer camp

The Astronomy Summer Camp aims to familiarize middle-school students with astronomy in general and with the research fields pursued at Peking University in particular. Another important aim is to select excellent students to join us, trying to cultivate their interests in exploring the Universe and trigger their enthusiasm to study astronomy and astrophysics. This activity is mainly targeted at high-school sophomores in China. Since 2008, we have successfully held nine summer camps in collaboration with the National Astronomical Observatories of the Chinese Academy of Sciences (NAOC), Beijing Planetarium, and Beijing Normal University. Increasing numbers of applications are received every year. Thus, the summer camp is an important channel for PKU Astronomy to attract excellent students.

In 2016, 112 of 970 applicants from all over the country were selected to attend the summer camp, which was held from 28 to 31 July 2016. Most activities were held at the KIAA. Through

subject navigation, lectures, mutual activities, a visit to Xinglong Observatory & examination, and interviews, the summer camp provides an opportunity for high-school students to become familiar with astronomy as a science, and it offers a good platform for them to understand the Universe and to communicate with each other.

Twelve middle-school teachers from 10 famous high schools attend the summer camp. We hope that by inviting more high school teachers to participate in the summer camp, increasing numbers of high-school students will get to know and like astronomy through their teachers' enthusiasm.

# Visitors hosted in 2016

## The Kavli Visiting Scholars programme

The Kavli Institute for Astronomy and Astrophysics (KIAA) has initiated the *Kavli Visiting Scholars* programme. The programme supports astrophysicists from across the Kavli network to spend a meaningful period of time (2 to 4 weeks) in residence at the KIAA on the campus of Peking University (PKU). During the visit, the Kavli Visiting Scholar is expected to give a KIAA/PKU colloquium and he or she is encouraged to participate in various formal and informal activities to facilitate interaction with members and students at the KIAA and the PKU Department of Astronomy. The *Kavli Visiting Scholars* programme is part of an effort to stimulate scientific interactions, broaden the scientific horizons of KIAA members, and potentially foster new collaborations.

## Individual visitors to the Kavli Institute for Astronomy and Astrophysics and the Department of Astronomy at Peking University, 2016.

*(Research interests are indicated for those visitors who stayed for longer than one day and for collaborative purposes.)*

- 5 January 2016: **Weiguang Cui** (ICRAR, University of Western Australia, Australia)
  - Host: Luis Ho
  - *Research interests*: Numerical simulations, large-scale structure, galaxy clusters
- 8–9 January 2016**: Erwin Lau** (Yale University, USA)
  - Host: Luis Ho
  - *Research interests*: Galaxy clusters, cosmology, numerical simulations
- 11 January 2016: **Dong Lai** (Cornell University, USA)
  - Host: Luis Ho
  - *Research interests*: Theoretical astrophysics: exoplanets, compact objects
- 11–15 January 2016: **Chengyuan Li** (Macquarie University, Australia)
  - Host: Richard de Grijs
  - *Research interests*: Stellar populations in star clusters
- 3–9 March 2016: **Yifu Cai** (University of Science and Technology of China, Hefei, China)
  - Host: Li Zhuo
  - *Research interests*: Bouncing cosmology, inflation in string theory, dark energy, cyclic Universe, cosmic strings, black hole physics
- 20–23 March 2016: **Li Yun** (Shanghai Jiaotong University,

China)
- o Host: Thijs Kouwenhoven
- o *Research interests*: Galaxy evolution, star formation, low-mass stars and brown dwarfs, stellar dynamics

◆ 14 January–31 March 2016: **Jonas Sommer** (Ludwig-Maximilians University, Munich, Germany)
- o Host: Thijs Kouwenhoven
- o *Research interests*: Star cluster dynamics, stellar populations

◆ 30 March–6 April 2016: **Alain Omont** (Institut d'Astrophysique de Paris, Université Pierre et Marie Curie and CNRS, France)
- o Host: Ran Wang
- o *Research interests*: High-redshift dust and molecules, star formation and evolution of high-redshift galaxies and QSOs

◆ 6–8 April 2016: **Juntai Shen** (Shanghai Astronomical Observatory, China)
- o Host: Yingjie Peng
- o *Research interests*: Galactic dynamics, supermassive black holes

◆ 7–17 April 2016: **Evan Kirby** (California Institute of Technology, USA)
- o Host: Luis Ho, Eric Peng
- o *Research interests*: Galaxy evolution, dwarf galaxies, stellar abundances, instrumentation

◆ 21–24 April 2016: **Lei Hao** (Shanghai Astronomical Observatory, China)
- o Host: Yingjie Peng
- o *Research interests*: AGN, starbursts, dwarf galaxies, high-redshift Lyα emission-line galaxies

◆ 12 April–12 May 2016: **Katelyn Allers** (Bucknell University, USA)
- o Host: Gregory Herczeg
- o *Research interests*: Directly imaged exoplanets, brown dwarfs, young stars, infrared spectroscopy

◆ 14 April–14 May 2016: **Yujing Qin** (Shanghai Astronomical Observatory, China)
- o Host: Luis Ho
- o *Research interests*: Interpretation of galaxy morphology based on orbital dynamics, spontaneous modeling of galactic structures and stellar populations

◆ 29 April 2016: **Bozena Czerny** (Nicolaus Copernicus Institute, Poland)
- o Host: Richard de Grijs
- o *Research interests*: AGN

◆ 9–15 May 2016: **Ruobing Dong** (Lawrence Berkeley National Laboratory, USA)
- o Host: Luis Ho
- o *Research interests*: Extrasolar planets; specifically, how to connect the theories of planet formation with observations of protoplanetary disks.

◆ 18 May 2016: **Ezequiel Treister** (Pontificia Universidad Católica de Chile, Chile)
- o Host: Luis Ho
- o *Research interests*: AGN, galaxy formation and evolution, black holes

◆ 18–22 May 2016: **Christopher Sneden** (University of Texas at Austin, USA)
- o Host: Richard de Grijs
- o *Research interests*: The chemical compositions of stars based on spectroscopic studies

◆ 3–24 May 2016: **Keiichi Umetsu** (Academia Sinica Institute of Astronomy and Astrophysics, Taiwan)

- o Host: Zuhui Fan
- o *Research interests*: Gravitational lensing, observational cosmology, galaxy clusters, cosmic structure formation

◆ 20–27 May 2016: **Tsevi Mazeh** (Tel Aviv University, Israel)
- o Host: Subo Dong
- o *Research interests*: Extrasolar planets, transiting extrasolar planets, binaries, eclipsing binaries, dynamics, data analysis and algorithms, analysis of photometric and spectroscopic data

◆ 20–27 May 2016: **Simchon Faigle** (Tel Aviv University, Israel)
- o Host: Subo Dong

◆ 21 May–6 June 2016: **Dimitris Stamatellos** (University of Central Lancashire, UK)
- o Host: Thijs Kouwenhoven
- o *Research interests*: Star formation, exoplanets, brown dwarfs, low-mass stars, protoplanetary disks, binary stars, gravitational instabilities, computational hydrodynamics, radiative transfer

◆ 8 June 2016: **Claire Max** (University of California, Santa Cruz, USA)
- o Host: Luis Ho
- o *Research interests*: Adaptive optics and its applications to galaxies and AGN

◆ 8–13 June 2016: **Ian Philip Czekala** (Harvard University, USA)
- o Host: Gregory Herzceg

◆ 13 June 2016: **Tsvi Piran** (Hebrew University of Jerusalem, Israel)
- o Host: Lixin Li
- o *Research interests*: Relativistic astrophysics, the link between astrophysics and fundamental theories: relativity and high-energy physics

◆ 16 June 2016: **Jian Ge** (University of Florida, USA)
- o Host: Luis C. Ho

◆ 21–23 June 2016: **Thomas Tom** (Sun Yat-Sen University, Guangzhou, China)
- o Host: Zhuo Li
- o *Research interests*: High-energy astrophysics, gamma-ray astronomy, neutron stars, millisecond pulsars, X-ray binaries, gamma-ray bursts

◆ 2–13 July 2016: **Kohta Murase** (Pennsylvania State University, USA)
- o Host: Zhuo Li
- o *Research interests*: High-energy astrophysics (multi-messenger studies of extreme astrophysical objects), particle astrophysics and cosmology (neutrinos, gamma rays, cosmic rays, dark matter)

◆ 25 July 2016: **Li Zeng** (Harvard University, USA)
- o Host: Luis Ho
- o *Research interests*: Planet formation, high-energy astrophysics, computational astrophysics

◆ 21 July–8 August 2016**: Pau Amaro-Seoane** (Max-Planck Institute for Gravitational Physics, Germany)
- o Host: Rainer Spurzem
- o *Research interests*: Stellar dynamics, LIGO/Virgo/LISA black holes, data analysis and gravitational-wave search algorithms, planetesimal dynamics, scalar fields and collisional dark matter, GPU computing

◆ 10 July–10 August 2016: **Aigen Li** (University of Missouri, USA)
- o Host: Ran Wang

- *Research interests*: Physics and chemistry of the interstellar medium and interstellar dust, comets, planet-forming dust disks, dust-producing evolved stars, external galaxies, active galactic nuclei, gamma-ray bursts.

◆ 29 August–3 September 2016: **Martin Haehnelt** (Cambridge University, UK)
- Host: Qingjuan Yu
- *Research interests*: Formation of galaxies and their central supermassive black holes, intergalactic medium and QSO absorption lines, reionization, large-scale structure, observational cosmology

◆ 21–27 September 2016: **Garrett Somers** (Vanderbilt University, USA)
- Host: Gregory Herczeg
- *Research interests*: Evolution of rotation, magnetic activity, chemical abundances, and other physical phenomenon during the life cycles of stars

◆ 2–25 October 2016: **Chengyuan Li** (Macquarie University, Australia)
- Host: Richard de Grijs
- *Research interests*: Stellar populations in star clusters

◆ 26 October–23 December 2016: **Matthias Kühtreiber** (Vienna University, Austria)
- Host: Rainer Spurzem
- *Research interests*: Chemo-dynamical evolution of dwarf galaxies, dark matter, numerical simulations.

◆ 27 October 2016: **Fupeng Zhang** (Sun Yat-Sen University, Guangzhou, China)
- Host: Qingjuan Yu
- *Research interests*: Supermassive black holes, general relativity, active galactic nuclei

◆ 7–15 November 2016: **Matt Johns** (Mirror Laboratory, Steward Observatory, University of Arizona, USA)
- Host: Luis Ho

◆ 23 November 2016: **Ying Zu** (The Ohio State University, USA)
- Host: Subo Dong
- *Research interests*: Cosmology, quasars, galaxies

◆ 23–25 November 2016: **Xueying Zheng** (Nanjing University, China)
- Host: Eric Peng
- *Research interests*: Cosmic rays, magnetic fields

◆ 7–9 December 2016: **Pengfei Chen** (Nanjing University, China)
- Host: Zhuo Li
- *Research interests*: MHD numerical simulations of solar and space plasmas, multi-wavelength observations of solar activities, space weather, planetary science, application of magnetic reconnection in astrophysics

◆ 11–16 December 2016: **Minjin Kim** (Korea Astronomy and Space Science Institute, Republic of Korea)
- Host: Luis Ho
- *Research interests*: Coevolution of galaxies and black holes

◆ 11–16 December 2016: **Taehyun Kim** (Korea Astronomy and Space Science Institute, Republic of Korea)
- Host: Luis Ho
- *Research interests*: Galaxy evolution, stellar structures of galaxies

◆ 11–16 December 2016: **Soojong Pak** (Kyung Hee University, Republic of Korea)
- Host: Luis Ho
- *Research interests*: Optical and infrared spectroscopy, star formation, central regions of galaxies

# Wider engagement

## The Kavli Visiting Scholarsprogramme

*Many Peking University astrophysicists engage in external outreach and education efforts. Here are the year's main highlights.*

**de Grijs, Richard:**

- *3 February 2016: Blog post*: Bringing physics to the migrant children of China, de Grijs R., Institute of Physics/IOP Life blog; http://www.iopblog.org/bringing-physics-to-the-migrant-children-of-china/
- *June 2016: Book Review*: China's tunnel vision, de Grijs R., *Physics World*, p. 38; review of *From the Great Wall to the Great Collider* (Steve Nadis and Shing-Tung Yau); also published in *Physics World* special issue on China (September 2016)
- *April–May 2016* and *October–November 2016*: *Facilitator/ Senior Facilitator*, *"AuthorAID Online Course in Research Writing"*, a 6-week course for early-stage researchers from developing countries, covering all aspects of writing research papers for publication in peer-reviewed journals. Enrolment: ~2000–2500; awarded a *Star Guest Facilitator* badge
- *May 2016*: Reproducibility in research: How a small field is pioneering a culture of sharing, de Grijs R., 2016, *The Winnower*, 3:e146449.94380; doi:10.15200/winn.146449.94380
- *25 June 2015*: *Keynote speaker*, Orange Tulip Scholarships award ceremony, embassy of the Kingdom of the Netherlands to China, Beijing
- *August 2016*: Taking your Science to 'the Public': Meaningful Engagement with a General Audience, de Grijs R., Na J., 2016, *The Winnower*, 3: e147079.95728; doi:10.15200/winn.147079.95728
- *26 August 2016: Blog post*: First steps taken towards degree-level astrophysics programme in Mongolia, de Grijs R., Institute of Physics/IOP Life blog; http://www.iopblog.org/first-steps-taken-towards-degree-level-astrophysics-programme-in-mongolia/
- *21 October 2016*: Schools lecture, Beijing No. 35 high school
- *18 November 2016*: Keynote lecture, PhD workshop, embassy of the Kingdom of the Netherlands to China, Beijing
- *30 November 2016*: Official release of an NSFC-funded extended TV documentary about Chinese astronomy throughout the ages: "*Science of Heaven*" ( 中国天文 ): http://china.nlembassy.org/news/2016/12/dutch-professor-and-movie-director-produce-documentary-about-chinese-astronomy.html; *Physics World blog:* http://blog.physicsworld.com/2016/12/19/the-science-of-heaven/
- *December 2016*: Optics sharpen telescope view, de Grijs R., 2016, *Physics World*, December issue; specially commissioned article about the Thirty Meter Telescope's adaptive optics system: http://live.iop-pp01.agh.sleek.net/2016/11/20/optics-sharpen-telescope-view/pugpig_index.html
- *7 December 2016*: Public talk, European Union Science Counsellors meeting
- *December 2016:*

o China's research regulators step up efforts:
http://www.china.org.cn/opinion/2016-12/25/content_39980170.htm
o China's potential as a mature spacefaring nation:
http://www.china.org.cn/opinion/2016-12/29/content_40005623.htm

- Joint organizer, monthly science cafés in English ("Understanding Science")

**Thijs Kouwenhoven** and **Richard de Grijs** alternate monthly to contribute feature articles to *The Amateur Astronomer*. Features published in 2016 with PKU affiliation:

- *January*: New developments offer a boost to extragalactic distance determination (**de Grijs, Richard**)
- *February*: (1) The missing planet in the Alpha Centauri System (**Kouwenhoven, M.B.N.**); (2) The human face of early modern astronomy in China (**de Grijs, Richard**)
- *March*: Spinning stars giving up their secrets (**de Grijs, Richard**)
- *April*: The Chelyabinsk asteroid impact, three years after (**Kouwenhoven, M.B.N.**)
- *May*: A stellar treasure chest of gold and other heavy elements (**de Grijs, Richard**)
- *June*: Discovering evidence of supernova explosions on the ocean floor (**Kouwenhoven, M.B.N.**)
- *July*: Supernovae and gravitational lensing: A match made in heaven! (**de Grijs, Richard**)
- *August*: Makemake's Moon: the discovery of a new ice world in our Solar system (**Kouwenhoven, M.B.N.**)
- *September*: Visualizing dark energy (**de Grijs, Richard**)
- *November*: The star that didn't blow up after all (**de Grijs, Richard**)

Coordinated by KIAA faculty member **Richard de Grijs** and in association with the Migrant Children's Foundation, Peking University undergraduate and graduate students reach out to children in migrant communities on a monthly basis, offering one-day hands-on physics classes.

**Kouwenhoven, M.B.N.:**

- *16 January 2016*: Public lecture, *Climate change on planet Earth: the impact of astrophysical processes*, Beijing Planetarium
- *11–18 July 2016*: Lecturing at a Peking University summer school for outstanding college students on *Astrophysics and cosmology*; Extrasolar planets

**Wu, Xinji:**

- *June and September 2016*: Public lectures, *Chinese Space Dream*, Xinjiang Astronomical Observatory
- *July 2016*: Public lecture, *Sun, Moon and Stars*, Guanghua summer school at Peking University
- *November 2016*: Public lecture, *Chinese Space Dream*, Anhui Qianxian High School
- *November 2016*: Public lecture, *Chinese Space Dream*, Shanghai Astronomical Observatory

In May 2016, **Xinji Wu** (Peking University) and Xueshi Wen (Beijing Planetarium) published a book "Observing the universe from the space – Space Astronomy".

**Wu, Xue-Bing:**

- *24 April 2016*: Lecturing on *Supermassive black holes in the early Universe*, Astronomy Popularization Events, Beijing Normal University
- *18 July 2016*: Frontiers lecture, Peking University summer school on *Astrophysics and Cosmology*, Beijing, China
- *20 September 2016*: Lecturing at the *2016 NAOC Observational Astrophysics Summer School* (20–24 September 2016), Beijing, China

# The Peking University astronomy "family"

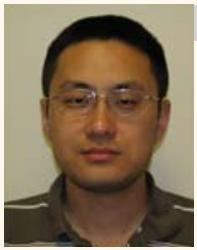
## KIAA Faculty

### Chen, Jiansheng, ( 陈建生 )

coordinator, professor, joint appointment with the PKU Department of Astronomy
**Research interests**:
wide-field astronomy, quasar surveys, large-scale structure of the Universe, galaxy formation and evolution

### de Grijs, Richard ( 何锐思 )

professor
**Research interests**:
young massive star clusters, internal star cluster dynamics, distance determination in astronomy



### Dong, Subo( 东苏勃 )

youth Qianren research professor
**Research interests**:
Extrasolar planets, gravitational microlensing, dynamics, Type Ia supernovae, time-domain astronomy

### Fan, Xiaohui( 樊晓晖 )

visiting chair professor (Qianren B)
**Research interests**:
first light and reionization, surveys of high-redshift galaxies and quasars, supermassive black holes, intergalactic medium

### Herczeg, Gregory J. ( 沈雷歌 )

youth Qianren research professor
**Research interests**:
accretion onto young stars, disk dissipation mechanisms and disk structure, observational diagnostics of wind-launching mechanisms, pre-main sequence stellar evolution, chromospheric and coronal activity around dwarf stars

### Ho, Luis C. ( 何子山 )

director, university chair professor
**Research interests**:
processes in galactic nuclei, accretion disks and jets, massive black holes, origin of the Hubble sequence, extragalactic star formation, star clusters, interstellar medium

### Jiang, Linhua ( 江林华 )

youth Qianren research professor
**Research interests**:
Extragalactic astronomy and cosmology, high-redshift quasars/active galactic nuclei and supermassive black holes, high-redshift galaxies, cosmic reionization

### Kouwenhoven, M.B.N. (Thijs; 柯文采 )

Bairen research professor (until August 2016)
**Research interests**:
formation and evolution of binary and multiple stellar systems, dynamics of planetary systems, star formation, N-body simulations, the initial mass function

### Lee, Kejia( 李柯伽 )

youth Qianren research professor
**Research interests**:
pulsars, gravitational waves

### Li, Li–Xin ( 李立新 )

professor
**Research interests**:
black hole physics, accretion disks, X-ray binaries and quasi-periodic oscillations, gamma-ray bursts and supernovae, active galactic nuclei and jets, cosmology, gravitational lensing, dark matter and dark energy, brane world and extra dimensions

### Peng, Yingjie( 彭影杰 )

assistant professor
**Research interests**:
observational cosmology, galaxy formation and evolution

### Wang, Ran ( 王然 )

youth Qianren research professor
**Research interests**:
formation and co-evolution of supermassive black holes and their host galaxies in the early Universe

### Wu, Xue–Bing ( 吴学兵 )

professor, associate director
**Research interests**:
quasars and active galactic nuclei, supermassive black holes, accretion physics, X-ray binaries

### Yu, Qingjuan( 于清娟 )

professor
**Research interests**:
black hole physics, planetary and stellar dynamics, galaxy formation and evolution, galactic nuclei, and cosmology

# Joint KIAA/Department of Astronomy (DoA) Faculty

## Chen, Xian( 陈弦 )

Assistant Professor
**Research interests**:
dynamics and radiation processes in the vicinity of black holes, Galactic Center dynamics, gravitational-wave astrophysics

## Fan, Zuhui( 范祖辉 )

professor, associate director of the DoA
**Research interests**:
cosmology, gravitational lensing, clusters of galaxies, galactic dynamics

## Li, Zhuo( 黎卓 )

Bairen research professor
**Research interests**:
gamma-ray bursts and supernovae, high-energy cosmic rays and neutrinos, relativistic collisionless shocks

## Liu, Fukun( 刘富坤 )

professor, director of the DoA
**Research interests**:
supermassive black hole binaries, accretion disks and active galactic nuclei

## Liu, Xiao–Wei ( 刘晓为 )

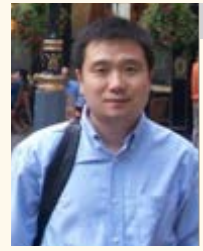
professor
**Research interests**:
wide-field astronomy, spectroscopy, Galactic archeology and near-field cosmology, interstellar medium, atomic and molecular processes, radiation mechanisms

## Peng, Eric W. ( 彭逸西 )

associate professor
**Research interests**:
galaxy formation and evolution, stellar populations, galaxy dynamics, globular cluster systems

### Xu, Renxin( 徐仁新 )

professor
**Research interests**:
particle astrophysics, pulsars, quark stars, neutron stars



### Zhang, Bing ( 张冰 )

Chang Jiang visiting chair professor
**Research interests**:
high-energy astrophysics, gamma-ray bursts and relativistic jets, black holes, neutron stars, multi-messenger astrophysics

### Zhang, Hua–Wei ( 张华伟 )

associate professor
**Research interests**:
stellar abundances, Galactic structure

## Joint KIAA/NAOC Faculty

### Spurzem, Rainer

professor
**Research interests**:
modeling dense stellar systems, galactic nuclei with black holes, relativistic dynamics, N-body simulations, parallel many-core and accelerated computing

# Postdoctoral Researchers

## Bose, Subhash

KIAA Postdoc

**Research interests**:

Supernovae, supernova distance scale, supernova-CSM interaction

## Gully-Santiago, Michael Anthony

KIAA Postdoc (until September 2016)

**Research interests**:

optical/near-infrared identification, spectral modeling, and characterization of young and low mass stars

## Guo, Jincheng ( 郭金承 )

DOA Postdoc

**Research interests**:

Multi-wavelength observations of compact objects, white dwarfs, debris disks, black holes, soft X-ray sources, structure and evolution of the Milky Way

## Hong, Jongsuk:

KIAA Fellow

**Research interests**:

Stellar dynamics, globular clusters, multiple populations, gravitational waves, numerical simulations

## Chen, Bingqiu ( 陈丙秋 )

DoA Postdoc

**Research interests**:

three-dimensional extinction maps; dust, interstellar medium, structure of the Milky Way; pulsating stars; photometric/spectroscopic surveys

## Guo, Kexin( 郭可欣 )

KIAA Postdoc

**Research interests**:

galaxy formation and evolution

## Hayashi, Kohei

KIAA Fellow

**Research interests**:

Dark matter distribution of dwarf spheroidal galaxies, formation history of the Milky Way and its satellites, Galactic archaeology, numerical simulations

## Huang, Yang ( 黄样 )

DoA postdoc, LAMOST Fellow

**Research interests**:

large-scale spectroscopic surveys, Galactic dynamics, stellar populations, stellar physics, AGN

### Jose, Jessy

KIAA Postdoc

**Research interests**:

Galactic HII regions, embedded star clusters, triggered star formation, young stellar objects

### Kim, Yonghwi

KIAA Fellow

**Research interests**:

galaxy formation and evolution, gas dynamics in disk galaxies and galaxy clusters, instability

### Kolodzig, Alexander

KIAA Fellow

**Research interests**:

large-scale structure studies with active galactic nuclei, angular correlation studies of the cosmic X-ray background with Chandra and XMM–Newton surveys, and related topics

### Lim, Sungsoon

DoA Postdoc

**Research interests**:

galaxy formation and evolution, starburst galaxies, star clusters, globular cluster systems, ultra-compact dwarf galaxies

### Liu, Xiangkun ( 刘项琨 )

DoAPostdoc

**Research interests**:

cosmology, weak gravitational lensing, large-scale structure, numerical simulations

### Longobardi, Alessia

KIAA Fellow

**Research interests**:

ormation and evolution of extended halos around galaxies in galaxies cluster, age, metallicity, and IMF studies

### Pattarakijwanich, Petchara

KIAA Fellow

**Research interests**:

Multi-wavelength modeling of stellar populations inSDSS galaxies, post-starburst quasars and their role in star-formation quenching

### Subramanian Hari Sharma, Smitha

KIAA Fellow

**Research interests**:

AGN and black hole masses in void galaxies, the structure of the Magellanic Clouds, Generation of the near-infrared guide-star catalog for Thirty Meter Telescope observations

## Tian, Zhijia ( 田志佳 )

DoAPostdoc

**Research interests**:

stellar structure and evolution; stellar oscillations; stellar populations synthesis

## Wang, Shu( 王舒 )

KIAA Fellow

**Research interests**:

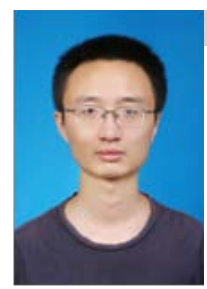
Interstellar UV, optical, IR extinction law and its variation with environments, "Anomalous" extinction and dust properties, Interstellar grain models, PAHs, sub-millimeter excess of dwarf galaxies

## Xie, Yanxia ( 谢艳霞 )

KIAA Postdoc

**Research interests**:

infrared properties and dust content in active galaxies



## Yang, Yuanpei ( 杨元培 )

KIAA–CAS Fellow

**Research interests**:

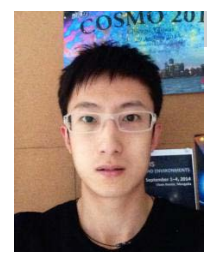
high-energy astrophysics, neutron stars, magnetars, fast radio bursts, gamma-ray bursts, electromagnetic counterparts of gravitational wave sources.

## Yao, Su ( 姚苏 )

KIAA–CAS Fellow

**Research interests**:

high-energy astrophysics, neutron stars, magnetars, fast radio bursts, gamma-ray bursts, electromagnetic counterparts of gravitational wave sources.



## Yu, Hao–Ran ( 于浩然 )

KIAA–CITA Joint Postdoctoral Fellow

**Research interests**:

cosmology, large-scale structure, weak gravitational lensing, N-body simulations, supercomputing

# Graduate students (December 2016)

- **Cao, Chunyang; 曹春洋** (class of 2016)
- **Cao, Rong; 曹荣** (class of 2013)
  PhD supervisor: Liu, Fukun
- **Chen, Ping; 陈平** (class of 2015)
  PhD supervisor: Dong, Subo
- **Chen, Yunfeng; 陈云峰** (class of 2012)
  PhD supervisor: Yu, Qingjuan
- **Dou, Jing; 窦晶** (class of 2015)
  PhD supervisor: Peng, Yingjie
- **Feng, Xiaotong; 冯晓曈** (class of 2016)
- **Fu, Yuming; 傅煜铭** (class of 2016)
- **Gao, Hua; 高桦** (class of 2013)
  PhD supervisor: Luis Ho
- **Guo, Yanjun; 郭彦君** (class of 2014)
  PhD supervisor: Xu,Renxin
- **Guo,Yucheng; 郭昱程** (class of 2015)
  PhD supervisor: Jiang, Linhua
- **Guo, Zen; 郭震** (class of 2012)
  PhD supervisor: Gregory Herczeg
- **Huang, Tianqi; 黄天奇** (class of 2016)
- **Huang, Yan; 黄艳** (class of 2015)
  PhD supervisor: Li, Zhuo
- **Li,Jia-nan; 李佳男** (class of 2015)
  PhD supervisor: Wang, Ran
- **Li, Qiong; 李琼** (class of 2014)
  PhD supervisor: Wang, Ran
- **Liu, Dezi; 刘德子** (class of 2012)
  PhD supervisor: Fan, Zuhui
- **Liu,Xunchuan; 刘训川** (class of 2015)
- **Liu, Yiqing; 刘逸清** (class of 2011)
  PhD supervisor: Eric Peng
- **Long, Feng; 龙凤** (class of 2013)
  PhD supervisor: Gregory Herczeg
- **Lu, Jiguang; 卢吉光** (class of 2012)
  PhD supervisor: Xu, Renxin
- **Luo, Rui; 罗睿** (class of 2013)
  PhD supervisor: Lee, Kejia
- **Ma, Chao; 马超** (class of 2013)
  PhD supervisors: Richard de Grijs, Luis Ho
- **Ma, Qinchun; 马芹春** (class of 2015)
  PhD supervisor: Wu, Xuebing
- **Man, Zhongyi; 满中意** (class of 2015)
  PhD supervisor: Peng,Yingjie
- **Men, Yunpeng; 门云鹏** (class of 2014)
  PhD supervisor: Xu,Renxin
- **Ning, Yuanhang; 宁远航** (class of 2016)
- **Ren,Fangzhou; 任方舟** (class of 2015)
  PhD supervisor: Richard de Grijs
- **Shangguan, Jinyi; 上官晋沂** (class of 2012)
  PhD supervisor: Luis Ho

- **Shao, Yali; 邵亚莉** (class of 2013)
  PhD supervisor: Wang, Ran; Rainer Spurzem
- **Shu, Qi; 舒琦** (class of 2014)
  PhD supervisors: Rainer Spurzem; Thijs Kouwenhoven
- **Sun, Hui; 孙惠** (class of 2012)
  PhD supervisor: Zhang, Bing
- **Sun, Ningchen; 孙宁晨** (class of 2013)
  PhD supervisor: Richard de Grijs
- **Sun, Weijia; 孙唯佳** (class of 2016)
- **Wang, Bitao; 汪碧涛** (class of 2015)
  PhD supervisor: Eric Peng
- **Wang, Chun; 王春** (class of 2013)
  PhD supervisor: Liu, Xiaowei
- **Wang, Feige; 王飞格** (class of 2012)
  PhD supervisors: Fan, Xiaohui; Wu, Xuebing
- **Wang, Jianfeng; 王健锋** (class of 2014)
  PhD supervisor: Yu, Qingjuan
- **Wang, Shu; 王澍** (class of 2014)
  PhD supervisor: Jiang, Linhua
- **Wu, Jin; 吴晋** (class of 2014)
  PhD supervisor: Jiang, Linhua
- **Wu, Junfei; 吴骏飞** (class of 2013)
  PhD supervisor: Eric Peng
- **Xia, Moran; 夏默然** (class of 2011)
  PhD supervisor: Yu, Qingjuan
- **Xie, Xiaojia; 解小佳** (class of 2014)
  PhD supervisor: Dong, Subo
- **Xu, Heng; 胥恒** (class of 2016)
- **Xu, Siyao; 徐思遥** (class of 2011)
  PhD supervisor: Zhang, Bing
- **Xu, Ziyan; 徐紫嫣** (class of 2015)
  PhD supervisor: Gregory Herczeg
- **Yang, Jinyi; 杨锦怡** (class of 2011)
  PhD supervisor: Wu, Xue-Bing
- **Yang, Qian; 杨倩** (class of 2012)
  PhD supervisor: Wu, Xue-Bing
- **Yang, Yujiao; 杨玉姣** (class of 2016)
- **Yu, Niankun; 余捻坤** (class of 2016)
- **Yuan, Shuo; 袁硕** (class of 2013)
  PhD supervisor: Fan, Zuhui
- **Yu, Siyue; 余思悦** (class of 2014)
  PhD supervisor: Luis Ho
- **Zhang, Bing; 张兵** (class of 2013)
  PhD supervisor: Li, Zhuo
- **Zhang, Chengpeng**; 张程鹏 (class of 2014)
  PhD supervisor: Peng,Yingjie
- **Zhang, Xiaoyue; 张晓悦** (class of 2016)
- **Zhao, Yulin; 赵玉琳** (class of 2013)
  PhD supervisor: Luis Ho
- **Zheng, Yun; 郑沄** (class of 2016)
- **Zhou, Enping; 周恩平** (class of 2012)
  PhD supervisor: Xu, Renxin
- **Zhou, Zhiqin; 周智勤** (class of 2014)
  PhD supervisor: Liu, Fukun
- **Zhuang, Mingyang; 庄明阳** (class of 2016)

# Administration and Support Staff

**Jie Yao**
Institute Manager

**Lili Liu**
Adminstration Assistant

**Shuyan Liu**
Science Secretary

**Shuo Zhang**
Adminstration Assistant

**Shuxian Li**
Adminstration Assistant

**Shikai Fu**
IT manager (part-time)