KIAA / DoA 2018
Postdoc Science Days

Book of Abstracts

December 18th and 19th 2018

in the KIAA Auditorium

Schedule

Time	Speaker	Title	Page
Tuesday December 18th 2018:			
10:00 - 10:10	Gregory Herczeg	Introduction	
Galaxy Evolution (Chair: Jingjing Shi)			
10:10 - 10:30	Toky Randriamampandry	Bar pattern speed: fast vs slow bars	3
10:30 - 10:50	Youkyung Ko (고유경)	Metallicity gradients in globular clusters systems of M87 and M49	3
10:50 - 11:10	Sonali Sachdeva	Comprehensive understanding of galaxies using Stripe82	4
11:10 - 11:30	Li Shao (邵立)	SkyMapper data processing and mapping of nearby galaxies	4
11:30 - 11:50	Ravi Joshi	Gas in galaxies: Feeding and Feedback	4
		Lunch	
Star Formation (Chair: John Graham)			
1:50 - 2:10	Yanxia Xie (谢艳霞)	The Star Formation Efficiency of Quasar Host Galaxies at Low-Redshifts	5
2:10 - 2:30	Siwei Zou (邹思蔚)	Neutral carbon -- a new tracer of star formation over cosmic time?	5
2:30 - 2:50	Hassen M. Yesuf	Interpreting UV Spectra of Galactic Winds Using Radiative Transfer of Hydrodynamic Galaxy Simulations	6
2:50 - 3:10	Pei Zuo (左沛)	Atomic Hydrogen in Molecular Clouds and Major-merger Galaxies	6
		Tea & Coffee Break	
Gamma Ray Bursts and Compact Objects (Chair: Sonali Sachdeva)			
3:40 - 4:00	Nicolas Caballero	Pulsar Timing: From gravitational waves to solar-system dynamics and timekeeping	7
4:00 - 4:20	Yuanpei Yang (杨元培)	Synchrotron Radiation from Electrons with a Pitch-angle Distribution	7
4:20 - 4:40	Ye Li (李晔)	A Global Test of Structured Jet of NS-NS mergers	7
4:40 - 5:00	John Graham	The Metallicity Distribution of LGRBs and Other Transients	8
Wednesday December 19th 2018:			
AGN Observation (Chair: Jingjing Shi)			
9:30 - 9:50	Su Yao (姚苏)	J1447+2833: Multi-wavelength study of a changing-look AGN discovered by LAMOST	9
9:50 - 10:10	Dohyeong Kim (김도형)	Unveiling intrinsic properties of dusty red AGNs	9
10:10 - 10:30	Xiaolong Yang (杨小龙)	The radio activity in a sample of supermassive black holes with the extremely high accretion rates	10
		Tea & Coffee Break	
Gravity and Cosmology (Chair: Shu Wang)			
11:00 - 11:20	Chandrachur Chakraborty	Does the gravitomagnetic monopole exist? A clue from a black hole x-ray binary	10
11:20 - 11:40	Kai Wang (王凯)	Hadronuclear interpretation of neutrino emission from TXS0506+056	11
11:40 - 12:00	David Fernandez-Arenas	The Hubble constant using the L-σ relation for local HII Galaxies.	11
		Lunch	
Milky Way (Chair: John Graham)			
2:00 - 2:20	Chun Wang (王春)	The Galactic phase space spirals at different Galactic positions revealed by Gaia and LAMOST data	12
2:20 - 2:40	Anupam Bhardwaj	Constraining stellar pulsation models with time-series analyses of Cepheid and RR Lyrae variables	12
2:40 - 3:00	Shu Wang (王舒)	The Optical to Mid-Infrared Extinction Law and High Precision Distance	13
3:00 - 3:20	Tapas Baug	Influence of Wolf-Rayet Star on Galactic star formation	13
		Tea & Coffee Break	
Illustris TNG (Chair: Sonali Sachdeva)			
4:00 - 4:20	Jingjing Shi (史晶晶)	Hydrogen reservoir in massive galaxies with IllustrisTNG simulations	14
4:20 - 4:40	Dongyao Zhao (赵冬瑶)	Bar galaxies in IllustrisTNG	14
4:40 - 5:00	Min Du (杜敏)	Kinematic Decomposition of Galaxies in The Cosmological Simulation IllustrisTNG100	14
5:00	Luis Ho	Closing remarks	

Tuesday December 18th 2018:

10:10 - 11:50 Galaxy Evolution Session (Chair: Jingjing Shi)

Bar pattern speed: fast vs slow bars

10:10 - 10:30 Toky Randriamampandry

More than 30 percent of nearby disc galaxies are strongly barred when observed in the optical wavelength. This fraction rise to 70 percent in the near-infrared and when weak bars are also included. Bars play an important role in the internal evolution of disk galaxies known as secular evolution. They move the gas toward the center and transfer angular momentum both to the disk and to the halo.

A galactic bar is fully characterized by its length, strength and pattern speed. The bar length and bar strength are measured from optical and near-infrared images. On the other hand, the bar pattern speed defined as the rotational frequency of the bar requires kinematic information and it is more difficult to measure. There are several methods available in the literature to estimate the bar pattern speed. However, the only model-independent method is the well-known "Tremaine-Weinberg method", which uses photometric and kinematic data to measure the pattern speed.

In this work, we apply the Tremaine-Weinberg method to mock galaxies from the GalMer database by Chilingarian et al. (2010) in order to investigate possible source of uncertainties on the measured pattern speed. We also collected bar pattern speeds and corotation radii measurements from the literature and explore various predictions from numerical simulations. Particularly the effect of the central dark matter halo concentration on the bar rotational frequency.

Metallicity gradients in globular clusters systems of M87 and M49

10:30 - 10:50 Youkyung Ko (고유경)

Globular clusters (GCs) are one of excellent tools to trace the formation history of galaxies. Especially, ages and metallicities of the GCs give clues about star formation epoch and merging history of their host galaxies. However, it has been hardly done to directly measure age and metallicity from spectroscopy for a large number of GCs in a single galaxy so far. We performed a stacking analysis to improve the signal-to-noise ratios of spectra, after obtaining optical spectra of about 1500 GCs in M87 and M49 using Hectospec on the Multiple-Mirror telescope. M87 and M49 are the most massive early-type galaxies in the Virgo cluster that host numerous GCs. We measure the ages, [Z/H], and alpha-abundances from the stacked spectra for the GCs within radial bins, based on Lick indices. We find clear metallicity and alpha-abundance gradients in the GC systems of both galaxies. In addition to the radial trends, we investigate the stellar populations in several GC subgroups divided according to colors, radial velocities, and spatial locations. We discuss the formation history of M87 and M49 based on the GC metallicities.

Comprehensive understanding of galaxies using Stripe82

10:50 - 11:10 Sonali Sachdeva

In this talk I will discuss the project that I have recently begun at KIAA. Aim of this project is wholistic understanding of structural and stellar properties of galaxy populations, and to set benchmarks in terms of local scaling relations. It shall play a pivotal role in the analysis of evolutionary mechanisms of different galaxy populations.

I will discuss the choice of Stripe82, the kind of data that already exists and the kind of measurements we intend to make. My present focus, in this project, is to compute structural parameters in a robust manner. I will discuss the importance of performing these measurements on VICS82 Near IR images. I will elaborate on some challenges involved in decomposition of galaxy structure and accurate measurement of all defining parameters.

Comprehensive understanding of galaxies using Stripe82

11:10 - 11:30 Li Shao (邵立)

SkyMapper Southern Sky Survey is a wide-field optical multi-color survey in all southern sky (dec < 0). The narrow u and v bands are designed to optimize the detection of A stars in local Universe (z<0.03). The combination of these colors can provide unique capability of measuring spatial resolved star formation history in nearby galaxies without IFU. We optimize the background subtraction for image coadding. We aim to provide a uniform color map for all nearby galaxies, to maximize the advantage of SkyMapper filters.

Gas in galaxies: Feeding and Feedback

11:30 - 11:50 Ravi Joshi

A comprehensive understanding of the physical conditions of gas within and surrounding galaxies is of paramount importance to understand the physical processes that regulate galaxy formation and evolution. In active galaxies, outflows are fundamental components of their environment and might play an important role in feedback to host galaxy evolution. Investigation of spectral variabilities in Broad Absorption Line (BAL) seen in the quasar spectra has been proven an important tool for deriving the key parameters of quasar wind such as their lifetimes, locations and geometries. I will discuss our recent efforts to understand the nature of outflows in a rare class of X-ray bright BAL quasars where we have detected 3 systems showing the signature of acceleration (i.e., kinematic shift) which make this subclass more promising to understand the wind acceleration and the driving mechanisms. In addition, I will also talk about our efforts to understand the connection between gas seen in absorption and their galaxy counterparts.

1:50 – 3:10 Star Formation Session (Chair: John Graham)

The Star Formation Efficiency of Quasar Host Galaxies at Low-Redshifts

1:50 - 2:10 Yanxia Xie (谢艳霞)

The tight correlation between the mass of supermassive black hole and stellar velocity dispersion in galaxy bulge has been well-established in local quiescent galaxies, triggering enormous studies on the interaction of black holes and their host galaxies. Yet, the origin of this relation remains elusive. Rigorous measurement of interstellar medium content and star formation rate (SFR) in active galaxies will provide valuable information to gain insight into how effectively the host galaxies build their mass. Employing a new SFR calibrator developed by us based on polycyclic aromatic hydrocarbons (PAHs), we quantify the SFRs of the hosts and investigate the star formation efficiency in light of gas content measurements for a low-redshift quasar sample. The final results are discussed in the context of star formation quenching scenario from AGN feedback.

Neutral carbon -- a new tracer of star formation over cosmic time?

2:10 - 2:30 Siwei Zou (邹思蔚)

I will present the work on a sample of 17, $z > 1.5$ absorbers selected based on the presence of strong C I absorption lines in SDSS spectra and observed with the ESO-VLT spectrograph X-shooter. We derive metallicities, depletion onto dust, extinction by dust and analyse the absorption from Mg II, Mg I, Ca II and Na I that are redshifted into the near infrared wavelength range. We show that most of these C I absorbers have high metallicity and dust content. Most of the systems (12 out of 17) have W(Mg II 2796) > 2.5 Å when six of them have log N(H I) < 20.3. The kinematics is strongly perturbed for most of these systems which probably do not arise in quiet disks and must be close to regions with intense star formation activity and/or are part of interacting objects. All this suggests that a large fraction of the cold gas at high redshift arises in disturbed environments. Furthermore, I will briefly introduce the ongoing project on CI absorbers at higher redshift.

Interpreting UV Spectra of Galactic Winds Using Radiative Transfer of Hydrodynamic Galaxy Simulations

2:30 - 2:50 Hassen M. Yesuf

Understanding gas in galaxies and its movement as galactic winds in particular is critical in galaxy formation and evolution studies. While enormous progress has been made in the last decade, the detailed properties (spatial distribution, ionization state, phase and kinematic structure) of gas in and around galaxies are still poorly constrained. Observations of especially distant galaxies show that galactic winds are ubiquitous. These observations, however, were interpreted using useful but simple wind models. With the advent of advanced high resolution hydrodynamic cosmological galaxy simulations, which realistically model gas and metal distributions in galaxies and self-consistently generate winds, it is time to develop more sophisticated wind models to interpret the observations and also make simulation outputs into observable spectra. In this talk, I will describe my current work to post-process the outputs from state-of-art hydrodynamic simulations with radiative transfer code and generate mock UV spectra. I will present the progress I made in the last few months in the model development to analyze three simulation. Ultimately, I will produce several hundred UV spectra for robust and unprecedented comparison between wind observations and theory.

Atomic Hydrogen in Molecular Clouds and Major-merger Galaxies

2:50 - 3:10 Pei Zuo (左沛)

The 21cm line refers to the electromagnetic radiation spectral line of neutral hydrogen atoms, is one of the most important tracers in astrophysics to study the materials of various scales in the universe. Star formation is predominantly fueled by molecular hydrogen. The transition from atoms to molecules, in particular, the formation of H2 molecule, is a key step in cosmic structure formation en route to stars. It is crucial to study this process for understanding the initial stage of star formation.

We present the discovery of a rare, isolated dark cloud currently undergoing H2 formation, as evidenced by a prominent "ring" of HI self-absorption. Through a combined analysis of HI narrow self-absorption, CO emission, dust emission, and extinction, we directly measured, for the first time, the [HI]/[H2] abundance varying from 2% to 0.2%, within one region. We derived a cloud formation timescale of $\sim 10^6$ Myr, consistent with the global Galactic star formation rate, and favoring the classical star formation picture over fast star formation models. Our measurements also help constrain the H2 formation rate, under various ISM conditions.

Star formation also occurs in other galaxies. Another work we present is a study of the HI gas content of 88 close major-merger pairs of galaxies (44 spiral-spiral pairs, 44 spiral-elliptical pairs). We observed the 58 pairs by using the GBT and retrieving the HI data for the remaining pairs from the literature. Combined with the dust data from Herschel, we systematically calculated and analyzed the SFR of the whole sample. Our results are consistent with the conclusion that there is no any significant correlation between SFE_gas enhancement and gas fraction in these pairs. Dynamical simulations demonstrated that interaction-induced collision between gas clouds may play very important role in triggering enhanced star formation, and the effect is stronger in S+S pairs.

3:40 - 5:00 Gamma Ray Bursts and Compact Objects Session
(Chair: Sonali Sachdeva)

Pulsar Timing: From gravitational waves to solar-system dynamics and timekeeping

3:40 - 4:00 Nicolas Caballero

Although only five decades old, pulsar astronomy is now a major branch of astronomy and often included in the key science projects of proposals for future telescopes. This can be attributed to the fact that pulsars astronomy deals not only with pulsar physics, but uses pulsars as tools to study a wide variety of astrophysical and fundamental physics problems. This is possible due to their stable, periodic rotations and the high precision by which we can predict the arrival time of future pulses. In this talk I focus on three applications of millisecond pulsars, the fastest rotating and most rotationally stable pulsars known. I will discuss how we use time-domain observations and the pulsar timing methods to search for nHz gravitational waves and how these efforts have also led to using the same data to probe the solar-system dynamics and development of independent pulsar-based time standards. I will conclude with recent results in these fields of research.

Synchrotron Radiation from Electrons with a Pitch-angle Distribution

4:00 - 4:20 Yuanpei Yang (杨元培**)**

In most astrophysical processes involving synchrotron radiation, the pitch-angle distribution of the electrons is assumed to be isotropic. However, if electrons are accelerated anisotropically, e.g, in a relativistic shock wave with an ordered magnetic field or in magnetic reconnection regions, the electron pitch angles might be anisotropic. In this work, we study synchrotron radiation from electrons with a pitch-angle distribution with respect to a large-scale uniform magnetic field. Assuming that the pitch-angle distribution is normal with a scatter of σ_p and that the viewing direction is where the pitch-angle direction peaks, we find that for electrons with a Lorentz factor γ, the observed flux satisfies $F_\nu\propto\nu^$ for $\nu\ll\nu_$ ($\nu_$ is the critical frequency of synchrotron), if $\sigma_p\lesssim1/\gamma$ is satisfied. On the other hand, if $\sigma_p\gg1/\gamma$, the spectrum below $\nu_$ is a broken power law with a break frequency $\nu_\sim2\nu_/\sigma_p^3\gamma^3$, e.g., $F_\nu\propto\nu^$ for $\nu\ll\nu_$ and $F_\nu\propto\nu^$ for $\nu_\ll\nu\ll\nu_$. Thus the ultimate synchrotron line of death is $F_\nu\propto\nu^$. We discuss the application of this theory to blazars and gamma-ray bursts (GRBs).

A Global Test of Structured Jet of NS-NS mergers

4:20 - 4:40 Ye Li (李晔**)**

The broad band observational signals of GW170817 indicates the jet, if any, of Neutron Star-Neutron Star mergers are structured, i.e., the energy depends on the viewing angle. However, the structure is still on debate. Besizes previously proposed gaussian and power law distribution, a cocoon distribution is also highly proposed. In this paper, we test the jet structure of NS-NS mergers in the context of short-duration Gamma Ray Bursts. We explore the jet structure with the peak flux distribution, redshift distribution and luminosity distribution of SGRBs.

The Metallicity Distribution of LGRBs and Other Transients

4:40 - 5:00 John Graham

Here I will present results from a handful of ongoing projects. Firstly, a now almost completed work showing a surprising lack of evolution in the metallicity distribution of the Long-duration Gamma Ray Burst (LGRB) host galaxy population. This is at odds with the general evolution in the mass metallicity relation, which becomes progressively more metal poor with increasing redshift. We further find that the LGRB host galaxy mass distribution increase with redshift is consistent with that needed to preserve the LGRB metallicity distribution as the mass metallicity relation decreases with redshift therefore the expected metallicities of LGRB host population (given their mass and redshift) also does not evolve. However, the metallicities estimated from mass and redshift are about twice as metal rich as the population with actually measured metallicity values which resolves much of the difference between the LGRB formation metallicity cutoff of about a third solar in Graham & Fruchter 2015 with the cutoff value of solar claimed in Perley et al. 2016 in favor of the former. Secondly, we look at the Specific Star-Formation Rate (SSFR - the SFR per unit mass) of LGRB host galaxies vs. a star-formation weighted general galaxy population and find that while they are skewed towards the the high SSFR tail of the galaxy distribution this effect is constant with their metallicity distribution and appears to be entirely explainable as a function thereof. Thirdly, I will discuss an interesting new project comparing the metallicity distribution of a large sample of generic Type II supernovae with the star-formation weighted metallicity distribution galaxies to constrain the degree to which the Initial Mass Function (IMF) can vary as a function of metallicity - initial results suggest there is no variation. Fourthly, I will update on an observational survey of additional $z < 0.5$ LGRB hosts.

Wednesday December 19th 2018:

9:30 – 10:30 AGN Observation Session (Chair: Jingjing Shi)

J1447+2833: Multi-wavelength study of a changing-look AGN discovered by LAMOST

9:30 - 9:50 Su Yao (姚苏)

LAMOST quasar survey has revealed a second largest number of quasar spectroscopies other than SDSS. In addition to the great supplement to the new quasar discoveries, LAMOST has also provided a large database (overlapped with SDSS) for investigating the AGN spectral variability and discovering unusual AGNs. Here we report an multi-wavelength study for a changing-look AGN discovered by LAMOST, J1447+2833. The violent increase of broad Halpha and appearance of broad Hbeta shows that this object has transitioned from type 1.9 to type 1. The Balmer decrement obtained from line flux upper limits and the multi-wavelength light curves rule out variable obscuration or TDE scenarios. The variation of its spectral shape in SED indicates an emergence of a strong accretion disk component. J1447+2833 is one of the best objects for studying detailed accretion process in changing-look AGNs.

Unveiling intrinsic properties of dusty red AGNs

9:50 - 10:10 Dohyeong Kim (*김도형*)

In recent years, I have studied several topics. First, I established new NIR BH mass estimators by using hydrogen Paschen and Brackett lines. These new NIR BH mass estimators are relatively unaffected by dust extinction when compared to UV or optical BH mass estimators, so these new NIR estimators are very useful for dust obscured AGNs (e.g., type 2 and red AGNs). Second, I have demonstrated that red AGNs are the intermediate population between merger-driven star-forming galaxies and unobscured type 1 AGNs, as expected in several theoretical studies. For this topic, I investigated the origin of the red colors of red AGNs, and the result implies that red colors are due to the dust in their host galaxies. Moreover, BH accretion rates of red AGNs are significantly higher than those of unobscured type 1 AGNs. These results point to the picture that red AGNs are the intermediate stage galaxies as predicted by simulations.

The radio activity in a sample of supermassive black holes with the extremely high accretion rates

10:10 - 10:30 Xiaolong Yang (杨小龙)

Active galactic nuclei (AGNs) accreting at rates close to the Eddington limit are poorly understood. In this talk, I will present our recent works about radio observations of a sample of extremely high Eddington ratio accreting supermassive black holes. The results from Very Large Array observations support that the radio emission are from AGN activities than star formations. It was found there is an inverse correlation between radio loudness and Eddington ratio, similar to the hard state of X-ray binaries (XRBs). By adding our samples, we found that this correlation can extended to super-Eddington regime. This overall inverse correlation between radio loudness and Eddington ratio further enhance the AGN-XRB unification scheme. AGNs accreting at rates close to the Eddington limit can drive strong outflows. Radio emission from super-Eddington accreting AGNs can either explained with the jets ejected from past sub-Eddington accreting phase, or mildly relativistic wind-driven radio outflow. In order to further clarify the radio origination, we selected 4 objects from our sample and performed milli-arcsec radio observations with Very Long Baseline Array (VLBA), I will also present the preliminary results in this talk.

11:00 – 12:00 Gravity and Cosmology Session (Chair: Shu Wang)

Does the gravitomagnetic monopole exist? A clue from a black hole x-ray binary

11:00 - 11:20 Chandrachur Chakraborty

The gravitomagnetic monopole is the proposed gravitational analogue of Dirac's magnetic monopole. However, an observational evidence of this aspect of fundamental physics was elusive. Here, we employ a technique involving three primary X-ray observational methods used to measure a black hole spin to search for the gravitomagnetic monopole. These independent methods give significantly different spin values for an accreting black hole. We demonstrate that the inclusion of one extra parameter due to the gravitomagnetic monopole not only makes the spin and other parameter values inferred from the three methods consistent with each other but also makes the inferred black hole mass consistent with an independently measured value. We argue that this first indication of the gravitomagnetic monopole, within our paradigm, is not a result of fine tuning.

Hadronuclear interpretation of neutrino emission from TXS0506+056

11:20 - 11:40 Kai Wang (王凯)

Recently, a high-energy neutrino event IceCube-170922A in the spatial and temporal coincidence with the flaring γ-ray blazar TXS 0506+056 was reported. A neutrino outburst between September 2014 and March 2015 was discovered in the same direction by a further investigation of 9.5 years of IceCube data, while the blazar is in a quiescent state during the outburst with a gamma-ray flux only about one-fifth of the neutrino flux. It is usually believed that a blazar is produced by a relativistic jet launched from an accreting supermassive black hole (SMBH). Here we show that the high-energy IC 170922A event and the 2014/2015 neutrino outburst can be interpreted by the inelastic hadronuclear interactions between the accelerated cosmic-ray protons in the relativistic jet and the dense gas clouds in the vicinity of the SMBH.

The Hubble constant using the L-σ relation for local HII Galaxies.

11:40 - 12:00 David Fernandez-Arenas

During the last years, I have been working mainly in the study of the physical properties of HII Galaxies (HIIGs) and extragalactic giant HII regions (GHIIRs), including the analysis of low and high spectral resolution data, particularly in their use to measure the local value of the Hubble constant using the correlation between the integrated Hβ line luminosity and the velocity dispersion of the ionized gas of HIIGs and GHIIRs which represents an exciting distance indicator that can be used up to redshifts $z \sim 4$.

I have studied other physical parameters for the sample of GHIIRs and HIIGs including the size, a morphological classification according to the emission line profiles of these massive stellar clusters, and estimations of the dynamical and photometric masses.

Finally, I am addressing my research comparing the existing relation between absolute blue magnitude and velocity dispersion ($M_B - \sigma$) for HIIGs and GHIIRs with that followed by old stellar systems as globular clusters, elliptical galaxies and bulges of spiral galaxies. In summary, I have been studying the physical properties of extragalactic HII regions and HII galaxies, and their use to determine the Hubble constant, through the analysis of $L - \sigma$ relation.

2:00 – 3:20 Milky Way Session (Chair: John Graham)

The Galactic phase space spirals at different Galactic positions revealed by Gaia and LAMOST data

2:00 - 2:20 Chun Wang (王春)

We have investigated the V_Φ and VR distributions at Z-V_Z plane across the disc of $6.34 \lesssim R \lesssim 12.34$ kpc and $|\Phi| \lesssim 7.5°$ using Gaia sample and Gaia-LAMOST sample. The distributions of V_Φ and V_R at Z-V_Z plane show significant spiral patterns. The distributions of V_R also show obvious quadrupole patterns, which are the consequence of the well-known tilt of the velocity ellipsoid. The radial and azimuthal variations of spiral and quadrupole patterns are evident. The phase space spiral patterns of V_Φ and V_R become more and more relaxed as R increase. The spiral patterns of V_Φ and V_R and the quadrupole patterns of V_R are strongest at $-2° < \Phi < 2°$, and negligible at $4° < \Phi < 6°$ or $-6° < \Phi < -4°$. Our results suggest an external origin of the phase space spiral patterns. The intruder is most possibly Sagittarius dwarf, which pass through the Galactic plane at the anti-center direction. The azimuthal variations of spiral patterns also provide strong constrains on the mass and the passage speed of the intruder. A more detailed model is required to reproduce the observed spatial variations of spiral patterns of V_Φ and V_R.

Constraining stellar pulsation models with time-series analyses of Cepheid and RR Lyrae variables

2:20 - 2:40 Anupam Bhardwaj

I will discuss time-series analyses of classical Cepheid and RR Lyrae variables in the Galaxy and the Magellanic Clouds at multiple wavelengths. The Fourier decomposition and principal component analysis methods are adopted to quantify the structural changes in the light curves of Cepheid and RR Lyrae variables. A quantitative comparison of Cepheid Fourier parameters suggests that the canonical mass-luminosity models that lie towards the red-edge of the instability strip show a greater offset with respect to observations for short-period Cepheids. RR Lyrae models are consistent with observations in most period bins. We use ensemble light curve analysis to predict the physical parameters of observed Cepheid and RR Lyrae variables using machine learning methods. Our preliminary results suggest that the posterior distributions of mass, luminosity, temperature and radius for Cepheids and RR Lyraes can be well-constrained for a given metal abundance, provided a smoother grid of models is adopted in various input physical parameters.

The Optical to Mid-Infrared Extinction Law and High Precision Distance

2:40 - 3:00 Shu Wang (王舒)

A precise interstellar extinction law is critically important to properly interpret observations. In principle, both the color excess ratio (CER) and the relative extinction value are usually regarded as indicators of the extinction law. Comparing to CER, it is more challenging to derive an accurate wavelength-dependent relative extinction which requires an independent determination of extinction value or distance. By using Red clump stars as extinction tracers, the precise optical--mid-infrared (IR) relative extinction values have been determined in total twenty-one bands based on data from projects including Gaia DR2, APASS, SDSS, Pan-STARRS1, 2MASS, and WISE surveys.

Classical Cepheids are well-known and widely used distance indicators. It can be used to measure nearby extragalactic distances, constrain the Hubble constant, and study Galactic structure and kinematics. The well-established period--luminosity (PL) relation and interstellar extinction are crucial in accurate determination of Cepheids' distances. However, distance and extinction are often tightly coupled. Based on our IR PL relations, we carefully determined the IR extinction toward the Galactic Center region. The mean distance precision to our sample of Cepheids is improved to 4%, which solve the argument about the distance of these cepheids. Except for the nuclear disk, no other disk appears to exist in the inner bulge.

In addition, we have compiled the first all-sky mid-IR variable-star catalog based on WISE survey data. 50,296 periodic variables are discovered, of which 34,769 (69%) are new, including 1312 Cepheids. This enlarged sample of variable stars will not only be helpful to study Galactic structure and extinction properties.

Influence of Wolf-Rayet Star on Galactic star formation

3:00 - 3:20 Tapas Baug

Wolf-Rayet (W-R) stars ($M > 20\ M_{sun}$) are at the intermediate phase of the evolution descended from their early O-type progenitors. They have enormously high mass-loss rates $10^{-5}\ M_{sun}$/yr with high-speed stellar winds 1000-5000 km/s. In their short life span, these W-R stars have the ability to influence their natal environment to form the next generation of stars. They may develop wind-blown expanding shells of parsecs-to-ten-parsec scales with typical expansion velocities of a few km/s. Influence of W-R stars on their parent molecular clouds has been investigated using multi-wavelength data. A total of five Galactic regions are selected in the inner Galactic plane (l = 15-50 deg) for detailed study. All five W-R Stars are found to be associated with surrounding molecular clouds, and have developed expanding molecular shells due to their strong stellar wind. These molecular shells have typical expansion velocities of a few km/s. Estimation of different pressure components exhibited by W-R stars reveals that the pressure due to stellar wind dominates over the other components by an order of magnitude, and has the ability to influence the molecular clouds up to about 10 pc. Ongoing active star formation activities, by presence of cold molecular condensations and young stellar objects, are typically noted within 10 pc of the W-R stars. Overall, these five W--R stars have played a positive role in the surrounding star formation. Several other Galactic W-R stars can also be found with similar influence but identification of such regions lacks because of poor distant estimates of W-R stars. Details of the study will be presented.

Illustris TNG Session (Chair: Sonali Sachdeva)

Hydrogen reservoir in massive galaxies with IllustrisTNG simulations

4:00 - 4:20 Jingjing Shi (史晶晶)

Large HI reservoir is found in massive galaxies with the ALFALFA survey. The HI mass is independent of the star-formation activity, while the molecular hydrogen mass declines with the sSFR. To understand the origin of those reservoir and the trend with sSFR, we use the state-of-art cosmological hydro-dynamical simulation IllustrisTNG. We found similar trend as in the observation, however the molecular gas mass is lower than in the observation at given stellar mass. We further check the molecular gas distribution within galaxies of varying star-formation and kinematic properties, and the possible effects of BH activities.

Bar galaxies in IllustrisTNG

4:20 - 4:40 Dongyao Zhao (赵冬瑶)

Bar galaxies are important for their roles on reshaping galaxies and diagnosing the disc secular evolution. Probing formation and evolution of bars helps to better understand the galaxy evolution. Since every particle can be traced, simulations provide efficient way to study the bar growth. Using the state-of-art IllustrisTNG simulation, I first identify bar galaxies at z=0 by observational criteria. The derived bar fraction is consistent with observations, suggesting the good recovery of bar galaxies by IllustrisTNG. Applying observational measurement on bar size, similar relationship of bar size-stellar mass is found in simulation compared to observations. This allows insight on the mechanism of how bars grow with their host galaxies. Additionally, I find that a non-negligible fraction of bar galaxies would be missed if the traditional kinematic criterion is applied to identify bar galaxies in IllustrisTNG. It indicate that it should be very careful to identify bar galaxies and disc galaxies in simulations. Using the identified bar galaxies at z=0, I could trace their progenitors back at higher redshifts and discuss how bar evolve as well as their effects on galaxy evolution.

Kinematic Decomposition of Galaxies in The Cosmological Simulation IllustrisTNG100

4:40 - 5:00 Min Du (杜敏)

An automatic method is developed to make kinematic decomposition and classification for structures in thousands of galaxies in the IllustrisTNG. In this method, I apply the Gaussian Mixture Models (GMM) to find clusters in the kinematic phase space of jz/jc, jp/jc, and e/max(|e|). Stellar particles of each galaxy are classified into different structures that correspond to thin disks, thick disks, nuclear disks/pseudo-bulges, classical bulges, and halos. This project will provide the first kinematic decomposition in detail for the large sample of galaxies in IllustrisTNG. With this data, we can: (1) investigate the basic properties of these structures (e.g., mass, size, metallicity, age, et al.); (2) "witness" the formation and evolution of these structures.