THE EXTREME UNIVERSE: FROM COMPACT OBJECTS TO COSMOLOGY

Program Schedule and Abstract Book

28-30 June 2016

Department of Physics

The University of Hong Kong

Program Schedule

Day 1: June 28, 2016 (Tue)				
09:00 – 09:30		**Registration**		
09:30 – 09:45		**Welcome Remark**		
09:45 – 10:35		**Scientific Oral Session S1 (Chair: Stephen Ng)**		
S1-1	09:45 – 10:10	Formation of Double Intermediate Mass Black Hole Binary	K. S. Cheng	HKU
S1-2	10:10 – 10:35	On the Fermi GBM Interval 0.4 sec after GW 150914	Hoi-Fung David Yu	SYSU
10:35 – 11:20		**Coffee Break**		
11:20 – 12:10		**Scientific Oral Session S2 (Chair: Stephen Ng)**		
S2-1	11:20 – 11:45	Cosmological and Fundamental Physics Implications of the 21 cm Line Signal	Chun Sing Leung	PolyU
S2-2	11:45 – 12:10	Spectral Energy Distribution of Fermi Blazars	Junhui Fan	GZHU
12:10 – 14:00		**Lunch**		
14:00 – 14:50		**Scientific Oral Session S3 (Chair: K. S. Cheng)**		
S3-1	14:00 – 14:25	Properties of Spectrally-Defined Red QSOs at z = 0.3 – 1.2	An-Li Tsai	NCU
S3-2	14:25 – 14:50	Curvature of the Spectral Energy Distributions of Blazars	Rui Xue	YNNU
14:50 – 15:20		**Poster Highlights**		
15:20 – 16:05		**Coffee Break**		
16:05 – 17:20		**Scientific Oral Session S4 (Chair: K. S. Cheng)**		
S4-1	16:05 – 16:30	Cradle of Seed Black Holes: Two ULXs and a Nuclear IMBH in a Blue Compact Dwarf Galaxy	Yi-Jung Yang	SYSU
S4-2	16:30 – 16:55	The Impact of Supermassive Black Holes on Galaxy Evolution	Luis Ho	PKU
S4-3	16:55 – 17:20	Extremely Luminous Quasars with the Most Massive Black Holes in the Early Universe	Xuebing Wu	PKU

Day 2: June 29, 2016 (Wed)				
09:30 – 10:20		**Scientific Oral Session S5 (Chair: Albert Kong)**		
S5-1	09:30 – 09:55	A New Way of Searching Ultra-Compact Binaries	Biping Gong	HUST
S5-2	09:55 – 10:20	Tracking X-ray Spectral Modulations of A 6-Hz Type-B Quasi-periodic Oscillation in GX 339-4 using Hilbert-Huang Transform	Yi-Hao Su	NCU
10:20 – 11:05		**Coffee Break**		
11:05 – 11:55		**Scientific Oral Session S6 (Chair: Albert Kong)**		
S6-1	11:05 – 11:30	The Collapse Conditions of Oxygen-Neon White Dwarfs in the Accretion Induced Collapse Scenario	Shing Chi Leung	Kavli IPMU
S6-2	11:30 – 11:55	Studying Radio-Quiet Gamma-Ray Pulsars in Fermi Era	David Hui	CNU
11:55 – 14:00		**Lunch**		
14:00 – 15:15		**Scientific Oral Session S7 (Chair: David Hui)**		
S7-1	14:00 – 14:25	Magnetospheric Difference between Neutron Star and Strange Star	Renxin Xu	PKU
S7-2	14:25 – 14:50	Studying the SGR 1806–20/Cl* 1806-20 Region using the Fermi Large Area Telescope	Paul Yeung	NTHU
S7-3	14:50 – 15:15	Radio Observations of Pulsar Wind Nebula	Stephen Ng	HKU
15:15 – 16:00		**Coffee Break**		
16:00 – 16:50		**Scientific Oral Session S8 (Chair: David Hui)**		
S8-1	16:00 – 16:25	Gamma-Ray Bursts in the Last Frontier: the 10–100 GeV Energy Band	Pak Hin Thomas Tam	SYSU
S8-2	16:25 – 16:50	Chandra Phase-Resolved Spectroscopy of the High-Magnetic-Field Pulsar B1509–58	Chin-Ping Hu	HKU
S8-3	16:50 – 17:15	Statistical Analysis of Radio-Quiet Gamma-Ray Pulsars	Jongsu Lee	CNU

Day 3: June 30, 2016 (Thu)				
09:30 – 10:20		**Scientific Oral Session S9 (Chair: Chin-Ping Hu)**		
S9-1	09:30 – 09:55	Fast Radio Bursts and Relevant Problems	Zigao Dai	NJU
S9-2	09:55 – 10:20	Fast Radio Bursts: Statistical Properties and Cosmological Use	Fayin Wang	NJU
10:20 – 11:05		**Coffee Break**		
11:05 – 11:55		**Scientific Oral Session S10 (Chair: Chin-Ping Hu)**		
S10-1	11:05 – 11:30	R-Process Macronovae in GRB 060614 and 050709: Evidence for the Merger of a Neutron Star-Black Hole Binary System	Daming Wei	PMO
S10-2	11:30 – 11:55	On the Astrophysical Sources of High-Energy Neutrinos	Xiang-Yu Wang	NJU
11:55 – 14:00		**Lunch**		
14:00 – 15:15		**Astronomy & Beyond (1) (Chair: Stephen Ng)**		
B1-1	14:00 – 14:25	Realising the Dreams: From IT to Astronomy to Entrepreneurship	Alvis Ko	theOrigo Ltd.
B1-2	14:25 – 14:50	Data Science In Physics And Finance	Ki Cheong Franky Wong	
B1-3	14:50 – 15:15	From Astrophysics to Financial Industry	Ying Kit Jason Chan	Fenics Software, GFI, BGC
15:15 – 15:25		**Group Photo**		
15:25 – 16:10		**Coffee Break and Cake**		
16:10 – 17:00		**Astronomy & Beyond (2) (Chair: Stephen Ng)**		
B2-1	16:10 – 16:35	My Pursuit of the Beauty of Astronomy	Kwok Wai Eddie Ng	
B2-2	16:35 – 17:00	How Useful is Astronomy Training to Career in Physics	Hoi Fung Chau	HKU
17:00 – 17:30		**Free Discussion**		
18:30 –		**Banquet**		

Oral Presentations

S1-1 Formation of Double Intermediate Mass Black Hole Binary

Kwong Sang Cheng
The University of Hong Kong

The recent detection of gravitational wave resulting from the merger of two intermediate mass black holes (BH) by LIGO confirms a long term prediction but also stimulates the study of new topics. Unlike the stellar BH or neutron star (NS), the formation of intermediate mass BH is still an open question and how to form a binary with two similar intermediate mass BHs is even more challenging. In this talk I suggest that these binaries can be formed in the vicinity of high metalicity AGNs.

S1-2 On the Fermi GBM Interval 0.4 sec after GW 150914

Hoi-Fung David Yu[1,2], J. Greiner[1,2], J. Michael Burgess[3,4], V. Savchenko[5]
1 Max Planck Institute for Extraterrestrial Physics
2 Technical University of Munich
3 Oskar Klein Centre for Cosmoparticle Physics
4 KTH Royal Institute of Technology
5 Francois Arago Centre, APC, Université Paris Diderot

In view of the recent report by Connaughton et al. (2016) we analyse continuous TTE data of Fermi-GBM around the time of the gravitational wave event GW 150914. We find that after proper accounting for low count statistics, the GBM transient event at 0.4 s after GW 150914 is likely not due to an astrophysical source, but consistent with a background fluctuation, removing the tension between the INTEGRAL/ACS non-detection and GBM. Additionally, reanalysis of other short GRBs shows that without proper statistical modeling the fluence of faint events is over-predicted, as verified for some joint GBM-ACS detections of short GRBs. We detail the statistical procedure to correct these biases. As a result, faint short GRBs, verified by ACS detections, with significances in the broad-band light curve even smaller than that of the GBM-GW150914 event are recovered as proper non-zero source, while the GBM-GW150914 event is consistent with zero fluence.

S2-1 Cosmological and Fundamental Physics Implications of the 21 cm Line Signal

Chun Sing Leung[1], T. Harko[2]
1 Hong Kong Polytechnic University
2 University College of London

The redshifted 21 cm line, arising from the transition between the singlet and triplet hyperfine levels of neutral hydrogen, provides a unique observational probe of the high redshift Universe for $z > 6$, including the dark ages (before the first stars have formed) and the Epoch of Reionization. Although the primary task of the 21 cm experiments is to improve our current knowledge of the Universe's reionization history, they may also represent an additional tool for fundamental research in cosmology and astrophysics. The global 21 cm signal and the fluctuations of the 21 cm brightness temperature power spectrum can significantly improve the constraints on the cosmological parameters, dark matter, or alternative modified gravity theories. In the present study we first investigate the dependences on the astrophysical parameters (like, for example, the halo mass function, the threshold for halos to host star-forming galaxies, the X-ray efficiency and the stellar Lyman-α flux) of the 21 cm power spectrum. Then we consider the effects of the modification of the gravitational model and of the dark matter properties on the 21 cm signal. Changes in the cosmological history and dark matter properties could modify the thermal history of the intergalactic medium, and they could lead to distinctive features in the global 21 cm signal and in the 21 cm power spectrum at redshifts $10 \leq z \leq 30$. Therefore modifications of the 21 cm differential brightness temperature and its power spectrum due to the variation of the gravitational and cosmological or astrophysical parameters can provide a powerful method for testing the ΛCDM cosmological paradigm. However, disentangling modified gravity or dark matter signatures from astrophysical processes could be a very challenging task for terrestrial radio interferometers, given the current uncertainties in describing the astrophysical processes. On the other hand future space or Moon-based interferometers may provide significant improvements in the precision of measurements that could be sensitive to variations of the fundamental cosmological parameters, and free from astrophysical uncertainties.

S2-2 Spectral Energy Distribution of Fermi Blazars

Junhui Fan[1], Jianghe Yang[2], Yi Liu[1], Yuhai Yuan[1], Cao Lin[1], Hubing Xiao[1]
1 Guangzhou University
2 Hunan University of Science and Arts

In this work, we will present the calculations of spectral energy distributions of Fermi blazars, the peak frequency, peak luminosity, integrated luminosity and spectral indexes are also given. Some correlations and discussions are present.

S3-1 Properties of Spectrally-Defined Red QSOs at z = 0.3 – 1.2

An-Li Tsai, Chorng-Yuan Hwang
National Central University

We investigated the properties of a sample of red QSOs using optical, radio, and infrared data. These QSOs were selected from the SDSS DR7 quasar catalog. We only chose sources with sky coverage of the VLA FIRST survey, and searched for sources which have WISE counterparts. We defined typical QSOs and red QSOs based on the flux ratio of the rest frame 4000Å to 3000Å continuum emission. Under this criterion, we can only select QSOs with redshifts between 0.3 and 1.2. In addition, we defined radio-loud QSOs (RLQs) and radio-quiet QSOs (RQQs) based on their radio-to-optical ratios. We found that the red QSOs have stronger infrared emission than the typical QSOs have, especially for the RLQs.

We also found that the red QSOs have a higher fraction to be RLQs than the typical QSOs have, especially for luminous or high redshift red QSOs. Besides, the RLQs have a higher fraction to be red than the QSOs have. There might be a connection between the excess infrared emission and the radio activity of the QSOs. On the other hand, the red QSOs at high redshifts are less popular than the red QSOs at low redshifts, yet the typical QSOs show inverse population distribution along redshifts. Besides, at high redshifts, the luminosity distribution of the typical QSOs and the red QSOs seem to have similar pattern. However, at low redshifts, the red QSOs show different luminosity distribution with the typical QSOs. All these suggest that there might be more than one type of red QSOs.

S3-2 Curvature of the Spectral Energy Distributions of Blazars

Rui Xue, Zhao Hua Xie, Zw Rui Wang
Yunnan Normal University

We constructed the SEDs of a sample of Fermi blazars from the multi-frequency data by using the ASDC SED Builder. All the SED of the blazars were fitted by a log-parabolic law. According to Chen 2014, the statistically significant correlation between the synchrotron peak frequency and its curvature can be explained by statistical and/or stochastic particle accelerations. In our job, the significant correlation for both FSRQs and BL Lacs was confirmed. However, our results suggested that the particle acceleration of synchrotron radiation between FSRQ and BL Lac is different. Maybe this is another proof suggest that FSRQ and BL Lac are two types of blazar populations with widely different property.

S4-1 Cradle of Seed Black Holes: Two ULXs and a Nuclear IMBH in a Blue Compact Dwarf Galaxy

Yi-Jung Yang[1], Mar Mezcua[2], Dave Russell[3], David Cseh[4], Sean Farrell[5], Tom Maccarone[6], Fabien Grise[7], Albert Kong[8], Jeanette Gladstone[9], Yanking Chen[3]

1 Sun Yat-Sen University

2 University of Montreal

3 New York University Abu Dhabi

4 Radbound University, Nijimengen

5 University of Sydney

6 Texas Tech University

7 University of Strasbourg

8 National Tsing Hua University

9 University of Alberta

It is widely accepted that massive galaxies harbour nuclear supermassive black holes with masses from 10^6 solar masses ($M_\odot$) up to more than $10^{10} M_\odot$. Nuclear black holes with masses $< 10^6 M_\odot$ are essential to build up our understanding of the growth of supermassive black holes. Low-metallicity, star-forming dwarf galaxies are ideal environments for testing black hole birth and growth, as they represent the local analogue of the first galaxies that formed in the early universe. In this talk, I will present our discovery of an accreting intermediate-mass black hole (IMBH) with a mass of $\sim 4 \times 10^4\ M_\odot$ at the centre of the blue compact dwarf galaxy Mrk 59, and two ultra-luminous X-ray sources (ULXs) containing probably two massive stellar-mass black holes. Our study demonstrates that black holes in active compact dwarf galaxies indeed bridge the gap between supermassive and stellar-mass black holes and provide the long-sought observational evidence that blue compact dwarf galaxies might truly be the building blocks of larger galaxies.

S4-2 The Impact of Supermassive Black Holes on Galaxy Evolution

Luis Ho

Kavli Institute for Astronomy and Astrophysics, Peking University

I will review the latest developments in black hole mass measurements in ordinary as well as active galaxies, from low to high redshifts; discuss the correlations between black hole masses and galaxy properties; the discovery of intermediate-mass black holes in late-type galaxies; and the impact of black hole growth on galaxy evolution.

S4-3 Extremely Luminous Quasars with the Most Massive Black Holes in the Early Universe

Xuebing Wu[1], Feige Wang[1], Jinyi Yang[1], Qian Yang[1], Linhua Jiang[1], Ran Wang[1], Luis Ho[1], Xiaohui Fan[2], Ian Mcgreer[2], Richard Green[2], David Thompson[2], Weimin Yi[3], Bai Jinming[3], Wenwen Zuo[4], Fuyan Bian[5], Yuri Beletsky[6], Minjin Kim[7]

1 Peking University

2 University of Arizona

3 Yunnan Observatory

4 Shanghai Observatory

5 Austrilian National University

6 Las Campanas Observatory

7 Korea Astronomy and Space Science Institute

Using two domestic 2m telescopes and several 2m-8m telescopes outside China, our team is carrying out an observational program to search for luminous high-redshift quasars. So far we have discovered about 80 new quasars at redshifts between 4.4 and 6.3. Our identifications doubled the number of luminous quasars at $z > 4.5$, which will set strong constraints on the bright end of the quasar luminosity function. Among the new high redshift quasars, several are extremely luminous quasars with black hole masses more than 10 billion solar masses. SDSS J0100+2802, is a quasar with the highest redshift 6.3 in our program. Using the spectroscopic data, we estimated that the luminosity of this quasar is 430 trillion times of the solar luminosity, which is 7 times higher than the luminosity of the most distant quasar (at redshift 7.1). The central black hole mass was estimated to be 12 billion solar masses, making it to be the most luminous quasar with the most massive black hole in the early Universe. The discovery of this ultra-luminous object provides us a unique chance to study the structure of the early Universe, and also presents serious challenges to the theories of black hole formation and growth and the evolution of galaxies in the cosmic reionization epoch.

S5-1 A New Way of Searching Ultra-Compact Binaries

Biping Gong

Huazhong University of Science and Technology

Strange short-term timing behavior has been observed on two pulsars, their single pulse observations exhibit quasi-periodic shifts with amplitude up to a few ms. Such shifts can be simulated by ultra-compact binaries under tidal effect. This provides a new way of searching ultra-compact binaries.

S5-2 Tracking X-ray Spectral Modulations of A 6-Hz Type-B Quasi-periodic Oscillation in GX 339-4 using Hilbert-Huang Transform

Yi-Hao Su[1], Christopher S. Reynolds[2], Yi Chou[1]
1 National Central University
2 University of Maryland

We present the phase-resolved spectroscopy results based on the Hilbert-Huang transform (HHT) for a 6-Hz type-B quasi-periodic oscillation (QPO) in the black hole X-ray binary GX 339–4. It had been shown that type-B QPO frequencies have strong correlation with the hard X-ray flux, but the detail variations of hard X-ray spectral components during the oscillation is still not clear. To track modulations of spectral parameters, we utilized the HHT to characterize the HHT-based timing properties, extract the QPO instantaneous phases, and then construct its phase-resolved spectra. We found that the QPO is composed of a series of intermittent oscillations with a ∼1s coherence time. Furthermore, the phase-resolved spectra illustrate significant modulations of Comptonization parameters with unignorable modulations of thermal disk components. Finally, we discuss differences of the HHT-based timing property between this type-B QPO and a 4-Hz type-C from XTE J1550–564 and give possible interpretations of the spectral modulations.

S6-1 The Collapse Conditions of Oxygen-Neon White Dwarfs in the Accretion Induced Collapse Scenario

Shing Chi Leung, Ken'ichi Nomoto
Kavli IPMU, the Unversity of Tokyo

Recent surveys of neutron stars (NS) have discovered the bimodal distribution of the NS mass. The lower mass population is believed to be composed of NS formed from the collapse of a cold white dwarf, in the model of accretion induced collapse (AIC), by accreting mass from its main-sequence companion star in its red-giant stage till it reaches the Chandrasekhar mass limit. Deflagration first appears in the core of white dwarf, but the energy is inadequate to unbind the star. Instead, the electron capture soon takes place and reduces the pressure of the material in the stellar core, which triggers the following collapse.
Despite the physical picture has been established for decades, the exact collapse conditions are not yet well calibrated due to numerical difficulties in modeling the deflagration phase. In particular, this phase is known to be a multi-dimensional phenomenon, where in the literature most works have used one-dimensional model to study the collapse. To fill in the gap in the constraints of the AIC model, we study the deflagration-collapse of a white dwarf by using two-dimensional hydrodynamics simulations of an oxygen-neon white dwarf in the deflagration phase under different configurations, including initial central density, flame physics, progenitor models and so on. We probe for conditions which may trigger a successful collapse during the deflagration phase. Knowing the possible progenitor for the collapse candidate provides a more precise initial model for the consequent AIC simulations; the resultant NS properties can be compared with the current statistics of NS, which indirectly place constraints on the white dwarf properties and the pre-collapse dynamics.

S6-2 Studying Radio-Quiet Gamma-Ray Pulsars in Fermi Era

David C.Y. Hui
Chungnam National University

I will review the effort in exploring the nature of radio-quiet gamma-ray pulsars from the beginning of gamma-ray astronomy till now.

S7-1 Magnetospheric Difference between Neutron Star and Strange Star

Renxin Xu
Peking University

What's the nature of pulsar? This is a question challenging physicists and astrophysicists because of difficulties in both microphysics (non-perturbative behavior of strong force) and astrophysics (searching for clear evidence). After reviewing the speculated inner structures, we would like to discuss the difference of magnetospheric activity, which could be related to the pulsar models (neutron star or strange star) and may result in final identification by observation.

S7-2 Studying the SGR 1806–20/Cl* 1806-20 Region Using the Fermi Large Area Telescope

Paul Yeung[1], Albert Kong[1], Thomas Tam[2], Lupin C.C. Lin[3], David Hui[4], Chin-Ping Hu[5], K. S. Cheng[5]
1 National Tsing Hua University
2 Sun Yat-Sen University
3 Academia Sinica
4 Chungnam National University
5 The University of Hong Kong

The region around SGR 1806-20 and its host stellar cluster Cl* 1806-20 is a potentially important site of particle acceleration. The soft γ-ray repeater and Cl* 1806-20, which also contains several very massive stars including a luminous blue variable hypergiant LBV 1806-20, are capable of depositing a large amount of energy to the surroundings. Using the data taken with the Fermi Large Area Telescope (LAT), we identified an extended LAT source to the south-west of Cl* 1806–20. The centroid of the 1-50 GeV emission is consistent with that of HESS J1808-204 (until now unidentified). The LAT spectrum is best-fit by a broken power-law with the break energy $E_b = 297 \pm 15 MeV$. The index above E_b is 2.60 ± 0.04, and is consistent with the flux and spectral index above 100 GeV for HESS J1808–204, suggesting an association between the two sources. Meanwhile, the interacting supernova remnant SNR G9.7-0.0 is also a potential contributor to the LAT flux. A tentative flux enhancement at the MeV band during a 45-day interval (2011 Jan 21 – 2011 Mar 7) is also reported. We discuss possible origins of the extended LAT source in the context of both leptonic and hadronic scenarios.

S7-3 Radio Observations of Pulsar Wind Nebula

Stephen Ng
The University of Hong Kong

As a pulsar spins down, its rotational energy is mainly carried away by relativistic particle wind. Upon interaction with the surrounding medium, a wind termination shock is formed, with a synchrotron bubble downstream known as a pulsar wind nebula (PWN). Due to long synchrotron cooling time in radio frequencies, radio studies of PWNe can reveal the integrated history, tracing the long-term evolution of a system and providing complementary information to higher energy observations. In addition, radio polarization measurements offer a powerful probe of the magnetic field configuration in PWNe, which can give insights into the particle acceleration process in relativistic shocks.
In this talk I will give a brief introduction of PWNe in radio and present recent observational results of systems at various evolution stages, from a young PWN inside a supernova remnant to a middle age system crushed the supernova reverse shock to a bow shock nebula in the interstellar medium.
This work is supported by an ECS grant of the Hong Kong Government under HKU 709713P. The Australia Telescope is funded by the Commonwealth of Australia for operation as a National Facility managed by CSIRO.

S8-1 Gamma-Ray Bursts in the Last Frontier: the 10–100 GeV Energy Band

Pak Hin Thomas Tam[1], Xiangyu Wang[2], Qingwen Tang[3]
1 Sun Yat-Sen University
2 Nanjing University
3 Nanchang University

Thanks to many space-borne detectors such as the Swift and Fermi satellites and numerous ground-based followed-up telescopes, gamma-ray bursts (GRBs) are now quickly covered in virtually every wavelength in the electromagnetic spectrum. One of the main scientific objectives of the Fermi's two instruments: Gamma-ray Burst Monitor (GBM) and Large Area Telescope (LAT) are the study of GRBs. Covering the energy range above 30 MeV, the LAT has seen more than a hundred GRBs and have seen tens of photons above 10 GeV from several bright GRBs, limited by its collective area. In this talk, I will review recent GRB observations at >10 GeV and discuss the corresponding radiation mechanisms in the afterglow.

S8-2 Chandra Phase-Resolved Spectroscopy of the High-Magnetic-Field Pulsar B1509–58

Chin-Ping Hu, Stephen Ng
The University of Hong Kong

We report on timing and spectral analysis of the young, high-magnetic-field pulsar B1509–58 using Chandra continuous-clocking mode observation. The on-pulsed X-ray spectrum can be described by a power law with a photon index of 1.16(4), which is flatter than those determined with RXTE/PCA and NUStar. This result supports the log-parabolic model for the broadband X-ray spectrum. With the unprecedented angular resolution of Chandra, we clearly identified off-pulsed X-ray emission from the pulsar. The spectrum is best fitted by a power law plus blackbody model. The latter component has a temperature of 0.14 keV, which is similar to those of other young and high-magnetic-field pulsars, and lies between those of magnetars and typical rotation-powered pulsars. For the non-thermal emission of PSR B1509–58, we found that the power-law component of the off-pulsed emission is significantly steeper than that of the on-pulsed one. We further divided the data into 24 phase bins and found that the photon index varies between 1.0 and 2.0 and anti-correlating with the flux. A similar correlation was also found in the Crab Pulsar, and this requires further theoretical interpretations.

S8-3 Statistical Analysis of Radio-Quiet Gamma-Ray Pulsars

Jongsu Lee, David C. Y. Hui
Chungnam National University

We have performed a statistical analysis to compare the populations of radio-quiet gamma-ray pulsars and radio-loud gamma-ray pulsars. In a preliminary analysis, we have found that these two population can be differ in a number of parameters, including magnetic field of light cylinder, gamma-ray to x-ray flux ratio, and the shape of their spectra. Such differences can possibly lead us to have a deeper insight of the acceleration mechanism in the pulsar magnetosphere.

S9-1 Fast Radio Bursts and Relevant Problems

Zigao Dai, J. S. Wang, X. F. Wu, Y. F. Huang
Nanjing University

In this talk, I first give a brief review on the studies of fast radio bursts (FRBs). And then, I talk about our model for repeating FRBs in detail. In this model, highly magnetized pulsars travel through asteroid belts of other stars. We show that a repeating FRB could originate from such a pulsar encountering with lots of asteroids in the belt. During each pulsar-asteroid impact, an electric field induced outside a radially elongated, transversely compressed asteroid near the pulsar's surface is strong enough to accelerate electrons to ultra-relativistic speeds instantaneously. Subsequent movement of these electrons along magnetic field lines not only gives rise to an electric circuit, but also produces coherent curvature radiation, which can well account for all the properties of a cosmological FRB. While the high repetitive rate estimated is well consistent with the observed value, the predicted occurrence rate of repeating FRBs may imply that our model would be testable in the next few years. Finally, I discuss some problems in this research field.

S9-2 Fast Radio Bursts: Statistical Properties and Cosmological Use

Fayin Wang
Nanjing University

First, I will present the statistical properties of fast radio bursts (FRBs), such as fluence, peak flux, duration and waiting time. These properties are compared with theoretical model predictions. Then I will talk about the measurement of the proper distance-redshift relation with dispersion measures (DMs) of FRBs.

S10-1 R-Process Macronovae in GRB 060614 and 050709: Evidence for the Merger of a Neutron Star-Black Hole Binary System

Daming Wei[1], Zhi-Ping Jin[1], Yi-Zhong Fan[1], Tsvi Piran[2], Stefano Covino[3]
1 Purple Mountain Observatory
2 The Hebrew University
3 INAF/Brera Astronomical Observatory

Recently, the re-examination of the afterglow data of long-short burst GRB 060614 and short GRB 050709 both reveal significant I-band excesses at about 10 day after the bursts in joint-analysis of VLT and HST observations. The behaviors of these excesses are similar and can be interpreted as the macronova emission arising from the ejection of ~0.1 solar mass of r-process material from a neutron star-black hole merger. It means that neutron star-black hole mergers are sites of significant production of r-process elements. Similar infrared and optical signals are expected from collisions and coals cences of neutron stars or black holes, following the detections of gravitational waves from these events.

S10-2 On the Astrophysical Sources of High-Energy Neutrinos

Xiang-Yu Wang
Nanjing University

The Ice-Cube Collaboration recently announced the first-time discovery of extraterrestrial neutrinos. I will talk about recent theory progress and pay attention to the candidate sources for the high-energy neutrinos. As the neutrino production generates also gamma-rays, I will also talk about the gamma-ray constraints on the sources of high-energy neutrinos.

B1-1 Realising the Dreams: From IT to Astronomy to Entrepreneurship

Alvis Ko
The Origo Ltd.

This presentation is intended to be a sharing session rather than a formal talk. Alvis will share his insider experience as an astrophysics research student, employee, and business founder. He will focus on how the research training helped his career and also solving problems in individual work projects. Observations and experiences will be shared regarding selecting a career path, stepping out of the comfort zone, and growing through personal development.

B1-2 Data science in physics and finance

Ki Cheong Franky Wong

[No abstract]

B1-3 From Astrophysics to Financial Industry

Ying Kit Chan
Fenics Software, GFI, BGC

Multiply discipline collaboration is becoming more and more important. And applying skills trained in Physics curriculum to other topics is now become an emerging research topic. In this talk, I will share my experience how I benefit from my Physics training and how we can apply our knowledge in the industry. Also I will highlight some connections between Financial Engineering and Quantum Mechanics.

B2-1 My Pursuit of the Beauty of Astronomy

Kwok Wai Eddie Ng

It would cover my favour on astronomy since my childhood, reading magazines, star gazing, studying at the college and keeping abreast of the astronomy knowledge with peers. Purely not academic and simply a sharing on keeping the enthusiasm.

B2-2 How Useful is Astronomy Training to Career in Physics

Hoi Fung Chau
The University of Hong Kong

Not everyone with astronomy training will become a professional astronomer. Some may find jobs outside the academia. Even those stay in the “ivory tower” may not actively conduct their research in astronomy. In this talk, I will share with you my views and experience on the usefulness of astronomy training to a career in physics.

Posters

P-1 Relations between the Radio Spectral Indices and Flux Densities of Blazars

Yuhai Yuan, Junhui Fan, Zhiyuan Pei
Guangzhou University

Relations between the flux densities (F) and spectral indicescan help us to analyze the emission process. In this paper, based on UMRAO, we analyze the relations between the spectral index and the flux density at 14.5 GHz of 8 blazars (0235 + 164, 0430 + 052, 1156 + 295, 3C345, 1308 + 326, 1413 + 135, 3C454.3, 1749 + 096).

P-2 3FGL J2039.6−55618: A new Candidate Redback MSP

Andrea Belfiore[1], David Salvetti[1], Roberto Mignani[1], Pablo Saz Parkinson[2]
1 INAF - IASF (Milan)
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Fermi-LAT has opened a new era in gamma-ray astronomy, particularly in the field of pulsars, where new populations have emerged. Recycled millisecond pulsars (MSPs) represent a growing fraction of them, thanks to the synergy with radio, X-ray, and optical facilities. Black widows and redbacks are binary systems where an MSP is in a compact circular orbit around a low mass star, that gets ablated. We selected pulsar candidates applying automatic classification algorithms to unassociated LAT sources. Through X-ray, optical, and infrared follow-up we isolated 3FGL J2039.6-5618 as a most likely redback system. Its multiwavelength light curves show a significant periodicity of 0.227 days, with X-ray characteristics typical of an intra-binary shock. The orbital light curve has a peculiar 2-peaks morphology from infra-red to optical, that can be explained by differential heating in a tidally deformed companion. While pulsations have not been detected yet, deep searches are under way both in radio and in gamma rays.

P-3 Constraint on the Mass and Spin of GRB Central Black Hole

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Black holes (BHs) hide themselves behind various astronomical phenomena, and their properties, i.e., mass and spin, are usually difficult to constrain. One leading candidate for the central engine model of gamma-ray bursts (GRBs) invokes a stellar mass BH and a neutrino-dominated accretion flow (NDAF), with the relativistic jet launched due to neutrino-anti-neutrino annihilations. Such a model gives rise to a matter-dominated fireball, and is suitable to interpret GRBs with a dominant thermal component with a photospheric origin. We propose a method to constrain BH mass and spin within the framework of this model, and apply the method to a thermally-dominant GRB 101219B whose initial jet launching radius r0 is constrained from the data. Using our numerical model of NDAF jets, we estimate the following constraints on the central BH: mass $M_{BH}\sim 5-9M_{sun}$, spin parameter $a^{*} \geq 0.6$, and disk mass $3M_{sun} \leq M_{disk} \leq 4M_{sun}$. Our results also suggest that the NDAF model is a competitive candidate for the central engine of GRBs with a strong thermal component.

P-4 Spectral Features of Inhomogeneous Accretion Flows around Black Holes

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The accretion flow during the X-ray state transition should be different to the standard accretion flow or the advection dominated accretion flow. There are several models to explain the transition process. One of the models is the inhomogeneous accretion flow, with cold clumps embedding in the continuous hot corona. A lot of work has shown that the clumps are produced due to instabilities and can be maintained by the magnetic field. Using Monte Carlo methods and ray-tracing methods, we investigate the continuum and emission line features of inhomogeneous accretion flow, respectively. Some clues of transition process are found by comparison with observations.

P-5 STEMS3D: An X-Ray Spectral Model for Magnetar Persistent Radiations

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Anomalous X-ray pulsars and soft gamma-ray repeaters are recognized as the most promising magnetar candidates, as indicated by their energetic bursts and rapid spin-downs. It is expected that the strong magnetic field leaves distinctive imprints on the emergent radiation both by affecting the radiative processes in atmospheres of magnetars and by scattering in the upper magnetospheres. We construct a self-consistent physical model that incorporates emission from the magnetar surface and its reprocessing in the three-dimensional twisted magnetosphere using a Monte Carlo technique. The synthetic spectra are characterized by four parameters: surface temperature kT, surface magnetic field strength B, magnetospheric twist angle $\Delta\phi$, and the normalized electron velocity β. We also create a tabular model (STEMS3D) and apply it to X-ray spectra of magnetars.

P-6 Unbiased Correction Relations for Galaxy Cluster Properties Derived from Chandra and XMM-Newton

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We use a sample of 62 clusters of galaxies to investigate the discrepancies between the gas temperature and total mass within r_{500} from XMM-Newton and Chandra data. Comparisons of the properties show that (1) both the de-projected and projected temperatures determined by Chandra are higher than those of XMM-Newton and there is a good linear relationship for the de-projected temperatures: $T_{Chandra} = 1.25 \times T_{XMM} - 0.13$. (2) The Chandra mass is much higher than the XMM-Newton mass with a bias of 0.15 and our mass relation is $log_{10}M_{Chandra} = 1.02 \times log_{10}M_{XMM} + 0.15$. To explore the reasons for the discrepancy in mass, we recalculate the Chandra mass (expressed as M_{Ch}^{mo}/d) by modifying its temperature with the de-projected temperature relation. The results show that M_{Ch}^{mo}/d is closer to the XMM-Newton mass with the bias reducing to 0.02. Moreover, M_{Ch}^{mo}/d are corrected with the r_{500} measured by XMM-Newton and the intrinsic scatter is significantly improved with the value reducing from 0.20 to 0.12. These mean that the temperature bias may be the main factor causing the mass bias. Finally, we find that M_{Ch}^{mo}/d is consistent with the corresponding XMM-Newton mass derived directly from our mass relation at a given Chandra mass. Thus, the de-projected temperature and mass relations can provide unbiased corrections for galaxy cluster properties derived from Chandra and XMM-Newton.

P-7 Gravitational Wave's Detection

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On September 14, 2015, aLIGO detector observed the GW150914. This GW150914 is caused by two black hole merger. The signal swept upwards in frequency from 35 to 250 Hz with a peak gravitational-wave strain of 1.5×10^{-21}. Since a LIGO detected GW150914, many institutions want to detect the gravitational wave again. The compact object is a good source to cause gravitational wave. So many detectors are designed to detect the compact objects' gravitational wave. The plans of gravitational wave's detection are very important for the development of astronomy. In this poster I will introduce some plans of gravitational wave detection.

P-8 High Resolution Radio Polarimetry Study of The Pulsar Wind Nebula MSH 15-52

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We present a new high-resolution radio imaging study of the pulsar wind nebula (PWN) MSH 15-52, also dubbed as "the hand of God", with the Australia Telescope Compact Array observations. The system is powered by a young and energetic radio pulsar B1509–58 with high spin down luminosity of $\dot{E} = 2 \times 10^{37} erg/s$. Previous X-ray images have shown that the PWN has a complex hand-shape morphology extending over 10 pc with features like jets, arc, filaments and enhanced emission knots in the HII region RCW 89. The new 6cm and 3cm radio images show different morphology than the X-ray counterpart. No radio counterpart of the X-ray jet is detected, instead we found enhanced emission in a sheath surrounding the jet. Additional small-scale features including a polarized linear filament next to the pulsar have also been discovered. Our polarisation measurements show that the intrinsic orientation of magnetic field aligns with the sheath. Finally, spectral analysis results indicate a steep spectrum for the system, which is rather unusual among PWNe. Implications of these findings will be discussed.
