The 2nd PANDA Symposium on Multimessager Astronomy - Jets and Shocks in the Universe

Monday, 22 April 2013 - Friday, 26 April 2013

Xi'an

Book of Abstracts

Contents

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Bright broad-band afterglows of gravitational wave bursts from binary neutron star mergers as a probe of millisecond magnetars

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If double neutron star mergers leave behind a massive magnetar rather than a black hole, a bright early afterglow can follow the gravitational wave burst (GWB) even if there is no short gamma-ray burst (SGRB) - GWB association or there is an association but the SGRB does not beam towards earth (Zhang 2012). Besides directly dissipating the proto-magnetar wind, we here suggest that the magnetar wind could push the ejecta launched during the merger process, and under certain conditions, would reach a relativistic speed. Such a magnetar-powered ejecta, when interacting with the ambient medium, would develop a bright broad-band afterglow due to synchrotron radiation. We study this physical scenario in detail, and present the predicted X-ray, optical and radio light curves for a range of magnetar and ejecta parameters. We show that the
X-ray and optical lightcurves usually peak around the magnetar spindown time scale (~ 10ˆ3 – 10ˆ5 s), reaching brightness readily detectable by wide-field X-ray and optical telescopes, and remain detectable for an extended period. The radio afterglow peaks later, but is much brighter than the case without a magnetar energy injection. Therefore, such bright broad-band afterglows, if detected and combined with GWBs in the future, would be a probe of massive millisecond magnetars and stiff equation-of-state for nuclear matter.

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no lecture

Summary:

Detecting these bright signals associated with GWB triggers would unambiguously confirm the astrophysical origin of GWBs. Equally importantly, it would suggest that NS-NS mergers leave behind a hyper-massive neutron star, which gives an important constraint on
the neutron star equation of state. With the GWB data, one can infer the information of the two NSs involved in the merger. Modeling afterglow emission can give useful constraints on the ejected mass Mej and the properties of the post-merger compact objects. The combination of GWB and afterglow information would shed light into the detailed merger physics.

1

On the X-ray emission mechanisims of short bursts from magnetars

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Magnetars are isolated neutron stars with extremely strong magnetic fields, commonly known as Soft Gamma Repeaters (SGRs) and Anomalous X-ray Pulsars (AXPs). Magnetars are persistent X-ray

emitters. Occasionally they enter into active episodes, and emit X-ray bursts with luminosities anywhere between 10^{37} and 10^{45} erg/s. Persistent X-ray emission and bursts are both attributed to the decay of extremely strong magnetic fields in the framework of the magnetar model. However, it is not trivial to describe the observed data with detailed physical models, considering that the radiation ought to emerge from the strong magnetic and gravitational fields. In this talk I will first summarize our broadband spectral investigations of short duration bursts using phenomenological models, and then focus on our first attempt to study the burst spectrum with the physically motivated model. We detailed analyzed the spectra of both persistent emission and low-fluence bursts from SGR J0501+4516 observed during a very deep XMM-Newton observation near the peak of its 2008 outburst. For the persistent emission, we adopted an idealized physical model namely the Surface Thermal Emission and Magnetospheric Scattering model and spectroscopically determine important source properties such as the surface magnetic field strength and the magnetospheric scattering optical depth. We generated a magnetospheric scattered modified blackbody model and successfully described the low-fluence burst spectrum. Our results indicated that the burst and the persistent emission photons went through different radiation transfer processes before scattered in the magnetosphere. Therefore, very low-fluence bursts from magnetar are physically different from the persistent emission.

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Please refer to the main papers:
Lin et al. 2012, ApJ, 759, 54
Lin et al. 2012, ApJ, 761, 132

2

Two Types of Magnetic Reconnection in Coronal Bright Points and the Corresponding Magnetic Configuration

Author: Qingmin Zhang[1]

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Coronal bright points (CBPs) are long-lived small-scale brightenings in the solar corona. They are generally explained by magnetic reconnection. However, the corresponding magnetic configurations are not well understood. We carry out a detailed multi-wavelength analysis of two neighboring CBPs on 2007 March 16, observed in soft X-ray (SXR) and EUV channels. It is seen that the SXR light curves present quasi-periodic flashes with an interval of ~1 hr superposed over the long-lived mild brightenings, suggesting that the SXR brightenings of this type of CBPs might consist of two components: one is the gentle brightenings and the other is the CBP flashes. It is found that the strong flashes of the bigger CBP are always accompanied by SXR jets. The potential field extrapolation indicates that both CBPs are covered by a dome-like separatrix surface, with a magnetic null point above. We propose that the repetitive CBP flashes, as well as the recurrent SXR jets, result from the impulsive null-point reconnection, while the long-lived brightenings are due to the interchange reconnection along the separatrix surface. Although the EUV images at high-temperature lines resemble the SXR appearance, the 171 Å and 195 Å channels reveal that the blurry CBP in SXR consists of a cusp-shaped loop and several separate bright patches, which are explained to be due to the null-point reconnection and the separatrix reconnection, respectively.

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In this paper, we carried out a detailed multi-wavelength analysis of two neighboring CBPs captured by Hinode/XRT and STEREO-B/EUVI on 2007 March 16. During the 5 hr observations, the newly formed northern CBP was dynamic,

with strong flashes accompanied by SXR jets. The spot-like feature in SXR can be resolved into a cusp-shaped loop under the jet and several discrete kernels in 171Å and 195 Å. The preexisting CBP, i.e., BP2, however, presented gentler variations, probably due to the fact that it was in the late phase of its lifetime, and no jets were found during the observations. The potential field extrapolation revealed that the two bright points are located above "embedded bipolar fields," where one polarity is surrounded by the opposite polarity. Both of them are covered by a dome-like separatrix surface with a magnetic null point above. The height of null points, which characterizes the height of reconnection, is found to correlate with the magnetic flux of the embedded polarities under the null points.We suggest that the SXR light curves of the bright points of this type present two components: quasi-periodic recurrent flashes with a period of ~1 hr and long-lived brightenings with small-amplitude fluctuations. The CBP flashes result from the impulsive null-point reconnection between the small-scale loops and the unipolar field, which leads to the cusp-shaped structure and jets guided by the spine field lines, whereas the long-lived brightenings are due to the gentle interchange reconnection along the separatrix surface between the anemone-like loops and the unipolar field, which gives rise to bright kernels around the cusp. The two types of reconnection in a single event might be responsible for those CBPs associated with recurrent jets. According to the 3D magnetic configuration of the CBPs, we infer that the quasi-periodic CBP flashes might be caused by the magnetic reconnection modulated by slow-mode wave along the spine field lines or be due to the recycling of continuous pumping of magnetic energy via the localized rotating motions of the photosphere and the sporadic releasing of the magnetic free energy. Further investigations are required in order to find out how often the CBPs are associated with the "embedded bipolar field."

4

Central black hole masses in ultraluminous X-ray sources

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Ultra-luminous X-ray sources(ULXs) are off-nuclear X-ray sources in nearby galaxies with X-ray luminosities $L_{\rm X} > 10^{39}$ erg s^{-1}. The estimates of black hole(BH) masses of ULXs is a long-standing problem. Here we estimate BH masses of ULXs from both the X-ray photon index and X-ray variability using the correlations derived from reverberation mapping active galactic nuclei (AGNs), and discuss whether the results are in agreement with each other. We find that some high-luminosity($L_{\rm X} > 10^{40.5}$ erg s^{-1}) ULXs contain the BH of 10^4-10^5 $M_{\odot}$. While the X-ray variability for some low-luminosity($L_{\rm X} < 10^{40.5}$ erg s^{-1}) ULXs suggests larger masses, which are in conflict with that from X-ray photon index. This may indicate that some low-luminosity ULXs generally accrete at different rate as luminous AGNs, or they have different power spectral densities of X-ray variability.

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We discuss two methods to estimate black hole (BH) masses using X-ray data only: from the X-ray variability amplitude and from the photon index Γ.

5

NS-NS merger: forming a short-living (˜100 s) supramassive neutron star (SMNS)?

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Co-author: Wei-hong Gao [2]

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In this talk I'll give a brief review of the current viewpoints on the possible outcome of double neutron star mergers. Special attention will be given to the possibility of forming a short-living (˜100 s) supramassive neutron star. The current observational evidence will be discussed.

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7

Molecular Environment toward the Supernova Remnant IC443

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We present the CO observations towards the well known mixed-morphology supernova remnant (SNR) IC443 to investigate its overall molecular environment. Some northern and northeastern partial shell structures of the CO gas were discovered around the remnant. It is clearly shown that one of the partial shell, about 5' extending beyond the northeastern border of the remnant's bright radio shell, seems to just confine the faint radio halo which was identified by Lee et al. (2008). On the other hand, some faint CO clumps can be discerned along the eastern boundary of the faint remnant's radio halo. Connected the eastern CO clumps, the northeastern partial shell structures, and the northern CO partial shells, we can see that it seems to form a half ring structure to surround the remnant. The CO spectra from the northeastern partial shell structures and the eastern CO clumps indicate that the LSR velocities of the emission are about -5 to -2km/s, which velocities are consistent with the LSR velocity of the quiescent, ambient gas associated with the shocked clumps B, E, F, and G. In combination with the 13CO LSR velocity distribution in the field of view of SNR IC443, thus we suggest that the half ring structure of the CO emission at V_LSR˜-4km/s is associated with the famous SNR. We suspect that these structures probably have relation to the stellar wind of SNR IC443's massive progenitor.

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1. The -4km/s MC extending along the northwest-southeast direction is mainly located on the front of SNR IC˜443. It is close to and associated with the remnant.
2. We find that a half ring structure centered at (06h16m50.3s,22d37'11") with radius of 26' appear to surround the northern part of SNR IC443. We suggest that this structure in the velocity range of -5 to -2km/s is associated with IC443. It may not be interacted with SNR IC443 directly, but associated with the stellar winds of it's massive progenitor star.
3. The progenitor of the remnant is probably a 12Msun B1 V star, whatever, it is not larger than a 20Msun O9 V star.
4. A faint CO bubble with diameter of 16" in the interval of -9.2 to -7.8km/s was discovered to be located to the north of the SNR IC443.

8

Evidence for Gamma-ray Jets in Our Milky Way

Author: Meng Su Su[1]

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Based on data from the Fermi Gamma-ray Space Telescope, we have discovered two gigantic gamma-ray emitting bubble structures in our Milky Way (known as the Fermi bubbles), extending ˜50 degrees above and below the Galactic center with a width of ˜40 degrees in longitude. The gamma-ray emission associated with these bubbles has a significantly harder spectrum (dN/dE ˜ Eˆ(−2)) than the inverse Compton emission from known cosmic ray electrons in the Galactic disk, or the gamma-rays produced by decay of pions from proton-ISM collisions. There is no significant difference in the spectrum or gamma-ray luminosity between the north and south bubbles. The bubbles are spatially correlated with the hard-spectrum microwave excess known as the WMAP haze; we also found features in the ROSAT soft X-ray maps at 1.5 − 2 keV which line up with the edges of the bubbles. The Fermi bubbles are most likely created by some large episode of energy injection in the Galactic center, such as past accretion events onto the central massive black hole, or a nuclear starburst in the last ˜10 Myr. Study of the origin and evolution of the bubbles also has the potential to improve our understanding of recent energetic events in the inner Galaxy and the Galactic cosmic ray acceleration. Furthermore, we have recently identified a gamma-ray cocoon feature within the southern bubble, with a jet-like feature along the cocoon ' s axis of symmetry, and another directly opposite the Galactic center in the north. If confirmed, these jets are the first resolved gamma-ray jets ever seen.

0:

I will discuss the galactic jet in our milky way

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Unveiling the Super-orbital Modulation of LS I +61 303 in X-rays

Author: Jian Li[1]

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LS I +61 303 is one of a handful of high-mass X-ray binaries that have been detected at all frequencies through radio to TeV. Its nature is still under debate, with rotationally powered pulsar-composed systems and microquasar jets being discussed. LS I +61 303 is a very bright TeV source and one of the 15th brightest GeV sources detected by Fermi. However, it enters a low TeV state and its Fermi MeV-GeV emission has declined in recent years for an unknown reason.

We found evidence from the longest monitoring of LS I +61 303 done to date by RXTE for the 1667 days super-orbital modulation in X-ray, which is probably related to the recent low state of very high energy emission. The 1667 days super-orbital period has already been detected at non-contemporaneous radio and optical measurements. We have found in phase super-orbital variability between optical frequencies and X-ray. However, the super-orbital variability at radio frequencies and X-ray are not consistent in phase, a 281.8 +/- 44.6 days shift are discovered.

The multi-wavelength phenomenology in super-orbital modulation of LS I + 61 303 and in particular, the recent low TeV emission, can be explained in the context of a high magnetic field, slow period pulsar model. In that case, LS I +61 303 system would most likely be subject to a flip-flop behavior, from a rotationally powered ejector regime in apastron to a propeller regime in periastron along each of the system ' s eccentric orbits. With long term variation of the accreted mass, these observed multi-wavelength behaviors are expected from LS I +61 303.

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r-mode instability in new born neutron stars

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[1] *Central China Normal University*

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r-mode instability in new born neutron stars (I will complete the form later)

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r-mode instability in new born neutron stars (I will complete the form later)

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Magnetic field amplification and maximum cosmic ray energy in supernova remnants

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It is widely believed that supernova remnants are the main sources of Galactic cosmic rays. The maximum energy to which particles can be accelerated through diffusive shock acceleration depends on the shock velocity and magnetic field amplification upstream of the blast wave. Magnetic fields can be amplified when escaping cosmic rays trigger a return current in the plasma that drives a current driven instability. The length scale of the field fluctuations determines the energy to which cosmic rays are confined. When cosmic rays are better confined, the current will decrease, generating a feed-back process on the amplification of the magnetic field. We have run simulations in which we incorporate this process and evaluate its self-consistency and effects on the upstream medium.

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N/A

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Fast co-evolving behavior of the corona with type-I X-ray bursts

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Taking advantage of the type-I X-ray bursts from the hard surface of a NS of the NS XRB Aql X-1 to probe the purported corona, we found, during the bursts, a clear anti-correlation between the soft and the hard X-rays, which indicates an additional cooling of the corona with the soft X-ray shower fed by the bursts. The phenomenon was also found in IGR J17473-2721, 4U 1636-536 and 4U 1608-522. The time delay between the burst emission and corona emission are different each other, but the time delay are all within 5 seconds. The similarity and difference may be understood that the corona have same mechanism but behave different structure or scale
along with the outbursts evolutions.

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The phenomenon was also found in IGR J17473-2721, 4U 1636-536 (Ji et al. 2012) and 4U 1608-522 (Chen et al. 2012a). The time delay between the burst emission and corona emission are different each other, but the time delay are all within 5 seconds. The
similarity and difference may be understood that the corona have same mechanism but behave different structure or scale along with the outbursts evolutions.

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Study of the scatter in single-epoch virial black mass estimates

Author: Rui She[1]

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The most frequently used method to estimate the BH mass of broad-line AGN and quasars is the so-called single-epoch virial BH mass estimators, in which one estimates the BH mass based on two quantities, the continuum luminosity of the AGN, and the line width of the broad emission lines, both are measured from single-epoch spectra. This method have strong assumptions about the intepretations of continuum luminosity and broad line width.

Since AGNs vary on weeks to years timescales, the changes in continuum luminosity and line profile will lead to scatter in the single-epoch virial BH masses estimates from different spectra for the same object.

We studied the consequences of AGN spectral varibility on the scatter of single-epoch virial BH mass estimates, and tested some of the underlying assumptions of this technique.

The dataset used is: duplicate quasar spectra from SDSS (mostly are two-epoch spectra for thousands of objects)

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Type-I burst as probe of the XRB corona

Author: long ji[1]

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The type-I X-ray bursts are thermonuclear explosions on the surface of neutron stars, which can be used to probe the corona. Because of their well-known location and intensity, the seed photons from the bursts can be regarded as a shower of soft X-rays, which comptonize with the hot plasma in the corona. The cooling of the corona has been observed in IGR 17473-2721, Aqla X-1, and 4u 1636-536. The shortage of hard X-rays, and the time lag between soft and hard X-rays can constraint the theoretical disk-corona model, namely, the detailed location and formation mechanism of the corona.

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Finding a Precessional Disk around the Obscured Supergiant X-ray Binary IGR˜J16318-4848

Author: Jingzhi Yan[1]

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We present the results of the long-term near infrared (NIR) photometric observations on IGR˜J16318-4848. Two period of 26.7 days and 79.7 days are found in the Swift/BAT light curve. A similar 80-day period is found from the JHK light curve of IGR˜J16318. The 26.7-day period is interpreted as the orbital period of the system and the neutron star moves in the dense circumstellar disk of the supergiant star. The same 80-day period found both in the Swift/BAT and the JHK light curves might be due to the precession of the circumstellar disk, which caused by the tidal motion of the neutron star.

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Evolution of characteristic time scales during the outbursts of the black hole transient GX 339-4

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We report the power density spectral evolution of GX 339-4 during the rising phase of four outbursts in 2002-2010. In order to probe the change in accretion geometry, we study the characteristic frequencies in the power spectra. Our results demonstrate quite uniform evolutional pattern for low frequency quasi-periodic oscillations, especially with the fact that the four cases differ great in the outburst magnitude. While for band-limited noises, larger scattering exists. Both sorts of power spectral components show significant relative rate-of-change on the timescale of one day, e.g., as much as 50 percent or more in some cases. We think that these phenomena may reflect properties of non-stationary accretion flow, which does not support either the SSD or the ADAF regime.

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intermediate Palomar Transient Factory: system and first results

Author: Yi Cao[1]

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Based on the Palomar Transient Factory (PTF), a major upgrade in both real-time pipeline and survey strategy has been performed in order to better detect very young supernovae and fast transients. The new phase of PTF, intermediate PTF (iPTF), started February 2013. With the new pipeline, we are able to discover a supernova candidate within 30 minutes after an image is taken. In this talk, I will introduce the real-time system of iPTF and its survey strategy. I will also present first results from iPTF from the first few months.

26

Non-Thermal Emission and Electron Acceleration in Young Supernovae

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While radiation signals from extragalactic young supernovae (within about a year after the explosion) are mostly emitted in optical and near-infrared, some of them are also non-thermal emitters in radio and X-ray. The non-thermal signal comes from the hydrodynamic interaction between the expanding supernova (SN) ejecta and circumstellar materials (CSM), and has been found to be useful to probe the CSM properties. In this talk, I discuss another aspect –how this is useful also for studying the electron acceleration mechanism at a strong shock wave. An emphasis is placed on the physical condition difference in young SNe and SN remnants (SN), especially highlighted by a potential to derive information (e.g., acceleration efficiency, energy distribution) on low energy electrons before being accelerated by a standard diffusive shock acceleration mechanism.

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Transient Universe and Gravitational Wave Astronomy

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A number of fascinating phenomena in the Universe produce transient events
studied by traditional astronomy in a wide spectrum of messengers: multi-wavelength
electromagnetic radiation, neutrinos and cosmic rays.
Gamma ray bursts, supernovae and other violent events are hallmarks of
fundamental astrophysical processes which govern the Universe. They may also produce
gravitational waves (GW) predicted by General Relativity. Coming from the strong field core
of the astrophysical events, gravitational waves will dramatically expand our means to
study the transient Universe. This is particularly true if gravitational wave events are
unambiguously associated with other messengers. In my talk I'll discuss anticipated
scientific benefits of multi-messenger observations, experimental and data analysis
challenges of joint experiments and prospects of future GW astronomy.

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Neutrino messenger approach for studying gamma-ray bursts and sources of ultra-high energy cosmic rays

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High-energy (TeV-PeV) neutrinos are predicted to be produced by cosmic ray particles in gamma-ray bursts, so they are key probes of the dissipation mechanism and jet composition of GRBs. I will talk about recent progresses of the IceCube observations on GRB neutrinos and the theoretical implication. I will also talk about the ultra-high energy (EeV) neutrino emission produced by ultra-high energy cosmic rays interacting with cosmic background photons and its implication for studying the sources of ultra-high energy comsmic rays.

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Durations of spectral state transitions in X-ray binaries and the implications

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Physics of the X-ray state transition are still not well understood. Comparisons between the black hole systems and the neutron star systems or between the persistent sources and the transient systems are very valuable. We performed a systematic study of the spectral state transitions of Galactic X-ray binaries in the period between 2005 and 2012 with the RXTE/ASM and the Swift/BAT. We find that the duration of hard-to-soft state transition of black hole X-ray binaries is longer than that of neutron star X-ray binaries, and that of the persistent sources is longer than that of the transient sources. But there was no obvious difference between the duration of soft-to-hard state transition of neutron star X-ray binaries and black hole X-ray binaries. We compared the duration of soft-to-hard state transition to that of hard-to-soft state transition and found that the former
is longer than the latter for neutron star X-ray binaries, but
opposite for black hole X-ray binaries. There was no statistical relation between the duration and the orbital period, indicating the spectral state transition was due to properties of the inner accretion flow. There was also no correlation between the duration of hard-to-soft state transition and the peak luminosity of the following soft state for both persistent and transient sources, indicating the durations of the state transitions are statistically quite independent of the luminosity scale of the flares or outbursts. We discuss the implications of the results and the mechanisms for the spectral state transitions.

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The last three outbursts of H 1743-322 observed by RXTE in its latest service phase

Author: Jianeng Zhou[1]

Co-authors: Hanqin Gao [2]; Jian Li [2]; Jinlu Qu [2]; Qingzhong Liu [1]; Shu Zhang [2]; Yupeng Chen [2]; Zhen Zhang [2]

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After 2010, three outbursts of H 1743-322 were detected by RXTE. We have carried out timing and spectral analysis of the data, emphasizing on the two with relatively complete evolution history presented in the RXTE/PCA observations. We then constitute an enlarged outburst sample for H 1743-322, which allows to investigate the spectral transitions in more details. We find that the spectral transitions to high-soft state constrain a region for four outbursts in hardness-intensity diagram. An extension of the region locates in the vicinity of the failed outburst in 2008, and excludes it from a successful group. We therefore suggest the failed outburst in 2008 may present the first almost successful outburst sample, which is important for modelling the outburst, especially upon the conditions required for transition to high-soft state.

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Black hole transient 4U 1630-47: nature of the mHz QPO and its phase-resolved soft X-ray spectra

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We report the discovery of a 4.1-sigma significance 9.5 mHz QPO in Swift/XRT observation of the black hole candidate 4U 1630-472. mHz QPO with period longer than 100 seconds has never been discovered in this source. Phase-resolved spectroscopy revealed an accretion disk inner radius without significant change with phase. Phase dependent iron absorption feature has been discovered for the first time in this source. Under typical systematical parameters for a Galactic black hole binary system, the inner radius lies in the very vicinity of the black hole. We assumed that the accretion disk existed down to the ISCO. This allows us to measure the spin of 4U 1630−472 for possible binary system systematical parameters.

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the correlation between CIV and Hbeta line width for low-z and low-luminosity broad line AGNs

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Compared with MgII, Halpha, Hbeta, the CIV mass estimator has been claimed to have a bias for high-z and and high-luminosity broad-line AGNs. We use a sample of ˜70 low-redshift(z<0.8) AGNs with archive HST UV spectra and optical spectra from the literature(Marziani et al. 2003) to compare the CIV estimator and Hbeta estimator for the low-z and low-luminosity regime. We found that the continuum luminosity of L1350 and the broad line luminosities(LCIV and LHbeta) are well correlated with L5100. Relatively, L1350 and LCIV have larger scatter in the correlation with L5100. The CIV FWHM is poorly corrlated with Hbeta FWHM for low-z and low-luminosity AGNs. We try to correct

CIV FWHM with the blueshifit of the CIV centroid relative to that of Hbeta, but it does not improve the agreements with the Hbeta estimator.

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Wide-field transient searches: the impact of new discoveries on theory

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Many transient surveys are performed intensively in these days and found interesting objects that have not been detected such as superluminous supernovae, tidal disruption events, and faint supernovae. In this review, I summarize the currently-conducted transient surveys, introduce peculiar transients and their physical mechanism, and present future prospects.

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Low-mass X-ray Binary Transients in the RXTE era: Outbursts Properties and Challenges to Accretion Theory

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Low-mass X-ray binary transients (LMXBTs) offer a significant advantage to study accretion regimes and non-stationary accretion due to the large range and strong variation of the accretion rate on timescale of days to months. We have performed a statistical study of the outburst properties of 110 X-ray outbursts in 36 LMXBTs seen with the All-Sky Monitor (ASM; 2–12 keV) on board the Rossi X-ray Timing Explorer (RXTE) during 1996–2011. Among these sources, we found statistical evidence that longer orbital period systems have more massive accretion disc, which tends to generate brighter outburst and causes larger e-folding rise/decay timescale. So we highly suggest the disc mass plays a leading role in non-stationary accretion process. However, in some individual sources with multiple outbursts, there is no statistical correlation, which needs further investigation.

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Cosmological evolution of AGNs in galaxy clusters and groups

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to be submitted

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A new supersoft X-ray progenitor model for the particular type Ia supernovae

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By using a low mass supersoft source (SSS) model with magnetic confinement and Eggleton's code, we investigate the progenitors for some observed type Ia supernova (SNe Ia) with high absolute magnitude. We calculate the properties of supernova companions when the white dwarfs (WDs) of mass 1.0,1.1, and 1.2M(solar mass) grow to Chandrasekhar limit mass. We find that a low mass SSS with a magnetic WD which can confine the accreted matter in its polar caps can be the progenitor of the particular SNe Ia.

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Study of X-ray Dust Scattering Halo of IGR J17544-2619

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The diffuse interstellar dust will not only absorb those X-ray photons emitted by point source, but also scatter the X-ray, which may produce a diffuse halo around the point source. The angular distribution of halo intensity caused by single scattering can be determined by the spectrum of the point source, interstellar dust model and dust spatial distribution along the line of sight (LOS). Thus, X-ray dust scattering halo can be used to study the properties of interstellar dust, as well as the point sources. We studied the lightcurves of X-ray dust scattering halo of IGR J17544-2619, which is a supergiant fast X-ray transient (SFXT). During the observation given by Chandra X-ray Observatory on July 3, 2004, we found a desirable lightcurve of the outburst of the source. Analyzing the PSF subtracted lightcurve of the halo at different radii, and using the cross correlation method, we estimate the location of the dust concentration along LOS.

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Chandra observation of the tail of ESO 137-002

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We present the analysis of a deep Chandra observation of the tail associated with a late type galaxy– ESO 137-002 in A 3627. The tail is very narrow with a nearly constant width. Spectral analyses show that the gas in the tail has a nearly constant temperature throughout it. X-ray emission is enhanced to 2 sigma level at the position of the secondary H alpha tail revealed by SOAR. Comparisons are made between the tail of ESO 137-002 and the tails of ESO 137-001 studied in our previous work. Both the similarities and diversities bring challenges to current simulations.

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Diffuse PeV neutrino emission from Ultra-Luminous Infrared Galaxies

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The origins of the reported two PeV neutrinos (by Ice- Cube Collaboration) are highly controversial so far. Ultra-luminous infrared galaxies (ULIRGs) are the most luminous and intense starburst galaxies in the Universe. Both their star-formation rate (SFR) and gas surface mass density are very high, implying a high supernovae rate and an efficient energy conversion of energetic protons. A small fraction of these supernovae is the so-called hypernovae with a typical kinetic energy ˜10ˆ52 erg and a shock velocity >=10ˆ9cm sˆ-1. The strong shocks driven by hypernovae are able to accelerate cosmic ray protons up to 10ˆ17 eV. These energetic protons lose a good fraction of their energy through proton-proton collision when ejected into very dense interstellar medium, and as a result, produce high energy neutrinos (<=5 PeV). Recent deep infrared surveys provide solid constraints on the number density of ULIRGs across a wide redshift range 0<z<2.3, allowing us to derive the flux of diffuse neutrinos from hypernovae. We find that at PeV energies, the diffuse neutrinos contributed by ULIRGs are comparable with the atmosphere neutrinos with the flux of 2e-9 GeV cmˆ-2 sˆ-1 srˆ-1, by assuming the injected power law cosmic ray spectrum with the index of -2. Such a component may be detected in 20 years by the IceCube full configuration.

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Demography of Faint X-ray Sources in Galactic Bulge and Globular Clusters

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We have studied the luminosity functions (LFs) and X-ray Spectra of faint X-ray sources in four Galactic globular clusters (GCs, including 47 Tuc, NGC 6266, NGC 6397 and ω-Cen) and a field toward the Galactic Bulge (GB), using deep {\it Chandra} observations. Our analysis of the LFs statistically accounts for the detection incompleteness and Eddington bias as well as the background source contamination. The LF of the GB is consistent with that of such sources in the field (solar neighborhood), whereas those of the GCs appear substantially flatter. The flattening of the LFs is correlated with the stellar encounter rates of the GC, suggesting a dynamical origin for many of the X-ray sources. We further find that the specific source number of X-ray sources is generally smaller for those with luminosities less than 5×10^{30} erg s^{-1}. The exception is ω-Cen, the LF slope of which

is similar to that of the field/GB, but the specific source number is about a factor of $\sim 3-10$ lower than that in the GB/field, apparently due to a low initial binary fraction, as well as the old age and the dynamically un-evolved nature of the cluster. We extract individual and accumulated spectra for X-ray sources in each of the targets. The fitting results show the hardness of the spectra is related to the luminosity ranges and the environments. We further build a log-normal distributed, partially ionized warm absorber model and apply to the CVs in the GCs and in the Bulge, the results can help us understand the masses of WDs and the properties of accreted matter in CVs

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Theory of High Energy Sources II: Supernova Remnants, Gamma-Ray Bursts and Blazars

Author: Matthew Baring[1]

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Galactic supernova remnants and the extragalactic jet sources in blazars and gamma-ray bursts provide sites for some of the most energetic X-ray and gamma-ray emission seen in the cosmos. All are thought to be probable sources of cosmic rays and neutrinos, and their bright light signals are intimately connected to non-thermal leptons and hadrons accelerated in their zones of activity. This review talk summarizes the physics of particle energization and radiative dissipation in these sources, and briefly discusses their central driving engines. It highlights recent developments in the understanding of their environs, spawned by gamma-ray detections by Fermi and various Atmospheric Cherenkov Telescopes, and a multitude of X-ray observatories including Chandra, XMM, Suzaku and Swift. Prospects that future X-ray polarimetry could offer are briefly addressed.

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Radio transients and the next generation of wide-field searches

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The domain of impulsive radio transients is largely unexplored. Recent improvements in computational power and telescope field of view are opening up the parameter space potentially inhabited by many kinds of impulsive radio phenomena. In this talk I will describe some of the prospects for this field, as exemplified by the discovery of several bright high-dispersion measure extragalactic ("Lorimer") bursts. I will describe the physics germane to the detection of radio transients, and how facilities such as LOFAR, the MWA and the SKA will impact this field.

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The Chemical Evolution of Mn in the Local Dwarf Spheroidal Galaxies

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Iron-peak element distribution is very important for research of the evolution of dwarf spheroidal galaxies (dSphs). Manganese (Mn) is the most observed element for local dSphs in the iron-peak elements (except Fe). In this paper, an improved model, more reasonable supernova nucleosynthesis and supernova explosion rates are used to investigate the Mn evolution of three local dSphs: Fornax, Sulptor and Sextans. Our model can fit the main observation of Mn distribution for these local dSphs. The results indicate the current estimated star formation history of these dSphs is reliable and consistent with the observational data of Mn (except the Sculptor dSphs at [Fe/H]>-1.3). The results also give some limit to the supernova nucleosynthesis. For example, the assumption of metellicity-dependant Mn yield is not necessary because we can explain the observation without it.

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Search for gamma-ray emission from four accreting millisecond pulsars with Fermi /LAT

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We report our search for γ-ray emission in the energy range from 100 MeV to 300 GeV from four Accreting Millisecond Pulsars (AMPs), SAX J1808.4−3658, IGR J00291+5934, XTE J1814−338, and XTE J0929−314, with four-year observations of Large Area Telescope (LAT) onboard the Fermi γ-ray Space Telescope. The AMPs were not detected. We obtained their γ-ray luminosity upper limits and compared with γ-ray irradiation luminosities required for producing optical modulations seen from their companions suggested by Takata et al. (2012). The upper limits have excluded γ-ray emission as the heating source in these systems except XTE J0929−314. Our results also do not support the model proposed by Takata et al. (2012) that relatively strong γ-ray emission could arise from the outer gap of a high-mass neutron star controlled by the photon-photon pair-creation for the AMPs. For SAX J1808.4−3658 and IGR J00291+5934, we derive the upper limits of their γ-ray conversion efficiencies, which are 57% and 3%, respectively. We discuss the implications to the AMP systems by comparing the efficiency upper limit values with that of 20 γ-ray millisecond pulsars (MSP) detected by Fermi and the newly discovered transitional MSP binary J1023+0038.

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Acceleration of particles in AGN

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Active Galactic Nuclei are the prime candidate for the acceleration of ultra-high energy cosmic rays. Their nonthermal electromagnetic spectrum reveals a population of strongly accelerated particles inside their radiation regions. This lecture will cover the possible acceleration mechanisms of particles causing this nonthermal radiation and it will deal with the question how the content of nonthermal particles can be deduced from the electromagnetic spectrum.

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A two-step energy injection explanation for the rebrightenings of the multi-band afterglow of GRB 081029

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The afterglow of GRB 081029 showed unusual behavior, with a significant rebrightening being observed at optical wavelength at about 3000 s after the burst. One possible explanation is that the rebrightening is resulted from energy injection. Here, we present a detailed numerical study of the energy injection process and interpret the X-ray and optical afterglow light curves of GRB 081029. In our model, we have assumed two periods of energy injection, each with a constant injection power.
One injection starts at 2.8×10^3 s and lasts for about 2500 s, with a power of 7.0×10^{47} erg s^{-1}. This energy injection is mainly engaged to
account for the rapid rebrightening at about 3000 s. The other injection starts at 8.0×10^3 s and lasts for about 5000 s. The injection power is
3.5×10^{47} erg s^{-1}. This energy injection can help to explain the slight rebrightening at about 10000 s. It is shown that the observed optical afterglow,
especially the marked rebrightening at about 3000 s, can be well reproduced. In X-ray band, the predicted amplitude of the rebrightening is much shallower, which is also consistent with
the observed X-ray afterglow light curve. It is argued that the two periods of energy injection can be produced by the falling of clumpy materials onto the central compact object of the burster,
which leads to an enhancement of accretion and gives birth to a strong outflow temporarily.

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High Energy sources (observations)

Author: Isabelle GrenierN[one]

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Results from TeV astronomy

Author: Gallant YvesN[one]

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Cosmic Rays (Auger)

Author: Tom PaulN[one]

Cosmic rays with energies as high as 10ˆ20 eV have been observed, but unveiling their origins and composition is a daunting challenge due to the rarity of events at this extreme end of the energy spectrum. I'll review some of the latest efforts on this front, focusing primarily on The Pierre Auger Observatory. This observatory was designed specifically to study such ultra-high energy cosmic rays using a giant array of particle detectors and fluorescence light telescopes. I'll describe the experimental techniques employed to infer cosmic ray properties from the extensive air showers they produce when they interact in Earth's atmosphere, and present the latest results concerning the energy spectrum, primary composition, and searches for the cosmic ray sources.

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neutrinos

Author: Albrecht KarleN[one]

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Status of MMA in China: TIBET shower array, Radio telescopes, HXMT, SVOM

Author: Shuangnan ZhangN[one]

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Palomar Transient Factory (PTF)

Author: Mansi KasliwalN[one]

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Submm Astronomy (ALMA & CCAT)

Author: John CarpenterN[one]

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Gravitational Waves

Author: Bruce AllenN[one]

In this talk I describe the advanced ground-based gravitational-wave detector projects (LIGO in the USA, VIRGO in Italy, GEO in Germany, KAGRA in Japan, LIGO in India). I review the status and capabilities of the detectors, and outline the different types of sources which we hope to be able to detect, and the corresponding signal characteristics and analysis pipelines. We expect that the first direct detections of gravitational waves (perhaps around 2017) will be from the coalescence and merger of binary neutron star pairs. Such events may also be accompanied by electromagnetic

gamma-ray bursts. I will also outline our hopes for the longer-term future of the field, both for ground- and space-based detectors.

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How not to give a talk

Author: Ralph WijersN[one]

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Particle acceleration

Author: Luke O'Connor DruryN[one]

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Relativistic shocks

Author: Lorenzo SironiN[one]

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Life with Nature

Author: Leslie John SageN[one]

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PanSTARRS results

Author: Martin WardN[one]

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Transient Science with SkyMapper and the Next Generation of Ground-based Surveys

Author: Fang YuanN[one]

SkyMapper is a 1.3m wide-field survey telescope located at Siding Spring Observatory in Australia. It will carry out a comprehensive digital survey of the entire southern sky. I will give an overview of the wide range of transient science projects planned for SkyMapper, including a rolling supernova survey that aims to deliver well-calibrated data for high-precision cosmological measurements. I will also briefly describe the unique opportunities to study transients in synergy with the new generation of radio telescopes in the southern hemisphere.

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X-ray transients

Author: WijnandsN[one]

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Timing X-ray Transients

Author: van der KlisN[one]

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Multi-messenger astronomy with Swift

Author: Philip Andrew EvansN[one]

In the era of multi-messenger astronomy it is vital to be able to carry out prompt electromagnetic observations of non-photon triggers, to search for the counterpart to the event. Due to its efficient and flexible planning, rapid slewing and short response time, the Swift satellite is an excellent facility to use to achieve this. In this talk I will show the results
of Swift follow-up of two gravitational wave triggers, and discuss the ongoing programme to follow-up neutrino triggers. I will also look at future opportunities and developments.

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neutrinos

Author: Shunsaku HORIUCHIN[one]

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The mass distribution of millisecond pulsars

Author: Chengmin ZhangN[one]

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Possible primary-electron-spectrum hardening at ~ 240 GeV:

Author: Lei FengN[one]

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The data collected by ATIC, CREAM and PAMELA all display remarkable cosmic-ray-nuclei spectrum hardening above the magnetic rigidity $\sim$

240 GV. One natural speculation is that the primary electron spectrum also gets hardened at ~ 240 GeV, which can partly account for the electron/positron total spectrum excess discovered by ATIC, HESS and Fermi-LAT. The subsequent positron-to-electron ratio may get flattened or even decreased, depending on the degree of the primary electron spectrum hardening. Such modification is detectable for AMS-02, a mission dedicated to measure the high energy cosmic ray spectra with unprecedented accuracy. The spectrum hardening of both primary-electrons and nuclei at ~ 240 GV, if confirmed by AMS-02 in the future, is likely attributed to a "nearby" supernova-remnant-like source with a lifetime
$lesssim 10^{13}$ s. Possible dark matter origin of the
positron excess revealed by PAMELA is also investigated.

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Possible primary-electron-spectrum hardening at ~ 240 GeV:

Author: Lei FengN[one]

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Neutrino astronomy in the transient universe

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Neutrino astronomy in the transient universe

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Particle acceleration in turbulent medium

Author: huirong YANN[one]

Recent advances in MHD turbulence call for fundamental revisions in the paradigm of cosmic ray transport and acceleration. I would like to clarify some outstanding issues related to particle transport and
acceleration in realistic turbulent astrophysical environments. I shall discuss
both the transport and acceleration of CRs, and demonstrate that compressible
fast modes dominate the interactions. I shall address effects arising from the
preexisting turbulence and waves generated by CR instabilities and provide implications
for solar flares and SNRs. I shall also discuss how Gamma Ray Bursts (GRBs) properties
can be explained by a model based on turbulent reconnection.

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Measuring spin of accreting supermassive black holes in AGN

Author: James COLLINSON[1]

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Measuring the spin of a black hole is important for two reasons. Firstly, it is key for our understanding of black hole physics. Secondly, it contains an imprint of the black hole ' s growth history over cosmic time. Recent results from continuum fitting studies (Done et al. 2013), to determine the spin of supermassive black holes (SMBHs) in active galactic nuclei (AGN), are presented. These results contradict the previously established method of applying analysis of the iron emission line profile, which often predicts very high spins. As an example, Fabian et al. (2009) adopted this latter method in their study of 1H 0707–495. Here we discuss the advantages and disadvantages of these two studies, and the wider implications for black hole growth.

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The study of the circumstance of type B quasi-periodic oscillations (QPO) phenomena

Author: Hanqin GAO[1]

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We studied the energy spectral properties of the type B quasi-periodic oscillations (QPOs) and the nearby observations in the SIMS, based on Rossi X-ray Timing Explorer (RXTE)/PCA and HEXTE data of the transient black hole binary GX 339-4 four outbursts (2002,2004,2007,2010). The result shows type B QPOs distribute in the region with relatively smaller inner disk radius and higher power-law flux comparing to the none QPO observations. The power-law component in the energy spectrum originates from up-scattering Compton of soft photons by high energy electron of corona. We suggest that the type B QPO phenomena occur at the circumstance with more violent Compton scattering process.

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Transient Events Detected in the Pan-STARRS Optical Sky Survey

Author: Ward Martin[1]

[1] *Durham University*

The Pan-STARRS project is sensitive to wide range of very
energetic transient phenomena including supernovae, active galaxies,
tidal disruptionabstract events. I will describe some of the diverse results
obtained on such events seen in extragalactic objects, including a new suggestion
to explain a sub-set of these, involving micro-lensing.

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Welcome speech

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Particle acceleration

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Blazar Anti-sequence of Spectral variation within Individual Blazars: Cases for Mrk 501 and 3C 279

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Particle acceleration in turbulent medium

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The extreme universe and extreme physics to be viewed with XTP

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Demography of Faint X-ray Sources in Galactic Bulge and Globular Clusters

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