Session:	**[B2B-5] S5 : Compact Objects, High Energy and Particle Astrophysics**
Date:	August 19, 2014 (Tuesday)
Time:	14:00~15:25
Room:	Room E (Room 107)
Chair:	Chang-Hwan Lee (Pusan National University)

[B2B-5-1] 14:00~14:20

[Invited] Latest Results of MAXI (Monitor of All-sky X-ray Image)

Tatehiro Mihara (RIKEN, Japan)

MAXI is a Japanese X-ray all-sky monitor mounted on the International Space Station (ISS). It has been scanning the whole sky since 2009 in every 92 minutes of ISS rotation. MAXI has two kinds of instruments: Gas Slit Camera (GSC) and Solid-state Slit Camera (SSC). GSC is a slit camera using Xe-gas proportional counter, and SSC is one using 32 X-ray CCD chips. By the real-time nova-search program, MAXI can find a transient quickly. MAXI issued 133 to Astronomers Telegram and 44 to Gamma-ray burst Coordinated Network so far. In the 4.5 years of observation MAXI discovered 6 of 12 new black holes. The long-term behaviors of MAXI black holes can be classified into two types of the outbursts; 3 fast-rise exponential-decay and 3 fast-rise and flat-top. The cause of types is still unknown. The slit camera is suitable to accumulate the data for a long time. MAXI issued the 37-month catalog detecting 500 sources above ~0.6 mCrab in 4-10 keV in |b| > 10 degrees. SSC with X-ray CCD has detected diffuse soft X-rays in the all-sky, such as Cygnus super bubble, as well as it found a fast soft X-ray nova MAXI J0158-744. The overall shapes of outbursts in Be X-ray binaries are well observed with GSC. There are two kinds of outbursts, a normal outburst and a giant outburst. The peak dates of the subsequent giant outbursts of A0535+26 repeated in a different period from the orbital one. The Be stellar disk is considered either to have a precession motion or a distorted shape (Nakajima et al. 2014). The long-term behaviors of Low Mass X-ray Binaries (LMXB) containing weakly magnetized neutron stars are investigated. Transient LMXBs (Aql X-1 and 4U 1608-52) repeats outbursts in every 200-1000 days. The luminosity changes 1.5 orders of magnitude, which is understood by the limit-cycle of hydrogen ionization state in outer accretion disk. The accretion rate from the companion star would be constant. However, the limit cycle produces a change of the accretion rate inward. The spectral state during an outburst changes from hard-state, soft-state, and then hard-state again. This state is created by the inner part of the accretion disk, depending on the accretion rate at there. Moreover, Aql X-1 and 4U 1608-52 have the third state, very dim state. We interpret it as the propeller effect in the unified picture of LMXB by Matsuoka and Asai (2013). Cir X-1 is a peculiar source, in the sense that the long-term behavior is not like typical LMXBs. The nature comes from the binary type, Be binary with a weakly magnetized neutron star. MAXI/GSC observed 21 outbursts from Cir X-1. In seven outbursts, we found sudden luminosity decreases at periastron. It cannot be explained by either a decay of an outburst, nor the propeller effect. The stripping effect by the clumpy stellar wind of the companion star at an outer accretion disk radius is possible (Asai et al. 2014).

[B2B-5-2] 14:20~14:40

[Invited] Particle Acceleration at Supernova Remnant Shocks

Hyesung Kang (Pusan National University, Korea)

Most of high energy cosmic rays (CRs) are thought to be produced by diffusive shock acceleration (DSA) at supernova remnants (SNRs) within the Galaxy. Plasma and MHD simulations have shown that the CR streaming instability excites MHD waves and amplifies the turbulent magnetic field by orders of magnitude in the precursor of strong shocks. In this study we demonstrate that the time-dependent evolution of the self-amplified magnetic fields, Alfvénic drift, and escape of the highest energy particles affect the energy spectra of accelerated protons and electrons at SNR shocks. The maximum energy of CR protons can be boosted

significantly only if the scale height of the magnetic field precursor is long enough to contain the diffusion lengths of the particles of interests. The source spectrum of PeV protons at SNRs is likely to be flatter than E-2, if order of 10 % of the explosion energy is transferred to the CR energy. The spectral cutoffs of nonthermal radiation spectra in X-ray and -ray emitted by CR protons and electrons are regulated by the evolution of the highest energy particles, which are injected at the early phase of SNRs. Thus detailed understandings of nonlinear wave-particle interactions and time-dependent history of DSA are crucial in testing the SNR hypothesis for the origin of Galactic cosmic rays.

[B2B-5-3] **14:40~14:55**

Particle Acceleration and Diffusion in Supernova Remnants in a Multiphase Interstellar Medium

Soonyoung Roh (Nagoya University, Korea), Shu-ichiro Inutsuka, and Tsuyoshi Inoue

Supernova remnants (SNRs) are one of the most powerful astrophysical events and are thought to be the dominant source of Galactic cosmic rays (CRs). A recent report by Funk et al. (2013) has shown an unequivocal signature of pion-decay in the gamma-ray spectra of SNRs. This provides strong evidence that high energy protons are accelerated in SNRs. On the other hand, Fukui et al. (2012) showed that pion decay from protons dominates in emission from SNR RX J1713 based on the spatial correlation of gamma-rays and molecular line emission. The actual gamma-ray emission from pion decay should depend on the diffusion of CRs in a multiphase interstellar medium with molecular clouds (Inoue et al. 2012). In order to quantitatively describe the diffusion of high energy CRs from acceleration sites, we have performed test particle numerical simulations using three-dimensional magnetohydrodynamics (MHD) simulation data provided by Inoue et al. (2012). In this presentation, we calculate realistic diffusion coefficients of cosmic rays in simulated SNRs, and discuss the possible implications for X-ray and gamma-ray observations.

[B2B-5-4] **14:55~15:10**

Strong Influence of the Galactic Magnetic Field on the Propagation of Ultra-high Energy Cosmic Rays

Jihyun Kim (Ulsan National Institute of Science and Technology, Korea), Hang Bae Kim, and Dongsu Ryu

The galactic magnetic field (GMF) affects the propagation of ultra-high energy cosmic rays (UHECRs) from sources to us. Here we examine the influence of the GMF with the independence of their sky distribution on the galactic latitude, l. We analyze the correlation between the arrival direction (AR) of UHECRs observed by the Pierre Auger Observatory and the large-scale structure of the universe in the regions of sky divided by l. Specifically, we compare the AR distribution of observed UHECRs to that of mock UHECRs generated from a source model constructed with active galactic nuclei. Our source model has the smearing angle as a free parameter that reflects the deflection angle of UHECRs from sources. The results show a trend that larger smearing angles are required for the observed distribution of UHECRs in lower galactic latitude regions. We obtain, for instance, the best-fit smearing angle 9° and 84° in the high galactic latitude, -90°< l < -60°, and in the low galactic latitude, -30°< l <30°, respectively. For all sky region, the best-fit smearing angle is 54°. These angles are larger than the expected value of a few degrees for proton, implying that UHECRs would be composed of heavier nuclei.

[B2B-5-5] **15:10~15:25**

Spider Invasion Across the Galaxy

David C. Y. Hui (Chungnam National University, Korea)

The nature of the exotic stellar corpses which reincarnate by consuming their companion will be reviewed. Apart from sucking life from their partners, they are actually eating the doomed companions away by their deadly and powerful particle/radiation beams. Such situation resembles that a female “black widow” spider (and their Australian cousin “redbacks”) that eats its mate after mating. These celestial zombies are called – Millisecond pulsars. In this talk, I will focus on the effort of Fermi Asian Network (FAN) in exploring these intricating objects over the last five years.