Session:	**[B3A-5] S5 : Compact Objects, High Energy and Particle Astrophysics**
Date:	August 20, 2014 (Wednesday)
Time:	11:00~12:20
Room:	Room E (Room 107)
Chair:	Hyesung Kang (Pusan National University)

[B3A-5-1] **11:00~11:20**

[Invited] The TeV Gamma-Ray Milky Way

Gavin Rowell (University of Adelaide, Australia)

TeV (1012 eV) gamma-rays provide crucial information about extreme environments in the Universe. In our Millky Way, about 70 TeV gamma-rays sources are now known., which are linked to objects such as supernova-remnants, pulsars, pulsar-powered nebulae, compact binary systems, molecular clouds, and perhaps, massive stellar clusters. Over 30% of the Galactic TeV sources however, remain unidentified. The TeV gamma-ray emission allows crucial insights into the types of particles being acceleration and how they interact with their environment. In this talk I will present a status report on the field, highlight recent advances, and, outline the intimate links that Galactic TeV gamma-ray astronomy has with surveys of the interstellar medium. I will conclude with a look at the future of TeV gamma-ray astronomy via next generation facilities such as CTA.

[B3A-5-2] **11:20~11:35**

Fast-Cooling Synchrotron Radiation in a Decaying Magnetic Field and Gamma-Ray Burst Emission Eechanism

Z. Lucas Uhm (Peking University, China) and Bing Zhang

Synchrotron radiation of relativistic electrons is an important radiation mechanism in many astrophysical sources. In the sources where the synchrotron cooling timescale is shorter than the dynamical timescale, electrons are cooled down below the minimum injection energy. It has been believed that such 'fast cooling' electrons have a power-law distribution in energy with an index -2, and their synchrotron radiation has a photon spectral index -1.5. On the other hand, in a transient expanding astrophysical source, such as a gamma-ray burst (GRB), the magnetic field strength in the emission region continuously decreases with radius. Here we study such a system, and find that in a certain parameter regime, the fast-cooling electrons can have a harder energy spectrum. We apply this new physical regime to GRBs, and suggest that the GRB prompt emission spectra whose low-energy photon spectral index has a typical value -1 could be due to synchrotron radiation in this moderately fast-cooling regime. For details, see Uhm & Zhang 2014, Nature Physics, 10, 351.

[B3A-5-3] **11:35~11:50**

Frequency Independent Quenching of Pulsed Emission

Vishal Gajjar (National Centre for Radio Astrophysics, India), Bhal Chandra Joshi, Michael Kramer, Ramesh Kurrupswamy, and Roy Smits

Pulsars show a variety of pulse to pulse variation in their pulsed emission. The most dramatic variation seen in many pulsars, with emission in a burst of one to several pulses interspersed with pulses with no detectable radio emission, is called pulse-nulling. This phenomenon has been reported in more than 100 pulsars to date. There are two different group of theories that attempt to explain the cause of nulling. Intrinsic effects such as cessation of primary particles on short time-scale, loss of coherence conditions or changes in the current flow may cause a pulsar to null. However, geometric effects such as line-of-sight passing between the emitting sub-beams or changes in the direction of the entire emission beam can also mimic absence of detectable

emission. As the emission at various radio frequencies originate at distinct heights from the neutron star surface, the spacing between the sub-beam, in the rotating carousal, may also differ significantly from lower to higher frequencies. Thus, the empty line-of-sight hypothesis, also known as the pseudo-nulls, be tested with simultaneous multiple frequency observations. There are very few long simultaneous observations of nulling pulsars reported so far. In this study, the simultaneous occurrence of the nulling phenomena in three pulsars, PSRs B0031-07, B0809+74 and B2319+60, was investigated. The observations were conducted simultaneously at four differ ent frequencies, 313, 607, 1380 and 4850 MHz, from three different telescopes viz. the GMRT, the WSRT and the Effelsberg radio telescope. We obtained the nulling fraction at each frequency which were found to be consistence within the error bars, at all four frequencies for all three pulsars. Similarly, the single pulse emission states were also compared using the contingency table analysis. To measure the stastical significance of the contingency tables, we measured the Cramer-V and the uncertainty coefficient for each pair of frequencies. For all three pulsars, both the statistical tests showed highly significant broadband nulling behaviour. About 44 out of 6776 pulses do not show simultaneous null (burst) state for PSR B0031-07. Among these, 25 occurred either at the start or at the end of a burst. There were 27 and 158 pulses observed in PSRs B0809+74 and B2319+60, respectively, where the emission states were not identical across the frequencies. Similar to PSR B0031-07, 20 and 82 of these occurred at the start/end of a burst for PSRs B0809+74 and B2319+60, respectively. Thus, while the nulling patterns for the three pulsars is largely broadband, deviations from this behaviour is seen in about one percent of pulses, about half of which occur at the transition from null to burst (or vice-verse). These results clearly suggest that nulling is truly a broadband phenomena and favors models invoking magnetospheric changes on a global scale compared to local geometric effects as a likely cause of nulling in these pulsars.

[B3A-5-4] **11:50~12:05**

Broadband Turbulent Spectra in Gamma-ray Burst Light Curves

Maurice H. P. M. van Putten (Sejong University, Korea), Cristiano Guidorzi, and Filippo Frontera

Broadband power density spectra offer a window to understanding turbulent behavior in the emission mechanism and, at the highest frequencies, in the putative inner engines powering long gamma-ray bursts (GRBs). We recently introduced a chirp search method alongside Fourier analysis for signal detection in the Poisson noise-dominated, 2 kHz sampled, BeppoSAX light curves (2014, ApJ, 786, 146). Using an efficient numerical implementation in O (Nn log n) operations, where N is the number of chirp templates and n is the number of samples in the data time series, we show a continuation of the spectral slope of Fourier-chirp spectra of GRB 010408 and GRB 970816 up to 1 kHz of Kolmogorov turbulence. The same continuation is observed in an average spectrum of 42 bright, long GRBs. In light of the recently funded KAGRA gravitational wave detector in Japan, we include an outlook on a similar analysis of upcoming gravitational wave data in searches for nearby GRBs and core-collapse supernovae.

[B3C-5-5] **12:05~12:20**

Thermal Stability of a Thin Disk with Magnetically Driven Winds

Shuangliang Li (Shanghai Astronomical Observatory, China) and Mitchell Begelman

The absence of thermal instability in the high/soft state of black hole X-ray binaries, in disagreement with the standard thin disk theory, has been a long-standing riddle for theoretical astronomers. We have tried to resolve this question by studying the thermal stability of a thin disk with magnetically driven winds in the M_dot- Σ plane. It is found that disk winds can greatly decrease the disk temperature and thus help the disk become more stable at a given accretion rate. The critical accretion rate, M_dot_ crit, corresponding to the thermal instability threshold, is significantly increased in the presence of disk winds. For $\alpha = 0.01$ and Bφ = 10Bp, the disk is quite stable even for a very weak initial poloidal magnetic field [βp,0 ～ 2000, βp = (Pgas + Prad)/(B2 p /8π)]. However, when Bφ = Bp or Bφ = 0.1Bp, a somewhat stronger (but still weak) field (βp,0 ～ 200 or βp,0 ～ 20) is required to make the disk stable. Nevertheless, despite the great increase of M_dot_ crit, the luminosity threshold, corresponding to instability, remains almost constant or decreases slowly with increasing M_dot_ crit due to decreased gas temperature. The advection and diffusion timescales of the large-scale magnetic field threading the disk are also investigated in this work. We find that the advection timescale can be smaller than the diffusion timescale in a disk with winds, because the disk winds take away most of the gravitational energy released in the disk, resulting in the decrease of the magnetic diffusivity η and the increase of the diffusion timescale.