neutrinos in ten seconds from a supernova explosion in our Galaxy. The pointing accuracy will be better than 1 degree and be able to guide early optical telescope observations. The expected rate of supernova explosion in our galaxy is once per every 30 years in the most optimistic case or once per every 100 years in the worst case. If it is indeed observed, it will be a historical chance to study the supernova explosion mechanism in great details. In this talk, various astronomy potentials will be discussed if the Korean neutrino observatory is built.

[구 NK-03] Supernova Rates of the Milky Way and the Local Group

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A major goal of the proposed Korean Neutrino Detector and Telescope is to detect neutrino burst from core-collapse supernova (SN) explosions in the Milky Way, which will provide an unprecedented opportunity to look into the core of an exploding massive star. Detection with high statistics would give important information for the explosion physics. It can also detect neutrino signals from SN events in the Local Group and trigger alert of the event for the astronomical community. In this talk, I will review the SN rates of the Milky Way and the Local Group, and will discuss the implications for the proposed neutrino telescope.

[구 NK-04] Supernovae Follow-up Observations and the Korean Neutrino Telescope

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Massive stars ($\geq$8 $M_\odot$) are believed to experience core-collapse and finish their lives as supernova (SN) explosions. Astronomers operating the current SN survey facilities try to catch the first moments of SN explosions. Since neutrinos are emitted first from the SNe before the electromagnetic lights, any neutrino detections from more than two sites within around 10 seconds could be useful alert for early follow-up observations, especially for optical SN follow-up telescopes. In this talk, I will brief the current SN follow-up observation projects, what they want to find out and contribute to SN sciences. Focus will be on the early detection and early sciences on SNe, which is what the Korean Neutrino Telescope can contribute most importantly.

고에너지 천체물리학

[구 HA-01] Ultra-high-energy cosmic rays and filaments of galaxies in the northern sky

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The Telescope Array (TA) experiment reported the arrival direction distribution of ultra-high-energy cosmic rays (UHECRs) with energies above 5.7×10^{19} eV in the northern sky. A clustering of TA events, the so-called hotspot, was found; however, its nature has not yet been understood. To understand the origin of the TA hotspot, we examine the sky distributions of the TA UHECR arrival direction and filamentary structures of galaxies in the local universe. By statistical tests for anisotropy, we find a close correlation of the TA events with the filaments of galaxies connected to the Virgo cluster. We discuss our finding and its implications.

[구 HA-02] Shock Acceleration Model for Giant Radio Relics

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Although most of observed properties of giant radio relics detected in the outskirts of galaxy clusters could be explained by relativistic electrons accelerated at merger-driven shocks, a few significant puzzles remain. In some relics the shock Mach number inferred from X-ray observations is smaller than that estimated from radio spectral index. Such a discrepancy could be understood, if either the shock Mach number is

under-estimated in X-ray observation due to projection effects, or if pre-existing electrons with a flat spectrum are re-accelerated by a weak shock, retaining the flat spectral form. In this study, we explore these two scenarios by comparing the results of shock acceleration simulations with observed features of the so-called Toothbrush relic in the merging cluster 1RXS J060303.3. We find that both models could reproduce reasonably well the observed radio flux and spectral index profiles and the integrated radio spectrum. Either way, the broad transverse relic profile requires additional post shock electron acceleration by downstream turbulence.

[구 HA-03] General Relativistic Effects on Pulsar Radiation

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We consider a magnetic dipole model of a pulsar and investigate general relativistic effects on electromagnetic radiation from the pulsar. The general relativistic modifications should be found applicable to many well-known issues in pulsar astronomy. Among other things, the modifications of Goldreich-Julian model and subpulse drift would be of significant interest and challenging issues. The electromagnetic fields in the pulsar magnetosphere are computed by solving Maxwell's equations defined in the strongly curved spacetime around the pulsar, hence containing the properties of strong gravitational effects. On top of these effects, we also investigate the effects from rotation and obliqueness of the pulsar to work out the general relativistic versions of Goldreich-Julian model and subpulse drift.

[구 HA-04] Gravitational Radiation Capture between Unequal Mass Black Holes

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The gravitational radiation capture between unequal mass black holes without spins is investigated with numerical relativistic simulations, and compared with the Post-Newtonian approximations. The parabolic approximation which assumes that the gravitational radiation from a weakly hyperbolic orbit is the same as that from the parabolic orbit is adopted. Using the radiated energies from the parabolic orbit simulations, we have obtained the impact parameters (b) of the gravitational radiation captures for weakly hyperbolic orbits with respect to the initial energy. The most energetic encounters occur around the boundary between the direct merging and the fly-by orbits, and we find that several percent of the total ADM initial energy can be emitted at the peak. The equal mass BHs emit more energies than unequal mass BHs at the same initial orbital angular momentum in the case of the fly-by orbits. The impact parameters obtained with numerical relativity deviate from those in Post-Newtonian when the encounter is very strong ($b \leq 100M$), and the deviations are more conspicuous at the high mass ratio.

[구 HA-05] Search for broadband extended gravitational-wave emission bursts in LIGO S6 in 350-2000 Hz by GPU acceleration

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We present a novel GPU accelerated search algorithm for broadband extended gravitational-wave emission (BEGE) with better than real-time analyis of H1-L1 LIGO S6 data. It performs matched filtering with over 8 million one-second duration chirps. Parseval's Theorem is used to predict the standard deviation σ of filter output, taking advantage of near-Gaussian LIGO (H1,L1)-data in the high frequency range of 350-2000 Hz. A multiple of σ serves as a threshold to filter output back to the central processing unit. This algorithm attains 80% efficiency, normalized to the Fast Fourier Transform (FFT). We apply it to a blind, all-sky search for BEGE in LIGO data, such as may be produced by long gamma-ray bursts and superluminous supernovae. We report on mysterious features, that are excluded by exact simultaneous occurrance. Our results are consistent with no events within a radius of about 20 Mpc.