components, respectively, as well as the orbital eccentricity distribution. There are notable gradients in the V velocity over [Fe/H] in both populations: -23 km s-1 dex-1 for the thin disk and +44 km s-1 dex-1 for the thick disk. The velocity dispersion of the thick disk decrease with increasing [Fe/H], while the velocity

New Frontier of Gravitational Wave Research

[구 GW-01] Superconducting Low-frequency Gravitational-wave Telescope (SLGT): pilot study status report

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The discovery of GW150914, black hole - black hole merger via gravitational waves (GWs) opened a new window to observe the Universe. GW frequencies from heavenly bodies and early Universe are expected to span between sub-nHz up to kHz. At present, GW detectors on Earth (LIGO, Virgo, KAGRA, LIGO-India) aims frequency ranges between 10-2000 Hz. The space-borne GW detector and Pulsar Timing Array targets mHz and nHz sources. Starting in March 2017, the KKN (KASI-KISTI-NIMS) collaboration launched a pilot study of SLGT (Superconducting Low-frequency Gravitational-wave Telescope). This project is funded by NST (Korea Institute of Science and Technology). The main detection bands expected for SLGT ranges between 0.1-10Hz, which is complementary of LIGO-type detectors and LISA for multi-band GW observation. We will present an overview of the SLGT project and report the status of the NST pilot study. We will also present prospective of GW astronomy with SLGT.

[초 GW-02] Development of Superconducting Low-frequency Gravitational-wave Telescope (SLGT): Technical Challenge and Feasibility

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Recent success of gravitational wave (GW) detection by LIGO opened a new window to expand our understanding of the Universe. In addition to LIGO, several other developments are going on or under planning. However, each of these detectors has a specific sensitive frequency range. There is a missing frequency band, 0.1-10 Hz, where detectors loose sensitivity significantly due to Newtonian noise on the Earth. We introduce a plan to develop a Superconducting Low-frequency Gravitational- wave Telescope (SLGT), which can observe massive black holes in 0.1-10 Hz. The SLGT system consists of magnetically levitated six test masses, superconducting quantum interference devices (SQUIDs), rigid support frame, cooling system, vibration isolation, and signal acquisition. By taking the advantage of nearly quantum-limited low-noise SQUIDs and capacitor bridge transducers, SLGT's detection sensitivity can be improved to allow astrophysical observation of black holes in cosmological distances. We present preliminary design study and expected sensitivity, and its technical feasibility.

[구 GW-03] Optical/NIR Follow-up Observation of GW Sources

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Identification of gravitational wave (GW) sources in electromagnetic (EM) wave observations is important because it enables us to understand the property of the GW-emitting sources/mechanisms much better than the GW detection. For that reason, a large number of astronomers are working on observations to identify the position and the nature of GW sources. We give a short

overview of the expected EM signals from GW sources and the current EM follow-up observations that have been undertaken in Korea and the world.

[구 GW-04] Gravitational Wave Astrophysics with the Superconducting Low-frequency Gravitational-wave Telescope

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Gravitational wave (GW) is a probe to observe compact objects (WD, NS, and BHs) in the Universe. Compact binary coalescences (CBCs) were expected to be primary sources of LIGO, VIRGO, and KAGRA. Indeed GW150914 from BH-BH binary coalescence at 430 Mpc was discovered by LIGO between 25-350 Hz. The total system mass of GW150914 is ~70$M_\odot$, and about 3$M_\odot$ of energy is converted to GWs in 0.2s of the observation duration. In lower frequencies below 10 Hz, in addition to CBCs with 1-100$M_\odot$, more massive sources of ~1,000-10,000$M_\odot$ are observable for seconds up to days in time scale. We introduce GW astrophysics and present highlights of target sources for the proposed super conducting low-frequency gravitational-wave telescope (SLGT).

[구 GW-05] Stochastic Gravitational Wave Background in 0.1-10 Hz

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Stochasitc gravitational wave background (SGWB) is expected to be contributed by primordial sources (e.g. inflation signature) and astrophysical sources (e.g., incoherent superposition of a large numbers of compact binary inspirals throughout in the Universe). Theoretically, SGWB is predicted to span in a broad frequency range between less than nHz up to kHz. Many gravitational-wave (GW) detectors such as LIGO or LISA aim to detect or constrain SGWB in different frequency band that is most sensitive for each detector. In this talk, we focus on the prospectives of constraining the energy density of SGWB between 0.1-10 Hz. We introduce the characteristics of SGWB and representative models for primordial and astrophysical sources. Then, we propose a signal extraction scheme to detect SGWB using one or several omni-directional GW detectors such as SLGT(Superconducting Low-frequency Gravitational-wave Telescope). Considering SLGT sensitivity, we discuss how to observe SGWB in 0.1-10 Hz if we have SLGT network. Finally, we highlight interesting SGWB models that can be constrained in 0.1-10 Hz with SLGT.

[구 GW-06] Binary Black Hole Inspirals and GW detection in 0.1-10 Hz

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The pilot study of SLGT (Superconducting Low-frequency Gravitational-wave Telescope) is being performed by KKN (KASI-KISTI-NIMS) collaboration. In this presentation, we discuss prospectives of detecting GWs in the low-frequency band (0.1-10 Hz), which is a target frequency band of SLGT, but can be hardly observed by advanced LIGO. IMBHBs (Intermediate Mass Black Hole Binaries) and IMRIs (Intermediate Mass Ratio Inspirals) with total masses of O(1000) up to O(10,000) solar masses are most probable sources between 0.1-10 Hz. We estimate horizon distances and signal to noise ratios of IMBHBs and IMRIs for different SLGT design sensitivities. Based on our calculations, detection rates for IMBHBs and IMRIs with SLGT will be discussed.