capabilities of G-CLEF.

[구 AT-05] Preliminary Design of the G-CLEF Flexure Control Camera

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The GMT-Consortium Large Earth Finder(G-CLEF) is one of the first light instruments at the Giant Magellan Telescope. The international consortium consists of five astronomical institutes including the Center for Astrophysics, the Observatories of Carnegie Institute, the University of Catolica in Chile, the University of Chicago, and Korea Astronomy and Space Science Institute, led by CfA. The extremely precise radial velocity capability is one of the principal instrumental feature of G-CLEF. The RV goal is 10 cm/s capable of detecting an Earth-like planet around a Sun-like host star. This high precision wavelength calibration stability requires a set of significantly tight optomechanical tolerances in the mechanical design of the Flexure Control Camera system. KASI is in charge of the Flexure Control Camera and the Calibration Light System for the G-CLEF spectrograph. In this presentation, we introduce the preliminary design and analysis results of the G-CLEF Flexure Control Camera.

[구 AT-06] Multi-Core Fiber Based Fiber Bragg Gratings for Ground Based Instruments

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Fiber Bragg gratings (FBGs) are the most compact and reliable method of suppressing atmospheric emission lines in the infrared for ground-based telescopes. It has been proved that real FBGs based filters were able to eliminate 63 bright sky lines with minimal interline losses in 2011 (GNOSIS). Inscribing FBGs on multi-core fibers offers advantages. Compared to arrays of individual SMFs, the multi-core fiber Bragg grating (MCFBG) is greatly reduced in size, resistant to damage, simple to fabricate, and easy to taper into a photonics lantern (PRAXIS). Multi-mode fibers should be used and the number of modes has to be large enough to capture a sufficient amount of light from the telescope. However, the fiber Bragg gratings can only be inscribed in the single-mode fiber. A photonic lantern bi-directionally converts multi-mode to single-mode. The number of cores in MCFBGs corresponds to the mode.

For a writing system consisting of a single ultra-violet (UV) laser and phase mask, the standard writing method is insufficient to produce uniform MCFBGs due to the spatial variations of the field at each core within the fiber. Most significant technical challenges are consequences of the side-on illumination of the fiber. Firstly, the fiber cladding acts as a cylindrical lens, narrowing the incident beam as it passes through the air-cladding interface. Consequently, cores receive reduced or zero illumination, while the focusing induces variations in the power at those that are exposed. The second effect is the shadowing of the furthest cores by the cores nearest to the light source. Due to a higher refractive index of cores than the cladding, diffraction occurs at each core-cladding interface as well as cores absorb the light. As a result, any core that is located directly behind another in the beam path is underexposed or exposed to a distorted interference pattern from what phase mask originally generates. Technologies are discussed to overcome the problems and recent experimental results are presented as well as simulation results.

[초 AT-07] Development of state-of-the-art detectors for X-ray astronomy

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We are developing large arrays of X-ray microcalorimeters for applications in X-ray astronomy. X-ray microcalorimeters can detect the energy of X-rays with extremely high resolution. High-resolution Imaging spectroscopy enabled by these arrays will allow us to study the hot and energetic nature of the Universe through the detection of X-rays from astronomical objects such

as neutron stars or black holes. I will introduce the state-of-the-art X-ray microcalorimeters being developed at NASA/GSFC and the future X-ray observatory missions based on microcalorimeters.

[구 AT-08] Amplitude Correction Factors of KVN Observations Correlated by DiFX and Daejeon Correlators

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We report results of investigation of amplitude calibration for very long baseline interferometry (VLBI) observations with Korean VLBI Network (KVN). Amplitude correction factors are estimated based on comparison of KVN observations at 22 GHz correlated by Daejeon hardware correlator and DiFX software correlator in Korea Astronomy and Space Science Institue (KASI) with Very Long Baseline Array (VLBA) observations at 22 GHz by DiFX software correlator in National Radio Astronomy Observatory (NRAO). We used the observations for compact radio sources, 3C 454.3 and NRAO 512 which are almost unresolved for baselines in a range of 350-477 km. VLBA visibility data of the sources observed with similar baselines as KVN are selected, fringe-fitted, calibrated, and compared in their amplitudes. We found that visibility amplitudes of KVN observations should be corrected by factors of 1.14 and 1.40 when correlated by DiFX and Daejeon correlators, respectively. These correction factors are attributed to the combination of two steps of 2-bit quantization in KVN observing systems and characteristics of Daejeon correlator.

[구 AT-09] VLBI Phase Referencing and Astrometry with KVN and KaVA

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Phase referencing is an important tool to study weak radio sources, especially in mm-VLBI (Very Long Baseline Interferometry) which are usually too faint to be observed using conventional VLBI. VLBI astrometry is a unique method to measure the position and to identify radio emitting regions of a radio source with unprecedented angular resolution. In order to evaluate the phase referencing and astrometric capabilities of KVN and KaVA, several observations have been conducted and analyzed. I will present the observational results and discuss constraints and requirements for high precision VLBI astrometry.

[구 AT-10] Near-Infrared Imaging Spectroscopic Survey in Space

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To probe the star formation in local and early Universe, the NISS with a capability of imaging spectroscopy in the near-infrared is being developed by KASI. The main scientific targets are nearby galaxies, galaxy clusters, star-forming regions and low background regions. The off-axis optical design of the NISS with 15cm aperture was optimized to obtain a wide field of view (FoV) of 2 deg. × 2 deg. as well as a wide spectral coverage from 0.9 to 3.8μm. The opto-mechanical structure was designed to be safe enough to endure in both the launching condition and the space environment. The dewar will operate 1k × 1k infrared sensor at 80K stage. The NISS will be launched in 2017 and explore the large areal near-infrared sky up to 200 deg.^{2} in order to get both spatial and spectral information for astronomical objects.

As an extension of the NISS, KASI is planning to participate in a new small space mission together with NASA. The promising candidate, SPHEREx (Spectro-Photometer for the History of the Universe Epoch of Reionization, and Ices Explorer) is an all-sky survey satellite designed to reveal the origin of the Universe and water in the planetary systems and to explore the evolution of galaxies. Though the survey concept is similar to that of the NISS, the SPHEREx will perform the first near-infrared all-sky imaging spectroscopic survey with the wider spectral range from 0.7 to 5μm and the wider FoV of 3.5 deg. × 7 deg.

Here, we report the current status of the NISS and introduce new mission for the near-infrared imaging spectroscopic survey.