properties associated with the inner and outer halos of the Milky Way, as identified by metal-poor stars from the Sloan Digital Sky Survey. In particular, using carbon-enhance metal-poor (CEMP) giants, we first map out the fractions of CEMP-no stars (without strongly enhanced neutron-capture elements) and CEMP-s stars (with a large enhancement of s-process elements) in the inner- and outer-halo populations, separated by their spatial distribution of carbonicity ([C/Fe]). The CEMP-no and CEMP-s objects are classified by their different levels of absolute carbon abundances, A(C). We investigate characteristics of rotational velocity and orbital eccentricity for these sub-classes within the halo populations. Distinct kinematic features and fractions between CEMP-no and CEMP-s stars identified in each halo region will provide important clues on the origin of the dichotomy of the Galactic halo.

[포IM-06] Gemini Observations of Planetary Nebula Candidates toward the Galactic Center

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We present high-resolution near infrared (IR) spectra of two candidate planetary nebulae (PNe) that were serendipitously found toward the Galactic center (GC). Our spectra obtained using GNIRS on Gemini North reveal strong Br ♑ and He I recombination lines. In one of the targets, we confidently detect Pa ♌ emission. Based on Br ♑ and Pa ♌ lines, we estimate a foreground reddening to be Av=27 mag, which confidently puts this object at the GC distance. Along with the presence of highly excited emission lines such as [S IV], [Ne III], [Ne V], and [O IV] detected in the mid-IR spectra from the Spitzer Space Telescope, and the extended emission in the Pa ♋ narrow-band image from the Hubble Space Telescope, this makes it the first spectroscopically confirmed PN in the GC.

[포IM-07] Correlation between Magnetic-field directions and intensity gradients in Orion A region

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Magnetic fields play an important role in star-forming processes by regulating gravitational collapse. In filamentary structures of star-forming regions, magnetic fields are likely to be aligned with minor axes of filamentary molecular clouds because matter freely moves along magnetic field lines. Orion A region, one of the well-known high-mass star forming regions, has long filament structure. In order to study magnetic field directions with respect to the filamentary structure in Orion A, we have analyzed 850 μm dust polarization observations obtained with the James Clerk Maxwell Telescope (JCMT). We found tight correlation of dust intensity gradients and magnetic field directions. It was estimated that 81% of magnetic field segments are aligned with density gradients within 40 degree. In conclusion, we confirmed most of magnetic field segments are perpendicular to the major axis of the filament in Orion A.

천문우주관측기술

[포AT-01] Automation of Kyung Hee Astronomical Observatory 76 cm Telescope

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We plan to automatize the operation of Kyung Hee Astronomical Observatory (KHAO) 76 cm Telescope by adapting KAOS30 (KHU Automatic Observing Software for McDonald 30 inch Telescope). The software is developed to improve the efficiency of the observation system for monitoring transients and variable sources. It has installed and operated at McDonald 30 inch telescope since 2017 August. KAOS76 (KHU Automatic Observing Software for KHAO 76 cm Telescope) consists of four packages: Telescope Control Package (TCP), Data Acquisition Package (DAP), Auto Focus Package (AFP), and Script Mode Package (SMP). Most of the packages can be configured by minimized modifications of the codes because it includes common libraries for FLI instruments and also ASCOM standard. TCP, DAP, and AFP control astronomical devices. SMP supports automatic observing in a script mode. TCP of KAOS76 can communicate with the TCS via ASCOM. Also, KAOS76 has an extra function to compensate the misalignment of the polar axis. In this poster, we show the current status of the

observing system with KAOS76.

[포AT-02] Introduction to Development of KaVA Digital Filter using GPU

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KaVA(KVN and VERA Array)는 KVN 3기, 일본 VERA 4기로 구성되어 있다. 더 나아가 일본의 JVN, 중국의 CVN으로 확장한다면 동아시아에 더 많은 기선들이 존재한다. 각 전파망원경은 천문학자의 연구수요, 디지털 백엔드(Back-end) 시스템 기술수준에 의해 각기 다른 다양한 자료구조를 이용한다. 이와 함께, 현재 전파천문관측은 디지털 백엔드 시스템의 발달로 2Gbps 관측이 주를 이루고 있으며 32Gbps 시험 관측이 이루어지고 있다. 이에 한일상관센터는 이런 다양한 자료구조와 관측 대역폭을 지원하기 위해 KaVA용 디지털필터를 개발하고 있다. 기존에 개발된 CPU기반의 디지털필터를 연산속도와 자료 입출력 대역폭을 상당히 높인 GPU 기반 디지털필터로 업그레이드하고 있다. 본 발표는 GPU를 활용한 KaVA용 디지털 필터 개발에 관하여 소개하고자 한다.

[포AT-03] Wavelength Calibration Solution of VPH Grating Slitless Spectroscopy Image

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Spectroscopic observations commonly use a slit or fiber; however, non-slit spectroscopy enables us to observe a larger number of targets in one frame of image. Hence, it has been adopted as an observational mode for observatories like HST and JWST. Slitless spectroscopy requires wavelength calibration solutions in order to distinguish and measure the absorption / emission lines from the spectra with high accuracy. We installed the Volume Phase Holographic (VPH) grating to SQUEAN camera on the McDonald 2.1m telescope and obtained images with spectral resolutions of ~ 100 and 200. In order to derive the wavelength calibration, we measured the distances between the 0th order images and spectral features of various quasars. The distances are converted to wavelengths using the known wavelengths of the emission lines. We tested several different methods of spectral extraction and peak estimation of emission lines. We will present the results for the wavelength calibration and suggest the reliable methods to find the solution.

[포AT-04] Optical Setup for Full-Field Imaging Test of MATS Limb Telescope

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The MATS (Mesosphere Airglow / Aerosol Tomography Spectroscopy) satellite is a Swedish scientific microsatellite which Kyung Hee University participates in developing. The limb telescope of the MATS satellite is designed with linear astigmatism-free off axis optical configuration which allows wide field of view (5.67º × 0.91º). Here we present the full-field optical performance test setup that consists of a point source, a collimator, the limb telescope and a CCD (Charged Coupled Device). The incidence angle of the collimator was carefully controlled by the rotary stage under the limb telescope. The imaging tests represent expected results without dominant aberrations.

[포AT-05] Development Process for Slit Mask Exchanger Mechanism Prototype (SMEM-P) of the Giant Magellan Telescope Multi-object Astronomical and cosmological Spectrograph (GMACS)

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GMACS is one of the instruments for the Giant Magellan Telescope (GMT) which will provide wide field, multi-object, moderate resolution spectroscopy of faint targets. KHU (Kyung Hee University) is in charge of control software of GMACS. As a first step, the Slit Mask Exchange Mechanism Prototype (SMEM-P) will be used as a preliminary example to make development process between electronics and high level software. Recently, we have developed a sample program to communicate with low level devices via EtherCAT. It is expected to be a mockup design for software