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한국천문연구원은 미국 텍사스대학교(UT)와 협력하여 2009년부터 2013년까지 IGRINS 분광기를 개발하였다. IGRINS는 UT의 맥도널드(McDonald) 천문대 2.7미터 망원경과 로웰(Lowell) 천문대의 4.3미터 망원경, 제미니(Gemini) 천문대 8.1미터 망원경에 장착하여 성공적으로 사용되어 왔으며, 최근 한국천문연구원이 제미니 천문대 운영에 정식으로 참여하면서 IGRINS와 유사한 관측기기를 8.1미터 망원경 전용으로 개발해 달라는 요청을 받고 개발계획을 준비하고 있다.

담금격자(immsersion grating)를 사용하는 IGRINS는 거대마젤란망원경(GMT)의 1세대 관측기기 중 하나로 선정된 적외선 고분산 분광기 GMTNIRS의 핵심 요소기술을 검증하기 위한 선행개발 기기의 의미도 갖고 있다. 한국천문연구원은 2011년 UT와 공동으로 GMTNIRS의 개념설계를 수행하였으며, 이후 개발팀에 카네기(Carnegie) 천문대가 합류하여 6.5미터 마젤란(Magellan) 망원경용으로 GMTNIRS와 유사한 담금격자 적외선 분광기를 개발하고 시험운영함으로써 GMTNIRS의 개발을 앞당기는 계획을 추진 중이다.

[구 AI-03] The first results of 1-m telescope imaging at SNU Astronomical Observatory (SAO)

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Since its installation on March 27th, 2018, the SAO 1-m telescope has been operating for about 5 months. We report first results of these observations in this presentation. Sample images were taken with a 4096x4096 CCD camera (Field of view of ~21x21 arcmin^2) and their characteristics such as seeing value, and limiting magnitudes are presented. The best seeing value is 0.85 arcsecond on July 16th, 2018. We find that the 5 sigma detection limit is about 20 magnitude AB in B, V, R, I bands with about 10-20 min exposures. We will also briefly introduce the spectrum of a faint transient taken with the spectrograph also installed on the SAO 1-m telescope.

[구 AI-04] Efficiency estimation of ASTE receiver optics using measured beam patterns from KASI band 7+8 feed horn

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We conducted efficiency calculation in a prototype receiver optics for ASTE 10 meter telescope using the measured beam patterns of the band7+8 feed horn.

Beam measurements results are summarized and estimated aperture efficiencies over band7+8 frequency range are presented.

태양/태양계

[구 SS-01] Optical Characteristics of Impact Craters on Mercury

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수성의 대기와 자기장은 매우 희박하여 그 표면이 우주환경에 거의 그대로 노출되어있다. 표면의 토양은 태양풍 입자와 미소유성체 등에 의해 계속해서 밝기가 어두워지고 입자의 크기도 작아진다. 이러한 현상을 종합적으로 '우주풍화'(space weathering)라고 부르는데, 그 정도를 정량화하거나 상대적으로 평가하는 데에는 어려움이 따른다. 왜냐하면 우주풍화의 정도에는 원인이 되는 입자의 입사 플럭스는 물론이고, 표면의 지역 조성비와 토양의 노화도 등이 모두 섞여 영향을 미치기 때문이다. 이를 극복하는 한 가지 방법은 수성 표면을 뒤덮고 있는 수많은 충돌구(impact crater) 내의 광학적 특성 분포를 통계적으로 분석하는 것이다. 충돌구 안쪽의 토양은 충돌 시점에 동시에 형성되었고, 그 성분이 충돌구 밖 임의의 지역에 비교해 상대적으로 균질하며, 지형적으로 충돌구 안팎의 경계가 분명하게 정해져 있다. 또한, 충돌구는 수성 전구(全球)에 걸쳐 어디에서나 발견되므로 각 충돌구의 특성을 경도·위도·연대 등 여러 측면에서 조사할 수 있다. 본 연구에서는, 메신저(MESSENGER) 탐사선의 MDIS 영상기에서 얻은 관측 자료를 활용하여 수성 충돌구의 광학적 특성에 대해 알아본다.

[구 SS-02] The Geometric Albedo of (4179) Toutatis

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(4179) Toutatis (Toutatis hereafter) is one of the Near-Earth Asteroids which has been studied most

rigorously not only via ground-based photometric, spectroscopic, polarimetric, and radar observations, but also via the in-situ observation by the Chinese Chang'e-2 spacecraft. However, one of the most fundamental physical properties, the geometric albedo, is less determined. In order to derive the reliable geometric albedo and further study the physical condition on the surface, we made photometric observations of Toutatis near the opposition (i.e., the opposite direction from the Sun). We thus observed it for four days on 2018 April 7-13 using three 1.6-m telescopes, which consist of the Korean Microlensing Telescope Network (KMTNet). Since the asteroid has a long rotational period (5.38 and 7.40 days from Chang'e-2, Zhao et al., 2015), the continuous observations with KMTNet matches the purpose of our photometric study of the asteroid. The observed data cover the phase angle (Sun-asteroid-observer's angle) of 0.65-2.79 degree. As a result, we found that the observed data exhibited the magnitude changes with an amplitude of ~0.8 mag. We calculated the time-variable geometrical cross-section using the radar shape model (Hudson & Ostro 1995), and corrected the effect from the observed data to derive the geometric albedo. In this presentation, we will present our photometric results. In addition, we will discuss about the regolith particles size together with the polarimetric properties based on the laboratory measurements of albedo-polarization maximum.

Hudson, R. and Ostro, S. J. 1995 Science 270, 84
Zhao, Y. et al. 2015 MNRAS 450, 3620

[구 SS-03] Investigation of surface homogeneity of (3200) Phaethon

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We present observational evidence of the surface homogeneity on Phaethon based on the time-series multi-band photometry and spectrometry. The observations of Phaethon were conducted in Nov.-Dec. 2017. We confirmed that Phaethon is a B-type asteroid, as was previously known, and its rotational color variation was not detected. During our observation period, the sub-solar latitude of this asteroid was approximately 55 °S, corresponding to the southern hemisphere of the body. Thus, we found that the southern hemisphere of Phaethon has a homogeneous surface from our observation results. In addition, we compared our spectra with archival data to investigate the latitudinal surface properties of the asteroid. The result showed that it doesn't have a latitudinal color variation. To verify this assumption, we investigated its solar-radiation heating effect, and the result suggested that this asteroid underwent a uniform thermal metamorphism regardless of latitude, which is consistent with our observations. Based on this result, we discuss the homogeneity of the surface of the body.

[구 SS-04] Interaction of Magnetic Flux Ropes in Relation to Solar Eruption

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Twisted magnetic flux tubes (also called magnetic flux ropes) are believed to play a crucial role in solar eruptive phenomena. The evolution of a single flux rope with or without the influence of an overlying field of a simple geometry has been extensively studied and its physics is rather well understood. Observations show that interacting flux tubes are often involved in solar eruptions. It was Lau and Finn (1996) who intensively studied the interaction between two flux ropes, whose footpoints are anchored in two parallel planes. In this too simplified setting, the curvature of the flux rope axial fields is totally ignored. In our study, the footpoints of flux ropes are placed in a single plane containing a polarity inversion line as in the real solar active region. Our simulation study is performed for four cases: (1) co-axial field and co-axial current (co-helicity), (2) counter-axial field and co-axial current (counter-helicity), (3) co-axial field and counter-axial current (counter-helicity), and (4) counter-axial field and counter-axial current (co-helicity). Except case 3, each case is found to be related with certain eruptive features.

[구 SS-05] Cross-Correlation of Oscillations in A Fragmented Sunspot

Kyeore Lee and Jongchul Chae