

The Korea Astronomy and Space Science Institute (KASI) and the Department of Astronomy at the University of Texas at Austin (UT) are developing a near infrared wide-band high resolution spectrograph, IGRINS (Immersion Grating Infrared Spectrograph). The white-pupil design of the instrument optics uses 7 cryogenic mirrors including 3 aspherical off-axis collimators and 4 flat fold mirrors. Two of the 3 collimators are H- and K-band pupil transfer mirrors and they are designed as compensators for the system alignment in each channel. Therefore, their mount design will be one of the most sensitive parts in the IGRINS optomechanical system. The design work will include the computer-aided 3D modeling and finite element analysis (FEA) to optimize the structural stability of the mount models. The mount body will also include a tip-tilt and translation adjustment mechanism to be used as the alignment compensators.

### [V-2-2] Alignment estimation performance of Multiple Design Configuration Optimization for three optical systems

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In this study, we investigated alignment state estimation performances of the three methods i.e. merit function regression (MFR), differential wavefront sampling (DWS) and Multiple Design Configuration Optimization (MDCO). The three target optical systems are 1) a two-mirror Cassegrain system for deep space Earth observation, 2) intermediate size three-mirror anastigmat for Earth ocean monitoring, and 3) extremely large segmented optical system for astronomical observation. We ran alignment state estimation simulation for several alignment perturbation cases including 1mm to 10mm in decenter and from 0.1 to 1 degree in tilt perturbation error for the two-mirror Cassegrain system. In general, we note that MDCO shows more competitive estimation performance than MFR and DWS. The computational concept, case definition and the simulation results are discussed with implications to future works.

### [V-2-3] Opto - Mechanical Design of IGRINS Slit-viewing Camera Barrel

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IGRINS (Immersion GRating INfrared Spectrometer) is a high resolution wide-band infrared spectrograph developed by Korea Astronomy and Space Science Institute (KASI) and the University of Texas at Austin (UT). The slit-viewing camera is one of four re-imaging optics in IGRINS including the input relay optics and the H- and K- band spectrograph cameras. Consisting of five lenses and one Ks-band filter, the slit viewing camera relays the infrared image of 2' x 2' field around the slit to the detector focal plane. Since IGRINS is a cryogenic instrument, the lens barrel is designed to be optimized at the operating temperature of 130 K. The barrel design also aims to achieve easy alignment and assembly. We use radial springs and axial springs to support lenses and lens spacers against the gravity and thermal contraction. Total weight of the lens barrel is estimated to be 1.2 kg. Results from structural analysis are presented.

### ■ Session : 기기 III

4월 29일(금) 14:10 - 14:50 제2발표장

### [VI-2-1] 양방향 분포 함수가 적용된 달의 3D 광학 모델

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연세대학교 천문우주학과 우주광학연구실, 연세대학교 우주과학연구소, 연세대학교 천문대

달의 양방향 분포 함수는 Hapke에 의하여 처음 이론적 모델이 만들어졌고, 이후 Foote에 의해 아폴로 11호의 달 토양 샘플 10084의 양방향 분포 함수가 측정된 바 있다. 이 연구에서는 실제 크기의 달의 표면에 Hapke의 양방향 분포 함수를 적용하여 광학 모델은 개발하였다. 달 표면의 산란특성 중 반 무한하고 매끄러운 지면에 적용되는 후방산란 효과와 산란각에 따른 위상 함수가 적용된 모델이 사용되었으며, 위상함수로는 Henyey-Greenstein 함수가 사용되었다. 달의 3D 모델에 사용된 매개 변수는 Foote가 측정한 Hapke의 변수를 따랐으며 달의 단일 산란 알베도는  $w=0.33$ , 핫스팟의 넓이는  $h=0.017$ , Legendre 다항 계수인  $b$ 와  $c$ 에는 각각  $b=0.308$ ,  $c=0.425$ 의 값이 사용되었다. 구성된 달의 양방향 분포 함수를 이용한 통합적 광선 추적 수치 모사 결과, 달 반사광의 복사 휘도율은 1차 근사 해석적 방법을 이용한 계산 결과의 복사 휘도율과 측정 오차 범위 이내의 오차를 보였다.

### [VI-2-2] Structural design revision of KRISS profilometer for improved measurement accuracy

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