

Complex organic molecules (COMs) are commonly detected in star forming regions and considered important species since they are seeds of prebiotic molecules. Although COMs form in ice mantles on dust grains, they are preferentially detected in the gas phase. The origin of the gaseous COMs highly depends on the circumstance of each star forming region. Therefore, the distribution of COMs emission reflects the physical and chemical conditions of the region. We present the newly detected COMs, especially methanol emission lines toward two massive star forming regions, G19.61-0.23 and G75.78+0.34 in the Atacama Large Millimeter/submillimeter Array Band 3 observations during the Cycle 2 phase. Multiple transitions of methanol are detected in both regions but show different emission morphology. The origin of the desorption (e.g. shocks or high energy photons) is discussed.

#### [포 IM-08] Statistical study of turbulence from polarized synchrotron emission

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When turbulent motions perturb magnetic field lines and produce magnetic fluctuations, the perturbations leave imprints of turbulence statistics on magnetic field. Observation of synchrotron radiation is one of the easiest ways to study turbulent magnetic field. Therefore, we study statistical properties of synchrotron polarization emitted from media with magnetohydrodynamic (MHD) turbulence, using both synthetic and MHD turbulence simulation data. First, we obtain the spatial spectrum and its derivative with respect to wavelength of synchrotron polarization arising from both synchrotron radiation and Faraday rotation. The study of spatial spectrum shows how the spectrum is affected by Faraday rotation and how we can recover the statistics of underlying turbulent magnetic field as well as turbulent density of electrons from interferometric observations that incorporate the effects of noise and finite telescopic beam size. Second, we study quadrupole ratio to quantitatively describe the degree of anisotropy introduced by magnetic field in the presence of MHD turbulence. We consider the case that the synchrotron emission and Faraday rotation are spatially separated, as well as the situation that the sources of the synchrotron radiation and thermal electrons causing Faraday rotation exist in the same region. In this study, we

demonstrate that the spectrum and quadrupole ratio of synchrotron polarization can be very informative tools to get detailed information about the statistical properties of MHD turbulence from radio observations of diffuse synchrotron polarization.

#### [포 IM-09] Obtaining the driving scale of turbulence from observations

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To maintain turbulence in astrophysical fluids, driving is required. Constraining the driving scale of turbulence is important to identify the driving mechanism and also to obtain more accurate turbulence statistics from observations. We discuss how to obtain the driving scale of turbulence from observations. First, we explain the method to obtain the driving scale from the standard deviation of centroid velocity (i.e. the first moment of the line profile). Second, we discuss other techniques to obtain the driving scale.

#### [포 IM-10] Correlation between Orion A Molecular Cloud's Velocity Gradient and Cloud Collision

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오리온 A 분자운은 은경 204°~220°, 은위 17°~21°영역에 분포하고 있다. 여기서  $V_{lsr}$ 은 은경이 증가함에 따라 감소하는 모습을 보이고 있다. 이러한 속도 기울기의 기울은 분자운의 회전으로 인한 것이라는 이론(Kutner et al. 1977; Maddalena et al. 1986)과 Ori OB1으로 발생한 항성풍이 주도하는 큰 규모의 팽창에 의한 것이라는 이론(Bally et al. 1987) 등 여러 가지가 있다. 이 연구에서는 TRAO, FCRAO 관측 데이터를 이용하여 충돌하는 분자운과 오리온 A 분자운의 속도 기울기 사이에 어떠한 상관관계를 가지는지 알아보려고 한다.

### 천문우주 관측기술

#### [포 AT-01] Optic-axis Alignment and Performance Test of the Schwarzschild-Chang Off-axis Telescope

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The Schwarzschild-Chang off-axis telescope is a “linear astigmatism-free” confocal system. The telescope comprises two pieces of aluminum-alloy freeform mirrors that are fabricated with diamond turning machine (DTM) process. We designed optomechanical structures where optical components in the telescope system can be adjustable on a linear stage. Optomechanical deformation caused by the weight of system itself and its temperature variation is analyzed by the finite element analysis (FEA). The results show that the deformation is estimated in the tolerance range. For the optic-axis alignment of telescope system, three-point alignment (TPA) method is chosen. The TPA method uses three parallel lasers and a plane mirror. Point source images were taken from collimated light and field observation. The performance of optical system was tested by point spread function and aberration measurement of the point sources.

#### [포 AT-02] Improvement and quasi optical analysis of wide band prototype feedhorn for ASTE focal plane array

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As an upgrade we report the current ASTE ultra-wideband corrugated horn design. The length of the feedhorn gets shortened from 12.5 mm to 11 mm, and it shows better side lobe level at the far-field patterns compared with the previous design.

We looked into possible quasi-optical solution to match the feedhorn beam to the optics of the current ASTE telescope, starting from frequency-independent solution using two ellipsoidal mirrors to which wideband performance of the feedhorn naturally fits. We used a commercial physical optics package (GRASP) with an user-defined optimizer to give physical

constraints to evaluated optical designs for highest efficiency.

#### [포 AT-03] Design of Integrated Control Software for Automated Observing System

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Remote and robotic telescopes are the most effective instrument for astronomical survey projects. The system is based on the dynamic operation of all astronomical instruments such as dome and telescope control system (TCS), focuser, filter wheel and data taking camera. We adopt the ASCOM driver platform to control the instruments through the integrated software. It can convert different interface libraries from various manufacturers into a uniform standard library. This allows us to effectively control astronomical instruments without modifying codes. We suggest a conceptual design of software for automation of a small telescope such as the new wide-field 0.25m telescope at McDonald Observatory. It can also be applied to operation of multi-telescopes in future projects.

#### [포 AT-04] Fabrication of Freeform Aluminum mirrors for Wide Field Infrared Telescopes

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Single Point Diamond Turning (SPDT) is a cost-effective technique to fabricate metallic mirrors. In particular, the servo-assisted diamond turning option is highly useful for the fabrication of freeform surfaces. However, the SPDT process