[구 IM-03] CHEMICAL PROPERTIES OF CORES IN DIFFERENT ENVIRONMENTS: THE ORION A, B AND λ ORIONIS CLOUDS

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We observed 80 dense cores (N(H_2) > 10^{22} cm^{-2}) in the Orion molecular cloud complex which contains the Orion A (39 cores), B (26 cores), and λ Orionis (15 cores) clouds. We investigate the behavior of the different molecular tracers and look for chemical variations of cores in the three clouds in order to systematically investigate the effects of stellar feedback. The most commonly detected molecular lines (with the detection rates higher than 50%) are N_2H+, HCO+ , $H^{13}CO$+, C_2H, HCN, and H_2CO. The detection rates of dense gas tracers, N_2H^+, HCO^+ , $H^{13}CO^+$, and C_2H show the lowest values in the λ Orionis cloud. We find differences in the D/H ratio of H_2CO and the N_2H^+/ HCO^+ abundance ratios among the three clouds. Eight starless cores in the Orion A and B clouds exhibit high deuterium fractionations, larger than 0.10, while in the λ Orionis cloud, no cores reveal the high ratio. These chemical properties could support that cores in the λ Orionis cloud are affected by the photo-dissociation and external heating from the nearby H II region. An unexpected trend was found in the [N_2H^+]/[HCO^+] ratio with a higher median value in the λ Orionis cloud than in the Orion A/B clouds than; typically, the [N_2H^+]/[HCO^+] ratio is lower in higher temperatures and lower column densities. This could be explained by a longer timescale in the prestellar stage in the λ Orionis cloud, resulting in more abundant nitrogen-bearing molecules. In addition to these chemical differences, the kinematical difference was also found among the three clouds; the blue excess, which is an infall signature found in optically thick line profiles, is 0 in the λ Orionis cloud while it is 0.11 and 0.16 in the Orion A and B clouds, respectively. This result could be another evidence of the negative feedback of active current star formation to the next generation of star formation.

[구 IM-04] TIMES: mapping Turbulent properties In star-forming MolEcular clouds down to the Sonic scale. I. the first result.

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Turbulence is one of the natural phenomena in molecular clouds. It affects gas density and velocity fluctuation within the molecular clouds and controls the mode and tempo of star formation. However, despite many years of study, the properties of turbulence remain poorly understood. As part of the Taeduk Radio Astronomy Observatory (TRAO) Key Science Program (KSP), "mapping Turbulent properties In star-forming MolEcular clouds down to the Sonic scale (TIMES; PI: Jeong-Eun Lee)", we have fully mapped two star-forming molecular clouds, the Orion A and the Ophiuchus molecular clouds, in 3 sets of lines (^{13}CO J=1-0, $C^{18}O$ J=1-0, HCN J=1-0, HCO^+ J=1-0, CS J=2-1, and N_2H^+ J=1-0) using the TRAO 14-m telescope. We apply a statistical analysis, Principal Component Analysis (PCA), which can recover an underlying turbulent-power spectrum from an observed P-P-V spectral map. We compare turbulence properties not only between the two clouds, but also between different parts within each cloud. We present the first result of our observation program.

[구 IM-05] High-resolution Near-infrared Spectroscopy of IRAS 16316-1540: Evidence of Accretion Burst

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The high-resolution near-infrared (NIR) spectroscopy can reveal the evidence of the accretion burst (e.g., the broadened absorption features produced by the Keplerian disk motion)

although the moment of the outburst was not caught. The embedded protostar IRAS 16316-1540 observed with the Immersion Grating Infrared Spectrograph (IGRINS, R = $\Delta\lambda/\lambda \sim 45000$) shows the broad absorption features in atomic and CO transitions, as seen in FU Orionis objects (FUors), indicative of an outburst event. We examine whether the spectra of IRAS 16316-1540 arise from the rotating inner hot gaseous disk. Using the IGRINS spectral library, we show that the line profiles of IRAS 16316-1540 are more consistent with an M1.5 V template spectrum convolved with a disk rotation profile than the protostellar photosphere absorption features with a high stellar rotation velocity. We also note that the absorption features deviated from the expected line profile of the accretion disk model can be explained by a turbulence motion generated in the disk atmosphere. From previous observations that show the complex environment and the misaligned outflow axes in IRAS 16316-1540, we suggest that an impact of infalling clumpy envelope material against the disk induces the disk precession, causing the accretion burst from the inner disk to the protostar.

[구 IM-06] The JCMT Transient Survey: Examination of Periodic Variability in nearby Star-forming Regions

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We perform the Lomb-Scargle Periodogram analysis to protostars identified by the JCMT Transient Survey, which monitors 8 nearby star forming regions. The observations have been done monthly for over 3 years using SCUBA-2 (the Submillimetre Common User Bolometer Array 2) in two wavelengths, 450 and 850 μm. Under the threshold of 1% False Alarm Probability, we found 16 variable sources including EC53, which is the first variable protostar detected by the JCMT Transient Survey. Most of the variable sources are cataloged as protostars (classified via the Spitzer data, Megeath et al. 2012; Dunham et al. 2015), but SerpS-MM19, which has a clear 1-year period, is a candidate of a first hydrostatic core (Maury et al. 2011; Young et al. 2018).

[구 IM-07] Removing Large-scale Variations in Regularly and Irregularly Spaced Data

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In many astrophysical systems, smooth large-scale variations coexist with small-scale fluctuations. For example, a large-scale velocity or density gradient can exist in molecular clouds that have small-scale fluctuations by turbulence. In redshifted 21cm observations, we also have two types of signals - the Galactic foreground emissions that change smoothly and the redshifted 21cm signals that fluctuate fast in frequency space. In many cases, the large-scale variations make it difficult to extract information on small-scale fluctuations. We propose a simple technique to remove smooth large-scale variations. Our technique relies on multi-point structure functions and can obtain the magnitudes of small-scale fluctuations. It can also be used to design filters that can remove large-scale variations and retrieve small-scale data. We discuss how to apply our technique to irregularly spaced data, such as rotation measure observations toward extragalactic radio point sources.

[구 IM-08] The distribution of magnetic field strength in Orion A region

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Magnetic fields play an important role in supporting molecular clouds against gravitational collapse. The measured magnetic field strengths in molecular clods enable us to see the effect of magnetic fields in star-forming regions. People have used the Chandrasekhar and Fermi (CF) method to estimate magnetic field strength from observational quantities of molecular cloud density, turbulent velocity and polarization angle dispersion. However, previous studies obtained just one magnetic field strength over the quite large region of a molecular cloud by using the CF method. We here suggest a way to estimate magnetic field strength distribution in Orion A region. We used 450 and 850-micron polarization data of James Clerk Maxwell Telescope (JCMT). Magnetic field strengths were estimated in two wavelengths with 4 pixel resolutions of 16, 20, 24 and 28″. Through statistical analysis, we proved the difference of magnetic field strengths between two wavelengths were caused by the difference of their beam sizes. Additionally, we calculated the radii of curvature of polarization segments to