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Thermal inflation is an additional inflationary mechanism before the big bang nucleosynthesis, which solves the moduli problem and naturally provides a plausible dark matter candidate. Thermal inflation leaves a slight enhancement followed by huge suppression of a factor of ~50 in the curvature and matter power spectrum, which can be expressed in terms of a single characteristic scale k_b. Here we describe the observability of the small-scale features of thermal inflation from various observations, such as CMB distortion, satellite galaxy abundance in the Milky-Way-sized galaxies, and 21-cm power spectrum before the epoch of reionization.

성간물질/별생성/우리은하

[포 IM-01] BISTRO and BISTRO-2

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The B-fields In STar-forming Region Observations (BISTRO) is the 3-year large program of the James Clerk Maxwell Telescope (JCMT) using SCUBA-2 and POL-2, started in 2016. We aim to study the roles of magnetic fields in star formation by observing 16 fields of nearby star forming regions, e.g., Orion and Ophiuchus molecular clouds. The angular resolution and wavelength provided by JCMT (14 arcsecond at 850 micrometer) is ideal to investigate the intermediate scales of magnetic fields (1000-10000 au) associated in cold dense cores and filaments. This year, moreover, we were awarded JCMT time for additional 16 fields (BISTRO-2), which allows us to cover broader physical properties of star forming regions. We report the current status of BISTRO and introduce BISTRO-2.

Note: (PI) D. Ward-Thompson, (co-PIs) P. Bastien, T. Hasegawa, W. Kwon, S. Lai, and K. Qiu

[포 IM-02] Filament, the Universal Nersery of Stars: Progress Report on TRAO Survery of Nearby Filamentary Filamentary Molecular Clouds

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To dynamically and chemically understand how filaments, dense cores, and stars form under different environments, we are conducting a systematic mapping survey of nearby molecular clouds using the TRAO 14 m telescope with high (N_2H^+ 1-0, HCO^+ 1-0, SO 32-21, and NH_2D v=1-0) and low (^{13}CO 1-0, $C^{18}O$ 1-0) density tracers. The goals of this survey are to obtain the velocity distribution of low dense filaments and their dense cores for the study of their origin of the formation, to understand whether the dense cores form from any radial accretion or inward motions toward dense cores from their surrounding filaments, and to study the chemical differentiation of the filaments and the dense cores. Until the 2017A season, the real OTF observation time is ~760 hours. We have almost completed mapping observation with four molecular lines (^{13}CO 1-0, $C^{18}O$ 1-0, N_2H^+ 1-0, and HCO^+ 1-0) on the six regions of molecular clouds (L1251 of Cepheus, Perseus West, Polaris South, BISTRO region of Serpens, California, and Orion B). The cube data for ^{3}CO and $C^{18}O$ lines were obtained for a total of 6 targets, 57 tiles, 676 maps, and 7.1 deg^2. And N_2H^+ and HCO^+ data were added for 2.2 deg^2 of dense regions. All OTF data were regridded to a cell size of 44 by 44 arcseconds. The ^{13}CO and $C^{18}O$ data show the RMS noise level of about (0.1-0.2) K and N_2H^+ and HCO^+ data show about (0.07-0.2) K at the velocity resolution of 0.06 km/s. Additional observations will be made on some regions that have not reached the noise level for analysis. To identify filaments, we are using and testing programs (DisPerSE, Dendrogram, FIVE) and visual inspection for 3D image of cube data. A basic analysis of the physical and chemical properties of each filament is underway.

[포 IM-03] Turbulent Properties in the Orion A and ρ Ophiuchus molecular clouds: Observations and preliminary results

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Molecular clouds are the sites of stellar birth. Turbulence is a natural phenomenon in molecular clouds, which largely determines the density and velocity fields. Additionally turbulent energy dissipation can affect the gas kinetic temperature via shocks. Turbulence thus controls the mode and tempo of star formation. However, despite its important role in star formation, the properties of turbulence remain poorly understood. As part of the Taeduk Radio Astronomy Observatory (TRAO) Key Science Program (KSP), "Mapping turbulent properties of star-forming molecular clouds down to the sonic scale (PI: Jeong-Eun Lee)", we have been mapping two star-forming clouds, the Orion A and the ρ Ophiuchus molecular clouds in 3 sets of lines (13CO 1-0/C18O 1-0, HCN 1-0/HCO+ 1-0, and CS 2-1/N2H+ 1-0) using the TRAO 14-m telescope. We apply a Principal Component Analysis (PCA), which is an useful tool to represent turbulent power spectrum. We will present the preliminary results of our TRAO KSP toward two regions: OMC 1-4 in the Orion A cloud, and L1688 in the ρ Ophiuchus cloud.

[포 IM-04] Chemical properties of cores in different environments; the Orion A, B and λ Orionis clouds

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We present preliminary results of KVN single dish telescope observations of 80 dense cores in the Orion molecular cloud complex which contains the Orion A, B, and λ Orionis cloud. 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 N2H+, HCO+, H13CO+, C2H, HCN, and H2CO. The detection rates of dense gas tracers, N2H+, HCO+ , H13CO+, and C2H show the lowest values in the λ Orionis cloud. We find difference between molecular D/H ratios and N2H+/H13CO+ abundance ratios towards different clouds, and between protostellar cores and starless cores. 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, which is a hint of negative stellar feedback on core formation. The striking difference between the [N2H+]/[H13CO+] ratios leads us to suggest that there are significant evolutionary differences between the Orion A/B and λ Orionis clouds. In order to examine whether starless cores can be candidates of pre-stellar cores, we compared the core masses estimated from the 850 um emission to their Virial masses calculated from the N2H+ line data and find that most of them are not gravitationally bound in the three clouds.

[포 IM-05] Chemical and Kinematic Properties of the Galactic Halo System

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We present chemical and kinematic properties of the Milky Way's halo system investigated by carbon-enhanced metal-poor (CEMP) stars identified from the Sloan Digital Sky Survey. We first map out fractions of CEMP-no stars (those having no over-abundances of neutron-capture elements) and CEMP-s stars (those with over-enhancements of the s-process elements) in the inner- and outer-halo populations, separated by their spatial distribution of carbonicity ([C/Fe]). Among CEMP stars, the CEMP-no and CEMP-s objects are classified by different levels of absolute carbon abundances, A(C). We investigate characteristics of rotation velocity and orbital eccentric for these subclasses for each halo population. Any distinct kinematic features identified between the two categories in each halo region provide important clues on the origin of the dichotomy of the Galactic halo.