to 0.9 depending on the supernova explosion frequency and the evolution model, has been calculated from the O VI and C IV maps. The hot gas generation models has been verified from the global distribution of O VI and C IV emissions, and a new complementary model has been proposed in this study.

[구 IM-03] Unbiased spectroscopic study of the Cygnus Loop with LAMOST

Ji Yeon Seok[1], Bon-Chul Koo[2], Gang Zhao[1]
[1]National Astronomical Observatories, CAS, Beijing, China, [2]Seoul National University

We present a spectroscopic study of the Galactic supernova remnant (SNR) Cygnus Loop using the fifth Data Release (DR5) of LAMOST. The LAMOST (Large Sky Area Multi-Object Fiber Spectroscopic Telescope) features both a large field-of-view (about 20 deg2) and a large aperture (~4 m in diameter), which allow us to obtain 4000 spectra simultaneously. Its wavelength coverage ranges from ~3700Å to 9000Å with a spectral resolution of R≈1800. The Cygnus Loop is a prototype of middle-aged SNRs, which has advantages of being bright, large in angular size (~3.8˚x3˚), and relatively unobscured by dust. Along the line of sight of the Cygnus Loop, 2747 LAMOST DR5 spectra are found in total, which are spatially distributed over the entire remnant. Among them, 778 spectra are selected based on the presence of emission lines (i.e., [O III]λ5007, Ha, and [S II]λλ 6717, 6731) for further visual inspection. About half of them (336 spectra) show clear spectral features to confirm their association with the remnant, 370 spectra show stellar features only, and 72 spectra are ambiguous and need further investigation. For those associated with the remnant, we identify emission lines and measure their intensities. Spectral properties considerably vary within the remnant, and we compare them with theoretical models to derive physical properties of the SNR such as electron density and temperature, and shock velocity. While some line ratios are in good agreement with model prediction, others cannot be explained by simple shock models with a range of shock velocities. We discuss these discrepancies between model predictions and the observations and finally highlight the powerfulness of the LAMOST data to investigate spatial variations of physical properties of the Cygnus Loop.

[구 IM-04] Internal structure of a massive star-forming region G33.92+0.11 revealed by the high resolution ALMA observations

Young Chol Minh[1], H. B. Liu[2], H.-R. Chen[3]
[1]Korea Astronomy and Space Science Institute), [2]ASIAA, Taiwan, [3]National Tsing Hua U. Taiwan

G33.92+0.11, classified as a core-halo UC HII region at a distance of 7.1 kpc, contains several sub-clumps (~20-200 solar masses) as identified by dust continuum emission. This source shows very complicated features associated with vigorous massive star-forming activities with a nearly face-on projection. The ambient gas is still accreting to the massive molecular clumps dynamically, while the whole cloud is under disruption by newly formed stars. Using the recent high resolution (< 0.2") ALMA observations, we investigate the detailed structure associated with the star-forming activities by comparing different chemical tracers. The sub-clumps having extremely complex morphologies still preserve cold dense gas together with the turbulent and dense warm gas resulted by newly formed stars and interaction with accreting gas. The accretion of the ambient gas may have occurred episodically to this source. Most recent star formation, which probably the third generation of star formation in this region, is taking place in the northern part (A5 clump). The relatively small mass (~ 1/3 of A1 or A2) and the lack of turbulent gas of this star-forming core may suggest that this core was formed already during the overall collapse of the whole cloud for the first star formation. We think that gravitational collapse of these sub-clumps appears as sequential star formation of this region. The later interaction with accreting gas may have not been a direct cause of the star formation activities of this source.

[구 IM-05] Magnetic Fields of the Youngest Protostellar System L1448 IRS 2 revealed by ALMA

Woojin Kwon (권우진)[1,2], Ian W. Stephens[3], John J. Tobin[4], Leslie W. Looney[5], Zhi-Yun Li[6], Richard M. Crutcher[5], Jongsoo Kim (김종수)[1,2], and Floris F. S. van der Tak[7,8]
[1]Korea Astronomy and Space Science Institute (한국천문연구원), [2]University of Science and Technology, [3]Harvard-Smithsonian Center for Astrophysics, [4]University of Oklahoma, [5]University of Illinois, [6]University of Virginia, [7]SRON Netherlands Institute for Space Research, [8]Kapteyn Astronomical Institute

Magnetic fields affect star formation in a broad range of scales from parsec to hundreds au. In particular, interferometric observations and ideal magneto-hydrodynamic (MHD) simulations have

reported that formation of a rotation-supported disk at the earliest young stellar objects (YSOs) is largely suppressed by magnetic fields aligned to the rotational axis of YSOs: magnetic braking. Our recent ALMA observations toward L1448 IRS 2, which has a rotation detected and its magnetic fields aligned to the rotation axis (poloidal fields) in ~500 au scales, show that the fields switch to toroidal at the center in ~100 au scales. This result suggests that magnetic braking may not be so catastrophic for early disk formation even in YSOs with magnetic fields aligned to the rotational axis.

[구 IM-06] FUNS - Filaments, the Universal Nursery of Stars. I. Physical Properties of Filaments and Dense Cores in L1478

Eun Jung Chung, Shinyoung Kim, Archana Soam, and Chang Won Lee
[1]*Korea Astronomy and Space Science Institute*

Formation of filaments and subsequent dense cores in ISM is one of the essential questions to address in star formation. To investigate this scenario in detail, we recently started a molecular line survey namely 'Filaments, the Universal Nursery of Stars (FUNS)' toward nearby filamentary clouds in Gould Belt using TRAO 14m single dish telescope equipped with a 16 multi-beam array. In the present work, we report the first look results of kinematics of a low mass star forming region L1478 of California molecular cloud. This region is found to be consisting of long filaments with a hub-filament structure. We performed On-The-Fly mapping observations covering ~1.1 square degree area of this region using C18O(1-0) as a low density tracer and 0.13 square degree area using N2H+(1-0) as a high density tracer, respectively. CS (2-1) and SO (32-21) were also used simultaneously to map ~290 square arcminute area of this region. We identified 10 filaments applying Dendrogram technique to C18O data-cube and 13 dense cores using FellWalker and N2H+ data set. Basic physical properties of filaments such as mass, length, width, velocity field, and velocity dispersion are derived. It is found that filaments in L~1478 are velocity coherent and supercritical. Especially the filaments which are highly supercritical are found to have dense cores detected in N2H+. Non-thermal velocity dispersions derived from C18O and N2H+ suggest that most of the dense cores are subsonic or transonic while the surrounding filaments are transonic or supersonic. We concluded that filaments in L~1478 are gravitationally unstable which might collapse to form dense cores and stars. We also suggest that formation mechanism can be different in individual filament depending on its morphology and environment.

[구 IM-07] Chemical Differentiation of CS and N_2H^+ in Starless Dense Cores

Shinyoung Kim[1,2], Chang Won Lee[1,2], Jungjoo Sohn[3], Gwanjeong Kim[4], and Mi-Ryang Kim[1]
[1]*KASI,* [2]*UST,* [3]*KNUE,* [4]*NAOJ*

CS molecule is known to be adsorbed onto dust in cold dense cores, causing its significant depletion in the center region of cores. This study is aimed to investigate the depletion of CS molecule with optically thin $C^{34}S$ molecular line observations, including significance of its differentiation depending on the evolutionary status of the dense cores. We mapped five evolved starless cores, L1544, L1552, L1689B, L694-2 and L1197 using two molecular lines, $C^{34}S$ (J=2-1) and N_2H^+ (J=1-0) with NRO 45 m telescope. The H_2 column density and temperature structures of each targets were obtained by SED fitting for Herschel continuum images and the internal number density profiles by model fitting. All of the integrated intensity maps of $C^{34}S$ show depletion holes and ‘semi-ring-like’ distribution, indicating that the depletion of CS is clear and general. The radial profiles of CS abundance also show significant decrease towards the core center, while N_2H^+ abundance is almost constant or enhanced. We find that the more evolved cores with higher H_2 density tend to have a stronger depletion of CS. Our data strongly support claims that CS molecule generally depletes out in the central regions of starless dense cores and such chemical differentiation is closely related to their evolution.

[구 IM-08] The ice features of Very Low Luminosity Objects (VeLLOs): Unveiling their episodic accretion history through the spectroscopic observation of AKARI IRC

Jaeyeong Kim[1], Jeong-Eun Lee[1], Yuri Aikawa[2], Il-Seok Kim[3], Ho-Gyu Lee[4], Woong-Seob Jeong[4,5], and Jennifer A. Noble[6]
[1]*School of Space Research, Kyung Hee University, Korea,*
[2]*Department of Astronomy, Graduate School of Science, The University of Tokyo, Japan,*
[3]*SE Lab, Korea,*
[4]*Korea Astronomy and Space Science Institute, Korea,*
[5]*Korea University of Science and Technology, Korea,*
[6]*Laboratoire de Physique des Lasers, Atomes et Molécules, The University de Lille, France*