Point Sources in the Galactic Center

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We present preliminary results of our long-term (2009-2017) observing campaign using the NASA IRTF at Mauna Kea, to obtain 2 – 5 μm spectroscopy of ~200 red point sources in the line of sight to the Galactic center. Point sources in our sample were selected from the mid-infrared images of the Spitzer Space telescope, and include candidate massive young stellar objects, which have previously been identified from our Spitzer/IRS spectroscopy. We show high foreground extinction of these sources from deep 3.1 μm H2O ice and aliphatic hydrocarbon absorption features, suggesting that they are likely located in the central 300 pc region of the Galactic center. While many sources reveal photospheric 2.3 μm gas CO absorption, few of them clearly indicate 3.54 μm CH3OH ice absorption, possibly indicating a large dust column density intrinsic to a massive young stellar object.

[포 IM-07] High-Resolution Spectroscopy of Hydrogen Emission Lines around a Herbig star, MWC 1080 with IGRINS

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Using IPHAS Hα data, we found bright Hα regions inside the elongated ^{13}CO cavity around a Herbig star, MWC 1080. To investigate the ionized hydrogen regions and the molecular cavity, we perform near-IR high-resolution spectroscopic of hydrogen Brackett lines and molecular hydrogen lines by Immersion GRating INfrared Spectrograph (IGRINS) observations. We detected broad Brackett line series and sharp molecular lines with various velocity components. We present three ionized hydrogen regions (near MWC 1080A, MWC 1080E, and CO boundary) with different line widths, central radial velocities, and line ratios. We also show two spatially-separate Brγ λ2.1662 μm peaks near MWC 1080A. To reveal a 3D structure of the cavity around MWC 1080, we try to use the detected sharp molecular lines.

[포 IM-08] Early Chemical Evolution of the Milky Way Revealed by Ultra Metal-Poor ([Fe/H] < -4.0) Stars

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Chemical abundance ratios of ultra metal-poor (UMP; [Fe/H] < -4.0) stars can provide important constraints on the early chemical enrichment of the Milky Way (MW), associated with the nucleosynthesis processes that occurred during the evolution of their progenitors, which are presumably the first generation of stars. Despite their importance, only about thirty UMP stars have been discovered thus far. In an effort to identify such stars additionally, we selected UMP candidates from low-resolution (R ~ 2000) spectra from the Sloan Digital Sky Survey and Large Sky Area Multi-Object Fibre Spectroscopic Telescope (LAMOST), and obtained with Gemini/GRACES high-resolution (R ~ 40,000) spectra of 15 UMP candidates. In this study, we present the results of the chemical abundance analysis of the UMP candidates. Furthermore, we compare the abundance patterns of our UMP stars with those of various metal-poor stars from literature to understand the early chemical evolution of the MW.

[포 IM-09] Characteristic Mass Function of First Generation of Stars Investigated by Extremely Metal-Poor ([Fe/H] < -3.0) Stars

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Even though the initial mass function (IMF) of the first generation of stars played important roles in reionization of the universe, subsequent star formation, and chemical enrichment of the universe, it is still very uncertain. In this study, among the several indirect ways of estimating the IMF of the population III (Pop III) stars, we make use of extremely metal-poor (EMP; [Fe/H] < -3.0) stars in the Milky Way, in order to infer the characteristic mass range of Pop III stars. As the progenitors of many of the EMP stars are known to be Pop III stars, we attempt to construct the characteristic mass range of the progenitors (e.g., Pop III stars) of the EMP stares by comparing their observed abundance pattern of various chemical elements with chemical yields from supernova models.

[포 IM-10] Impact of Interstellar Na on the

Estimation of Na Abundance from Low-resolution Stellar Spectra.

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It is inferred that many stars in the Galactic halo or bulge were once members of globular clusters (GCs), which are now dissolved. To distinguish the GC-originated stars, which can provide valuable information on the origin of the bulge and halo, from the in situ field stars, the Na abundance plays an important role. However, the interstellar Na in certain directions can unnecessarily enhance the estimate of the Na abundance from stellar spectra due to blended Na D lines unless the spectral resolution is very high, which allows to resolve the lines from the interstellar Na. In this study, we present a means of correcting the Na abundance affected by the interstellar Na in the low-resolution of the Sloan Digital Sky Survey stellar spectra.

[포 IM-11] ALMA Observations of a Massive-star-forming Infrared Dark Cloud Core MSXDC G053.11+00.05 MM1

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We present the ALMA observations of the infrared dark cloud (IRDC) core MSXDC G053.11+00.05 MM1 at the distance of 1.7 kpc. While the core was first identified at 1.2 mm with a mass of 124 Msun, recent near- and mid-infrared observations have revealed a parsec-scale molecular hydrogen (H2 1-0 S(1) at 2.12 micron) outflow and two early class young stellar objects (YSOs) at the center of the core, one of which is likely massive (M > 8 Msun). From the ALMA Band 7 observations with a resolution of 0.5", we have found a dust filament of < 0.1 pc in which five dense cores are embedded in the 870 micron continuum. The brightest core is consistent with one of the two previously-detected YSOs, but the other four are newly discovered implying their very deeply embedded status. We have also detected several molecular line emission including H13CO+ and C17O as well as 13CO outflow with complicated morphology. At the brightest core, the methanol line (CH3OH) shows velocity gradients, which may support the existence of a circumstellar disk around a high-mass protostar. Based on the derived properties of the dense cores, we discuss their association with the two YSOs and H2 outflow detected in infrared and high-mass star-formation process occurring in IRDC cores.

[포 IM-12] TRAO Survey of Nearby Filamentary Molecular Clouds, the Universal Nursery of Stars (TRAO FUNS). III. Dynamics of filaments in different star forming environments

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Recent high resolution IR observations reveal that molecular clouds are filamentary and such a structure is ubiquitous over various star-forming environments, and it is clear that filaments play a crucial role in the formation of cores and stars. However, the formation process of dense cores in the filaments are still unknown. To investigate this issue in detail, we have carried out TRAO FUNS (TRAO survey of nearby Filamentary molecular clouds, the Universal Nursery of Stars) toward various star forming filamentary molecular clouds.

In this presentation, we will report the first look results of filaments and dense cores in MCLD 123.5+24.9 and IC 5146, which are known as a quiescent, non-star-forming region and an active, high-mass star forming region, respectively. By comparing the kinematic properties of filaments and dense cores in different star forming environments, we verified the formation scenario of filaments and dense core, i.e., gravoturbulent fragmentation via supersonic motions.

[포 IM-13] JCMT-CHIMPS2 Survey

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The CHIMPS2 survey is to extend the JCMT HARP $^{13}CO/C^{18}O$ J=3-2 Inner Milky-Way Plane Survey (CHIMPS) and the ^{12}CO J=3-2 survey (COHRS) into the inner Galactic Plane, the Central Molecular Zone (CMZ), and a section of the Outer Plane. When combined with the complementary $^{12}CO/^{13}CO/C^{18}O$ J=1-0 survey at the Nobeyama 45m (FUGIN) at matching 15" resolution and sensitivity, and other current CO surveys, the results will provide a complete set of transition data with which to calculate accurate column densities, gas temperatures and turbulent Mach numbers. These will be used to: analyze molecular cloud properties