Session: **[B5B-2] S2 : Interstellar Matter, Star Formation and the Milky Way**
Date: August 22, 2014 (Friday)
Time: 11:00~12:30
Room: Room B (Room 103)
Chair: Busaba Hutawarakorn Kramer (Max Planck Institute for Radio Astronomy)

[B5B-2-1] **11:00~11:20**

[Invited] Radio Variability and Magnetic Activities of Low Luminosity Protostars

Minho Choi (Korea Astronomy and Space Science Institute, Korea), Jeong-Eun Lee, and Miju Kang

The origin of stellar magnetic fields is difficult to study because typical protostars are surrounded by opaque layers of gas, such as partially ionized winds that are opaque to radio waves. Recently discovered very low-luminosity protostars present a new opportunity to directly observe the protostellar atmospheres, because their winds can be optically thin in centimeter wavelength. We surveyed very low-luminosity objects in the 8.5 GHz continuum using the Very Large Array. A radio outburst of IRAM 04191+1522 IRS was detected, and the variability timescale was about 20 days or shorter. Considering the variability timescale and flux level, the radio outbursts of these protostars may be caused by magnetic flares. However, they are probably too young and small to develop an internal convective dynamo. If the detected radio variability is owing to magnetic activities, this phenomenon may be caused by the fossil magnetic fields of interstellar origin.

[B5B-2-2] **11:20~11:40**

[Invited] Molecular Outflows and the Formation of Very Low Mass Objects

Phan Bao Ngoc (International University, Vietnam)

We present our latest search for molecular outflows from very low-mass objects in rho Ophiuchi and Taurus. Our results suggest that: (1) the bipolar molecular outflow process in very low-mass objects is a scaled-down version of that in low-mass stars; (2) the outflow mass-loss and the associated mass accretion processes in very low-mass objects are possibly episodic with duration of a few thousand years; (3) the outflow mass-loss rate and the mass accretion rate during active episodes are very low and they do not significantly change for different stages of the formation process of very low-mass objects; (4) A very low mass accretion rate, possibly together with a high ratio of outflow mass-loss rate to mass accretion rate, may prevent a very low-mass core to accrete enough gas to become a star; and thus the core will end up a brown dwarf.

[B5B-2-3] **11:40~11:55**

Unveiling Complex Outflow Structure of UY Aur

Tae-Soo Pyo (National Astronomical Observatory of Japan, USA), Masahiko Hayashi, Tracy L. Beck, Christoper J. Davis, and Michihiro Takami

We present high-angular resolution 1-micron spectra toward the interacting binary UY Aur obtained by Near infrared Integral Field Spectrograph (NIFS) combined with adaptive optics system Altair of GEMINI observatory. We have detected [Fe II] λ1.257 μm, He I λ1.083 μm lines from both UY Aur A (the primary source) and UY Aur B (the secondary). In [Fe II] emission, UY Aur A is brighter than UY Aur B. The blueshifted and redshifted emissions between the primary and secondary show a complicated structure. The radial velocities of the [Fe II] emission features are similar for UY Aur A and B: ～−100 km s^{-1} and ～+130 km s^{-1} for the blueshifted and redshifted components, respectively. Considering the morphologies of the [Fe II] emissions and bipolar outflow context, we concluded that UY Aur A drives fast and widely opening outflows with an opening angle of ～90◦ while UY Aur B has micro collimated jet. The He I line profile of UY Aur A shows a central emission feature with deep blue and red absorptions that may be explained by stellar wind models, while that of UY Aur B shows only an emission feature.

[B5B-2-4] **11:55~12:15**

[Invited] Youngest Protoplanetary Disk Discovered with ALMA

Shih-Ping Lai (National Tsing Hua University, Taiwan), Nadia Murillo, Simon Bruderer, Daniel Harsono, and Ewine F. van Dishoeck

Rotationally supported disks are critical in the star formation process. The questions of when they form and what factors influence or hinder their formation have been studied but are largely unanswered. Observations of early-stage YSOs are needed to probe disk formation. VLA1623 is a triple non-coeval protostellar system, with a weak magnetic field perpendicular to the outflow, whose Class 0 component, VLA1623A, shows a disk-like structure in continuum with signatures of rotation in line emission. We aim to determine whether this structure is in part or in whole a rotationally supported disk, i.e. a Keplerian disk, and what its characteristics are. Methods. ALMA Cycle 0 Early Science 1.3 mm continuum and $C^{18}O$ (2−1) observations in the extended configuration are presented here and used to perform an analysis of the disk-like structure using position–velocity (PV) diagrams and thin disk modeling with the addition of foreground absorption. The PV diagrams of the $C^{18}O$ line emission suggest the presence of a rotationally supported component with a radius of at least 50 AU. Kinematical modeling of the line emission shows that the disk out to 180 AU is actually rotationally supported, with the rotation described well by Keplerian rotation out to at least 150 AU, and the central source mass is ~ 0.2 $M_\odot$ for an inclination of 55◦. Pure infall and conserved angular momentum rotation models are excluded. VLA1623A, a very young Class 0 source, presents a disk with an outer radius Rout = 180 AU with a Keplerian velocity structure out to at least 150 AU. The weak magnetic fields and recent fragmentation in this region of ρ Ophiuchus may have played a leading role in the formation of the disk.

[B5B-2-5] **12:15~12:30**

Clues to the Evolution of Protoplaentary Disks in Orion A Star-Forming Region

Kyoung Hee Kim (Korea Astronomy and Space Science Institute, Korea), Dan M. Watson, and Spitzer IRS_DISKS Team

Every newly forming stellar system passes a disk dominant phase (Class II stage) in the process of star-formation. The disk around a growing young star is called a protoplanetary disk and it is the birth place of infant planets. Therefore, encrypted in the evolution of these disks is the story of the origin of planets. Our major goal in this study is to analyze a large sample of protoplanetary disks with near- and mid-IR spectra, by statistical approaches, to get clues to understand the mechanisms of protoplanetary disk evolution and planet formation. We utilized mid-IR (5-35 μm) IRS/Spitzer spectra of 319 Class II young stellar objects in Orion A star-forming region to measure spectral index of disk continuum to infer disk's radial and vertical properties and to derive parameters for the degree of dust processing from silicate emission features, especially around 10 μm. We also measured disk-star mass accretion rates from near-IR (0.8-2.4 μm) SpeX/IRTF spectra of 120 objects. We have examined how these properties are correlated each other and how these correlations change according to disk's radial structure, i.e., radially continuous disks (FDs) or transitional disks (TDs) which have radial gap or central clearing. We also have compared Orion A disks to Taurus disks to find disk characteristic evolution owing aging. From these statistical examinations, we confirmed that inner disk evolve faster than outer disk. We detected possible evolution of the degree of dust process (growing and/or crystallization) along the ages of different star-forming regions. We also separated trends in four categories according to strength and significance of correlation between properties in evolution related combinations (e.g., TD vs. FD or Orion A vs Tau). This supplies useful clues for disk evolutionary mechanisms, and it guides for the future investigation to understand disk evolution and the related characteristics.