[구 IM-02] High-resolution ALMA Study of the Proto-Brown-Dwarf Candidate L328-IRS

Chang Won Lee[1,2], Gwanjeong Kim[1,2,3], Philip C. Myers[4], Masao Saito[5], Shinyoung Kim[1,2], Woojin Kwon[1,2], A-Ran Lyo[1], Archana Soam[1], & Mi-Ryang Kim[1]
[1]Korea Astronomy & Space Science Institute,
[2]Korea University of Science & Technology
[3]Nobeyama Radio Observatory, NAOJ
[4]Harvard-Smithsonian Center for Astrophysics
[5]NAOJ

We present our observational attempts to precisely measure the central mass of a proto-brown dwarf candidate, L328-IRS, in order to investigate whether L328-IRS is in the substellar mass regime.

Observations were made for the central region of L328-IRS with the dust continuum and CO isotopologue line emission at ALMA band 6, discovering the detailed outflow activities and a deconvolved disk structure of a size of ~87 AU × ~37 AU. We investigated the rotational velocities as a function of the disk radius, finding that its motions between 130 AU and 60 AU are partially fitted with a Keplerian orbit by a stellar object of ~0.30 $M_{\odot}$, while the motions within 60 AU do not follow any Keplerian orbit at all. This makes it difficult to lead a reliable estimation of the mass of L328-IRS.

Nonetheless, our ALMA observations were useful enough to well constrain the inclination angle of the outflow cavity of L328-IRS as ~66° degree, enabling us to better determine

the mass accretion rate of ~8.9 × 10^{-7} $M_{\odot}$ yr-1.From assumptions that the internal luminosity of L328-IRS is mostly due to this mass accretion process in the disk, or that L328-IRS has mostly accumulated the mass through this constant accretion rate during its outflow activity, its mass was estimated to be ~0.012 - 0.023 $M_{\odot}$, suggesting L328-IRS to be a substellar object.

However, we leave our identification of L328-IRS as a proto-brown dwarf to be tentative because of various uncertainties especially regarding the mass accretion rate.

[구 IM-03] Accretion Flow and Raman-scattered O VI and C II Features in the Symbiotic Nova RR Telescopii

Jeong-Eun Heo[1], Hee-Won Lee[1], Rodolfo Angeloni[2], Tali Palma[3] and Francesco Di Mille[4]
[1]Sejong University, Korea, [2]Universidad de La Serena, Chile, [3]Observatorio Astronómica, Argentina, [4]Las Campanas Observatory, Chile

RR Tel is an interacting binary system in which a hot white dwarf (WD) accretes matter from a Mira variable via gravitational capture of the stellar wind. We present a high-resolution optical spectrum of RR Tel obtained with MIKE at Magellan-Clay telescope, Chile. We find broad emission features at 6825, 7082, 7023, and 7053 Å, which are formed through Raman scattering of far-UV O VI λλ 1032 and 1038 Å, C II λλ 1036 and 1037 Å with atomic hydrogen. Raman O VI 6825 and 7082 features are characterized by double-peaked profiles indicative of an accretion flow with a characteristic speed ~ 30km/s, whereas the Raman C II features exhibit a single Gaussian profile with FWHM ~ 10 Å. Monte Carlo simulations for Raman O VI and C II are performed by assuming that the emission nebula around the WD consists of the inner O VI disk with a representative scale of 1 AU and the outer part with C II sphere. The best fit for Raman profiles is obtained with an asymmetric matter distribution of the O VI disk, the mass loss rate of the cool companion $\dot{M}$~2×$10^{-6}$$M_{\odot/yr}$ and the wind terminal velocity v~10 km/s. We also find O VI doublet at 3811 and 3834 Å, which are blended with other emission lines. Our profile decomposition shows that the O VI λλ 3811, 3834 doublet have a single Gaussian profile with a width ~ 25 km/s. A comparison of the restored fluxes of C II λλ 1036 and 1037 from Raman C II features with the observed C II λ1335 leads to an estimate of a lower bound of N(CII) > 9.87x$10^{13}$$cm^{-2}$ toward RR Tel, which appears consistent with the presumed distance D ~ 2.6 kpc.

[구 IM-04] Distance measurements for double red clump in the Milky Way bulge using Gaia DR2

Dongwook Lim, Seungsoo Hong, Young-Wook Lee
Center for Galaxy Evolution Research & Department of Astronomy, Yonsei University

The presence of double red clump (RC) in the Milky Way bulge is widely accepted as evidence for a giant X-shaped structure originated from the bar instability. We suggested, however, a drastically different interpretation based on the multiple stellar populations phenomenon as is observed in globular clusters. Our discovery of a significant difference in CN-band between two RCs strengthens our scenario. On the other hand, recent Gaia survey provides trigonometric parallax

distances for more than one billion stars in our Galaxy. These distance measurements would provide the important test as to the origin of the double RC in the Milky Way bulge. In this talk, we will present our preliminary results from Gaia DR2.

[구 IM-05] Evolutionary Models for Helium Giant Stars as Type Ibn Supernova Progenitors.

Jihoon Kim and Sung-Chul Yoon
Seoul National University

Among Type I supernovae, which show no evidence for hydrogen lines in spectra, Type Ib/c supernovae lack of strong Si absorption lines and are involved with massive progenitors. While strong helium absorption lines are present in Type Ib supernovae, narrow helium emission lines also can appear in some Type Ib that are often called Type Ibn supernovae (SNe Ibn). We consider helium giant stars as a promising progenitor candidate for SN Ibn and suggest the evolutionary scenario through binary systems using MESA code.

In our models the range of primary mass is 11 – 20 solar mass, mass ratio is 0.5 – 0.9, and initial period is 1.5 / 1.7 / 2.0 / 2.5 / 3.0 day. In particular, we find that the evolution of the secondary star can overtake the primary through mass transfer from the secondary to the primary, which is so-called 'reverse case B' mass transfer. In such systems the secondary star may undergo a supernova explosion earlier than the primary star. In this case, the primary star evolves towards a single helium giant to become a SN Ibn progenitor. These cases are more frequent in relatively low initial primary mass.

[구 IM-06] Extra-tidal stars around globular clusters NGC 5024 and NGC 5053 and their chemical abundances

Sang-Hyun Chun, Jae-Joon Lee
Korea Astronomy and Space Science Institute

NGC 5024 and NGC 5053 are among the most metal-poor globular clusters in the Milky Way. Both globular clusters are considered to be accreted from dwarf galaxies (like Sagittarius dwarf galaxy or Magellanic clouds), and common stellar envelope and tidal tails between globular clusters are also detected. We present a search for extra-tidal cluster member candidates around these globular clusters from APOGEE survey data. Using 20 chemical elements (e.g., Fe, C, Mg, Al) and radial velocities, t-distributed stochastic neighbour embedding (t-SNE), which identifies an optimal mapping of a high-dimensional space into fewer dimensions, was explored, and we find that globular cluster stars are well separated from the field stars in 2-dimensional map from t-SNE. We also find that some stars selected in t-SNE map are placed outside of the tidal radius of the clusters. The proper motion of stars outside tidal radius is also comparable to that of globular clusters, which suggest that these stars are tidally decoupled from the globular clusters. We manually measure chemical abundances for the clusters and extra-tidal stars, and discuss the association of extra-tidal stars with the clusters.

우주론/암흑물질, 암흑에너지

[박 CD-01] Toward precise and accurate modeling of matter clustering in redshift space

Minji Oh[1,2]
[1]Korea Astronomy and Space Science Institute, Daejeon 34055, Korea, [2]University of Science and Technology, Daejeon 34113, Korea

This dissertation presents the results on two-dimensional Redshift space distortion (hereafter RSD) analyses of the large-scale structure of the universe using spectroscopic data and on improvement of modeling of the RSD effect.

RSD is an effect caused by galaxies' peculiar velocity on their clustering feature in observation along the line of sight and is thus intimately connected to the growth rate of the structure in the universe, from which we can test the origin

of cosmic acceleration and Einstein's theory of gravity at cosmic scales in the end. However, there are several challenges in modeling precise and accurate RSD effect, such as non-linearities and the existence of an exotic component,

e.g. massive neutrino. As part of endeavors for modeling more precise and accurate galaxy clustering in redshift space, this dissertation includes a series of works for this issue. (More detailed descriptions were omitted.)

[구 CD-02] Testing Gravity with Cosmic Shear Data from the Deep Lens Survey

Cristiano G. Sabiu[1], Mijin Yoon[1], and Myungkook