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

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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

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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 $\dot{M}$~$2\times10^{-6}M_{\odot/yr}$ 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) > $9.87\times10^{13}cm^{-2}$ 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

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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