Search for Young Brown Dwarfs in the Core of Distant Massive Star Forming Regions

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Primary Science Goals:

The functional form and the universality of the Initial Mass Function (IMF) at a very low-mass regime including brown dwarfs (BDs) are still open questions. So far, the young brown dwarf (YBD) search has been limited to the nearby star-forming regions (< 500 pc). In order to detect and characterize the YBDs in distant massive star-forming regions, we need high sensitivity and high resolution. We present a new set of $J$, $H$, and $K$-band data for the W3 Main ($d \sim 1.83$ kpc) and NGC 7538 ($d \sim 2.8$ kpc) star-forming regions with higher resolution (FWHM ~ 0.35 arcsec) and sensitivity ($K \sim 20$ mag) for an area of ~ 2.6 arcmin$^2$ each centered on W3 IRS 5 and NGC 7538 IRS1-3, respectively. Our motivation is to look for the YBDs associated with the W3 Main and NGC 7538 star-forming regions and to discuss their nature and mass function (MF).

Observations:

Deep imaging observations of W3 Main and NGC 7538 star-forming regions at the NIR wavelengths $J$ ($\lambda = 1.25$ $\mu$m), $H$ ($\lambda = 1.64$ $\mu$m), and $K$ ($\lambda = 2.21$ $\mu$m) were obtained using the CISCO camera mounted on the Subaru 8.2 m telescope.

Result:

According to our results, it is unlikely that the MF shows the presence of cutoff and a sharp turnover around the substellar limit, at least at the hydrogen-burning limit (the MF rises monotonically up to 0.1 $M_{\odot}$ and shows a sharp decline in the BD regime). If confirmed, these BDs will be the lowest mass members of W3 Main and NGC 7538 IRS 1-3 clusters and therefore provide key clues to a census of very low-mass stars and the IMF down to about 25-30 Jupiter-mass regime for the first time in distant (> 1.8 kpc) massive star-forming regions.

Ojha et al., 2011 (submitted) (NGC 7538)
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