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Deep JWST Spectroscopic Survey of Free-Floating PMOs and Discovery of An Accretion Burst

Tuesday, December 16, 2025 11:10 AM (20 minutes)

We have conducted an extremely deep spectroscopic survey of the NGC 1333 young star cluster using NIRISS on the JWST to identify and characterize the lowest-mass free-floating objects in its midst. Our observations cover 19 known brown dwarfs, for most of which we confirm previously assigned spectral types. We discover six new candidates with L-dwarf spectral types that are plausible planetary-mass members of NGC1333, with estimated masses between 5-15 times that of Jupiter. One, at ~5 Jupiter masses, shows clear infrared excess emission and is a good candidate to be the lowest-mass object known to have a disk. We do not find any objects later than mid-L spectral type. The paucity of Jupiter-mass objects, despite the survey's unprecedented sensitivity, suggests that our observations reach the lowest-mass objects that formed like stars in this cluster. Our findings put the fraction of FFPMOs in NGC1333 at ~10% of the number of cluster members. We also search for wide binaries in our images and report a young brown dwarf with a planetary-mass companion. Separately, we report new findings on eight FFPMOs from near- and mid-infrared spectroscopy using NIRSpec and MIRI on JWST (see Damian et al contribution). In recent, multi-epoch observations of one of these objects with the XSHOOTER on the VLT, we have found dramatic changes in disk accretion-related emission lines, likely indicative of an accretion outburst –the first time such an event is seen in a planetary-mass object. We will discuss the implications of our findings for star and planet formation.

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