N17a Brown dwarf number density in the JWST COSMOS-Web field

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Brown dwarfs (BDs), often called failed stars, have very low masses ($13 - 75\ M_{Jup}$) and effective temperatures below 2500 K, bridging the gap between planets and red dwarfs. Due to their faintness, previous searches were mostly limited to the solar neighborhood (<20 pc). This study uses JWST COSMOS-Web data to identify distant brown dwarfs at kiloparsec scales, improving our understanding of the low-mass stellar population and Milky Way star formation history. JWST's sensitivity allows detecting brown dwarfs up to 100 times farther than earlier infrared surveys.

We applied two color criteria, $F115W-F277W < -0.8$ and $F277W-F444W > 1.1$, to identify BD candidates, followed by SED fitting and MCMC simulations to determine physical properties. Our search found 21 T-dwarf and 2 Y-dwarf candidates, ranging from 0.2 to 4 kpc away, surpassing previous JWST studies. Among them, 16 ± 4 T0-T5 dwarfs match the local luminosity function. The number of T0-T5 dwarfs aligns with the solar neighborhood's brown dwarf luminosity function, and the brown dwarf number density matches the exponential density model. Along with earlier studies, the JWST has opened a new window of brown dwarf research in the Milky Way thick disk and halo.