W0830: an extremely cold, missing-link planetary-mass object at the low-mass end of the IMF

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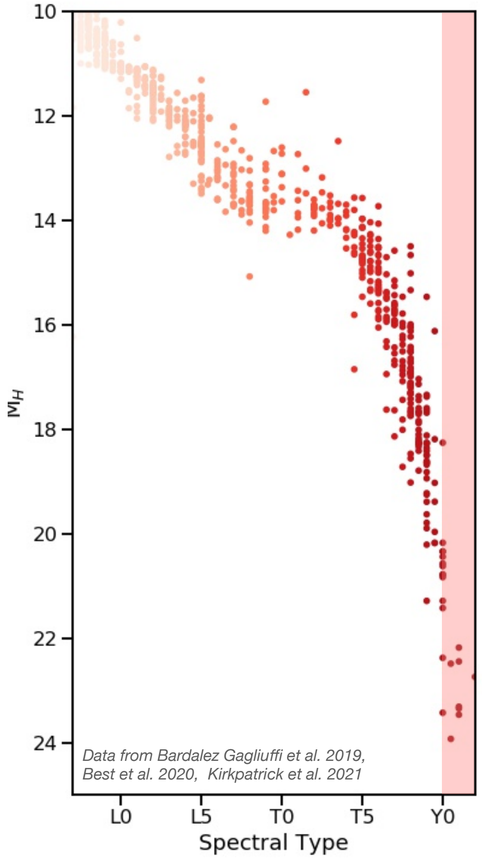
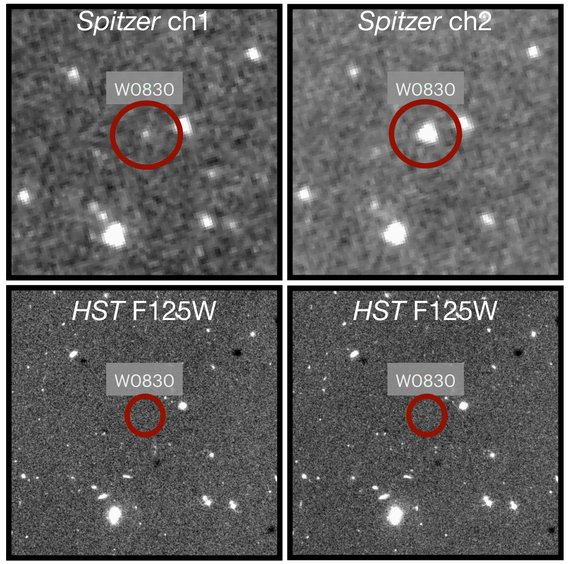
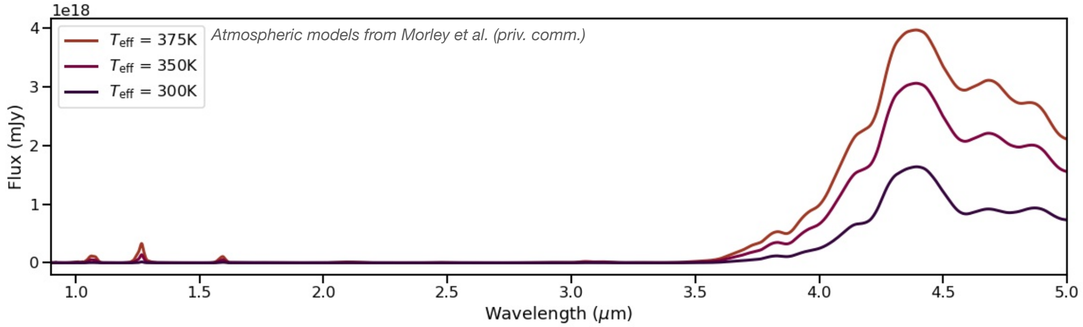
With temperatures ≤500K, **Y dwarfs are some of the lowest-mass products of star formation[1]**. Only ~40 Y dwarfs are known (30% of those with BYW![2,3]) and are critical to understanding the complex atmospheres of giant planets like Jupiter and the tail end of the IMF.



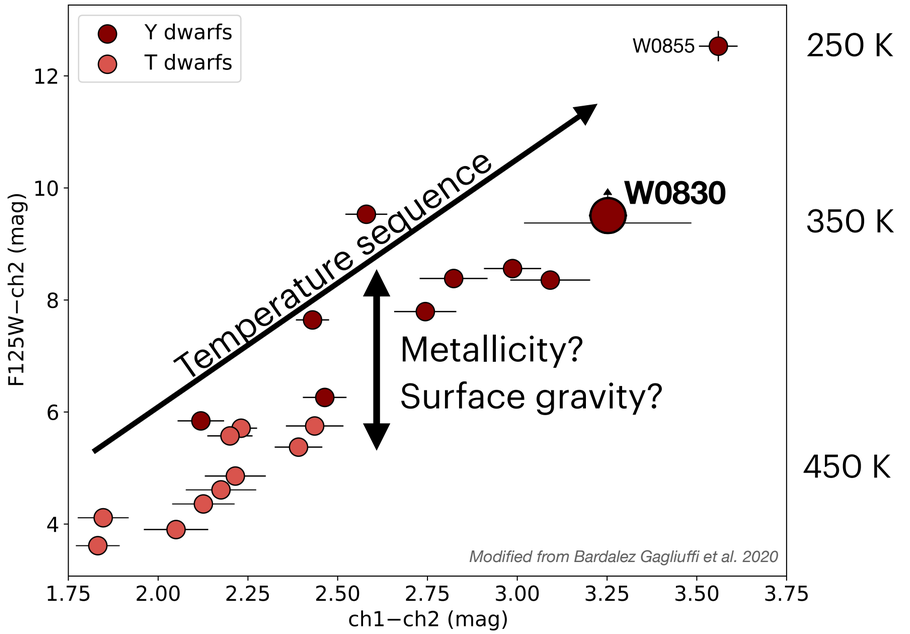
Citizen scientists from Backyard Worlds: Planet 9 discovered WISE J0830+2837, an extremely red source moving at 2"/yr in multi-epoch *WISE* images. **Follow-up NIR HST imaging did not detect the source**, even though it was bright in *Spitzer* images.



The red color and non-detection in the NIR indicate that **W0830 is extremely cold**. With our *Spitzer* parallax, we can place the object at 11pc with a T_{eff} ≈350 K. Assuming an age of 1-10 Gyr, W0830 is a planetary mass object of 4-13 M_{Jup}.



W0830 fills a temperature gap between the coldest known brown dwarf (W0855, 250K[4]) and the rest of the Y dwarf population.



This object is a crucial bridge connecting W0855 to the warmer Y dwarf population. Following the decommissioning of *Spitzer*, further characterization of W0830 will require either *JWST* or much deeper images from *HST*. Establishing metallicity, surface gravity, and temperature from its SED would aid in interpreting the role of fundamental properties in this temperature regime.

References
[1] Cushing et al. (2011)
[2] Bardalez Gagliuffi et al. (2020)
[3] Meisner et al. (2020a)
[4] Luhman (2014)

Read more: Bardalez Gagliuffi et al. 2020