Young Brown Dwarfs as Giant Exoplanet Analogs

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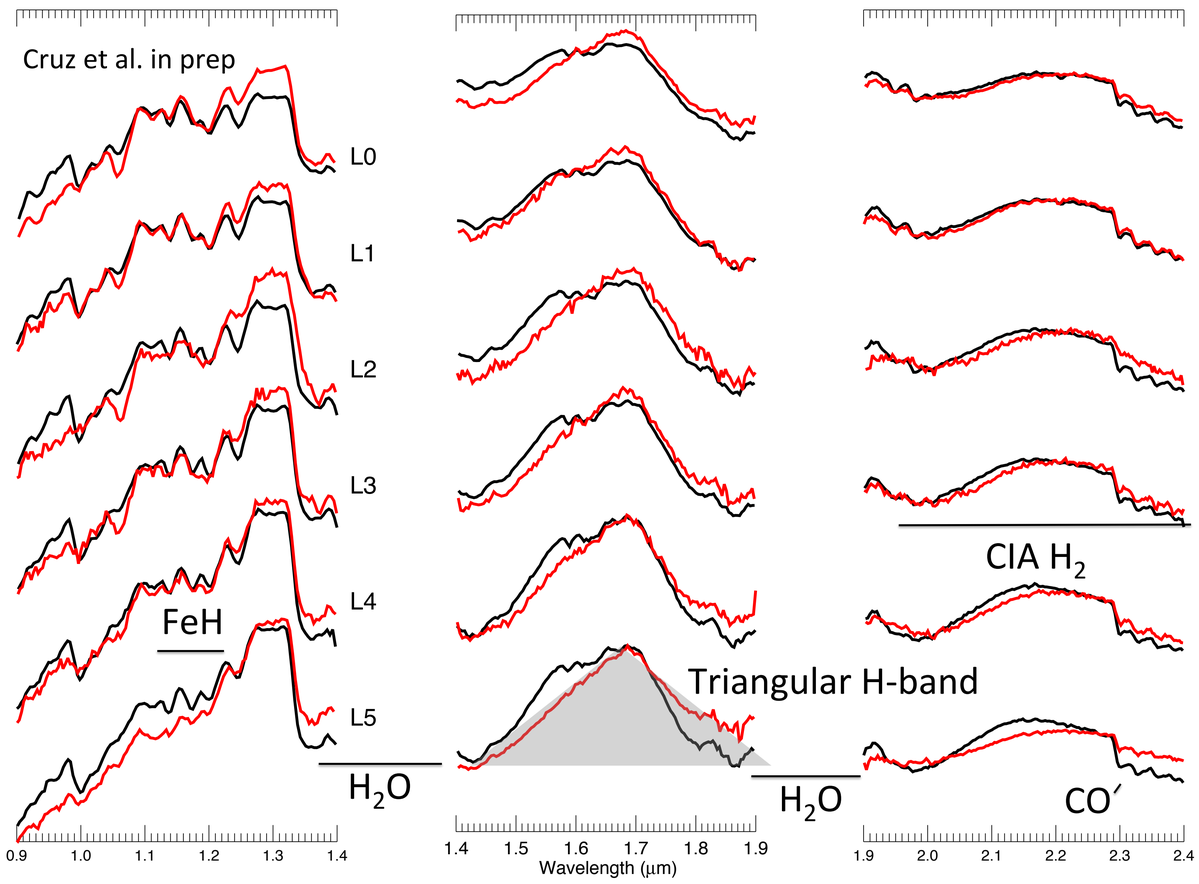
ABSTRACT: Young brown dwarfs and directly-imaged exoplanets have enticingly similar photometric, spectroscopic, and luminosity characteristics, indicating that their cool, low gravity atmospheres should be studied in concert. We have identified, confirmed, and characterized several new young M and L type brown dwarfs (see Faherty et al. 2013) and compared them to directly-imaged planetary mass companions and exoplanets like 2MASS 1207b and HR8799b. Similarities between the peculiar shaped H band and location on near-IR color magnitude diagrams provide important clues about how to extract physical properties of planets from current brown dwarf observations. In this poster I present a sample of age-calibrated young brown dwarfs that form the basis for comparative brown-dwarf exoplanet studies.

The L Dwarf Spectral Sequence: Normal and Low-Gravity

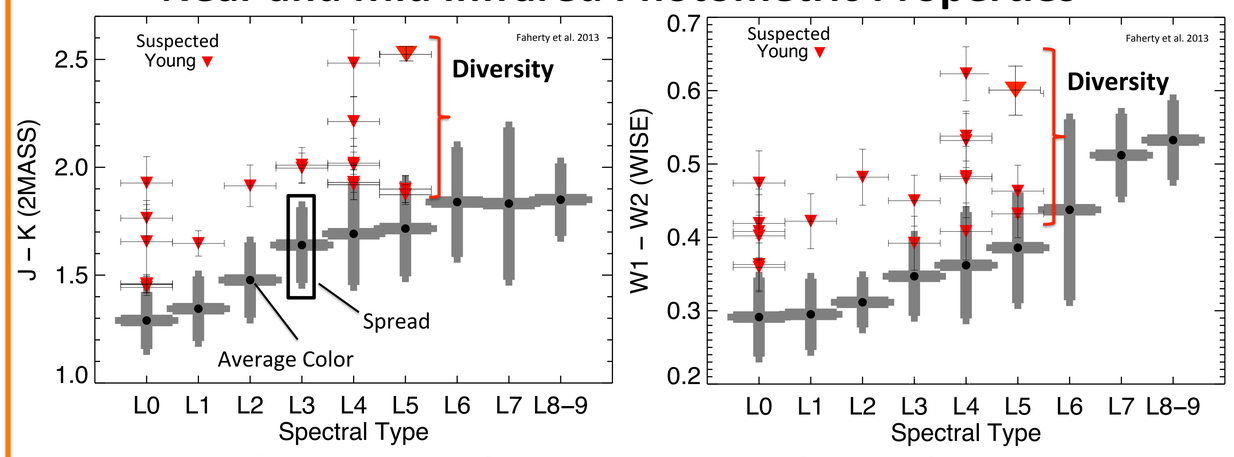


Spectral templates for normal (black)—no binaries, peculiar or suspected young/old sources— and low-gravity (red) L dwarfs (Cruz et al. in prep).

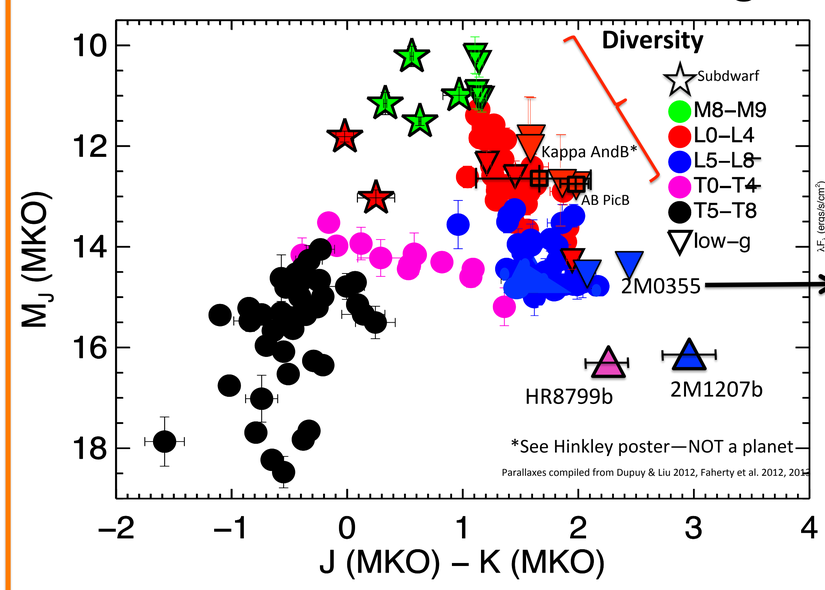
PLANET CONNECTION: The triangular shaped H band, a hallmark signature for low-gravity brown dwarfs, is also seen in directly imaged exoplanet data.

WHAT WE LEARN FROM BROWN DWARFS: We see a range in the shape of the H-band (as well as the strength and depth of gravity sensitive alkali lines—see table below) for similar age young BDs indicating that gravity effects alone cannot sculpt the spectral peculiarities (see also Cruz et al. poster).

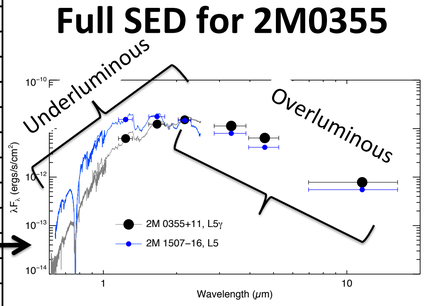
The Diversity of Young Brown Dwarfs Near and Mid Infrared Photometric Properties



Planet Inclusive Color Magntiude Diagram



Full SED for 2M0355

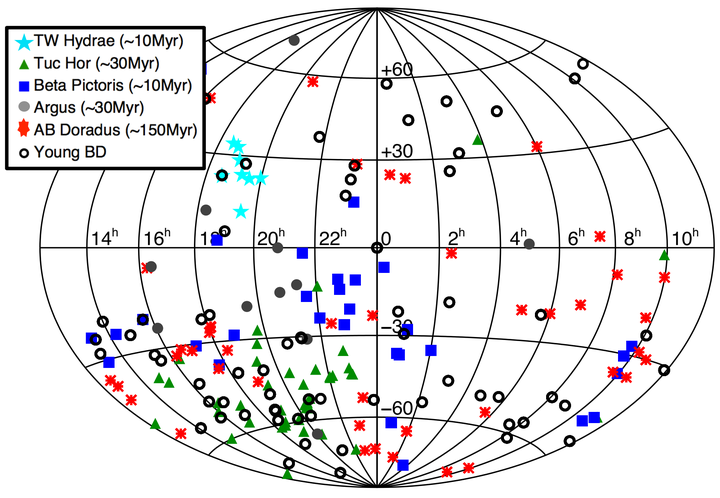


The full SED for 2M0355 indicates flux has shifted to longer wavelengths likely due to enhanced dust.

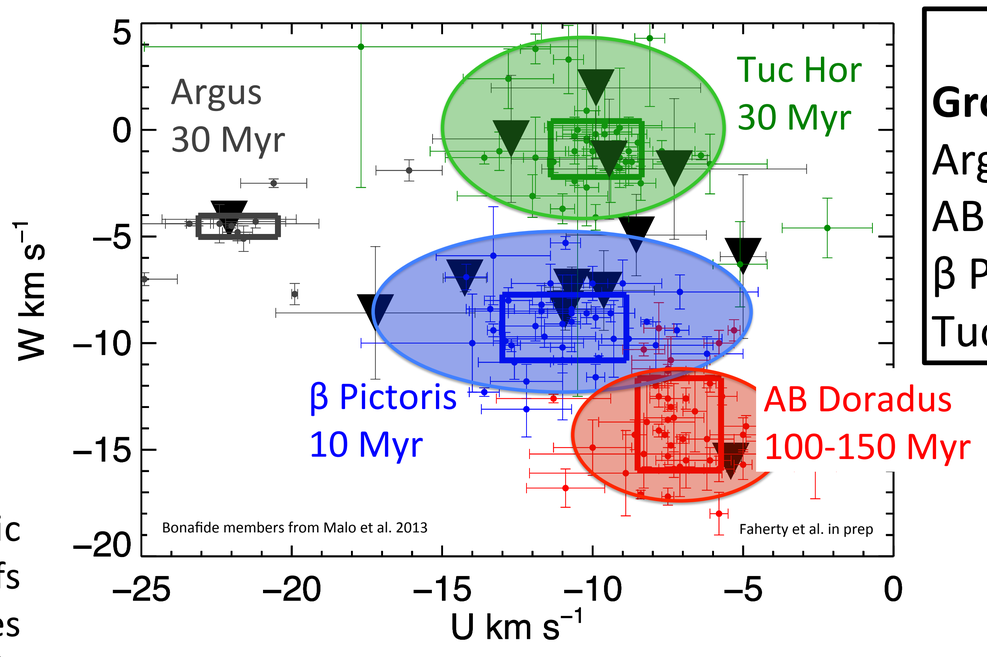
PLANET CONNECTION: Planets and young BDs are redward and less luminous than expected for their age and temperature.

WHAT WE LEARN FROM BROWN DWARFS: We see a **DIVERSITY** in the photometric and luminosity properties of similar age young BDs and conclude that gravity and clouds complexly influence observables.

An Age Calibrated Sample of Young Brown Dwarfs For Comparative Exoplanet Studies



Isolated across the sky (above--Galactic coordinates) is a sample of 65 brown dwarfs with spectral features indicating gravities ranging from intermediate (β class) to low (γ class). See Table at right for how the gravity class varies among new group members.



We find **14** BDs (plotted above) can be kinematically placed in groups with an additional **16** (not plotted) showing compelling membership evidence.

The BDNYC Young Sample

Group	Age (Myr)	#β	#γ
Argus	~30	2	0
AB Doradus	~100-150	2	2
β Pictoris	~10	4	8
Tuc Hor	~30	2	10

FUTURE PLANET CONNECTION:

An Age calibrated sample of BDs allow us to detangle secondary effects on observables (e.g. atmosphere, metallicity, and gravity). They also form observing templates for understanding future exoplanet data in a similar temperature regime.