Discovery of Young L Dwarfs in Taurus and Scorpius-Centaurus with the Pan-STARRS1 3π Survey

William M. J. Best, Michael C. Liu, Eugene A. Magnier, Kimberly M. Aller

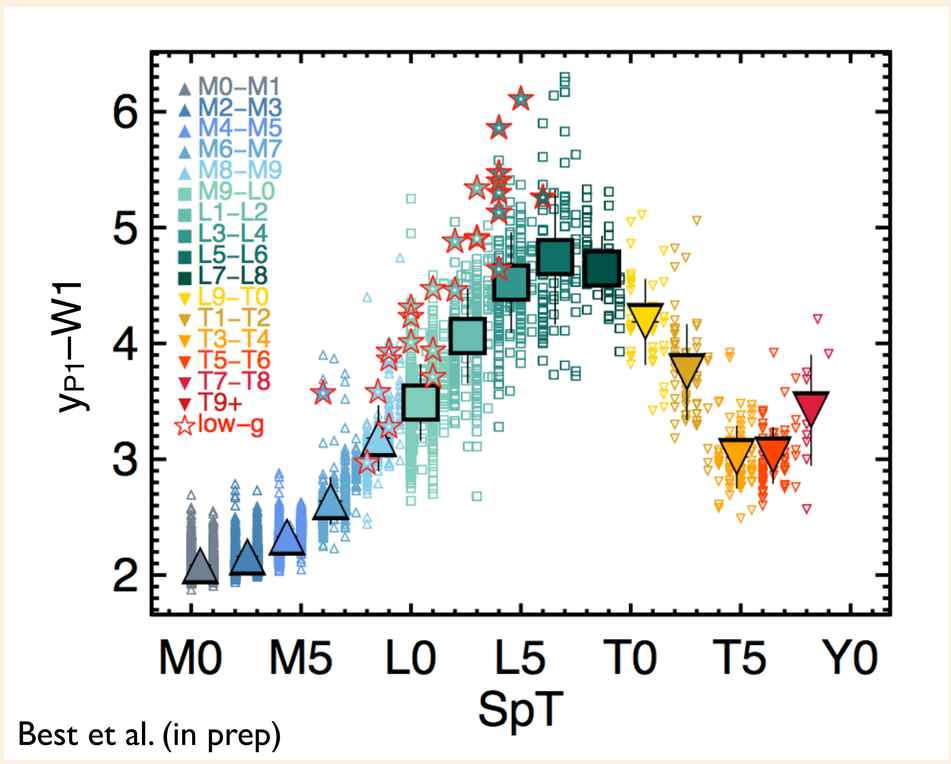
Institute for Astronomy, University of Hawai'i

wbest@ifa.hawaii.edu

L Dwarfs in star-forming regions are valuable laboratories for…

- Testing the youngest substellar evolutionary models (≈1–20 Myr)
- Testing the lowest mass (lowest gravity) atmospheric models (≈5–30 M_{Jup})
- Understanding directly imaged exoplanets.

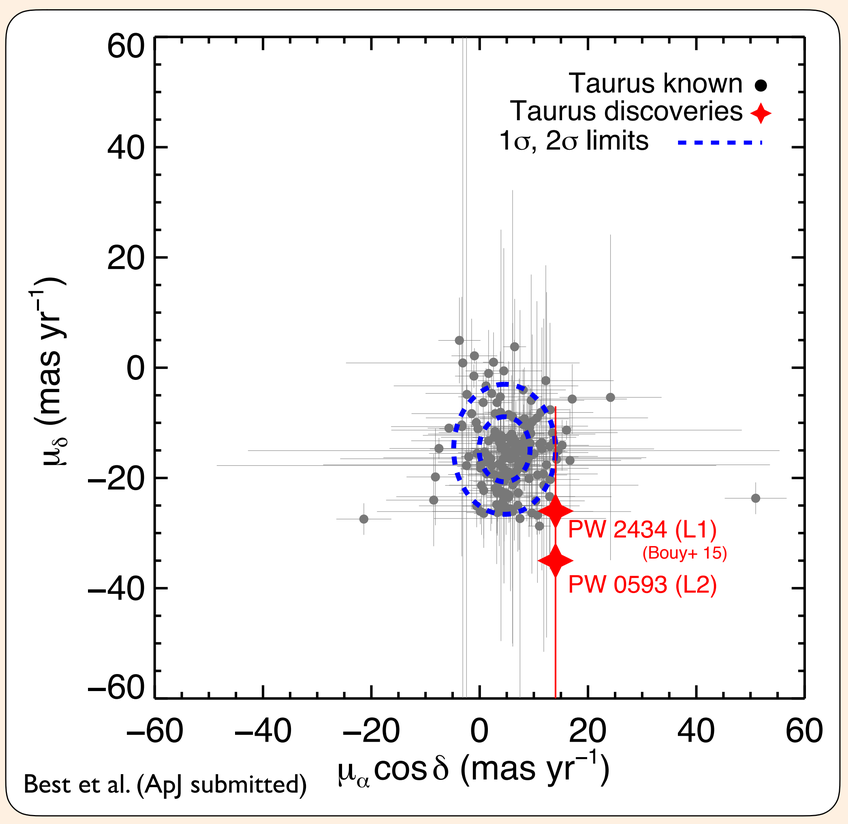
Pan-STARRS is a powerful tool for identifying young M and L dwarfs.



Best et al. (in prep)

y_{P1}–W1 colors of low-mass stars and brown dwarfs. Large symbols show the mean colors of the field. **Young objects (red star outliness) stand out from the field due to red y–W1 colors.**

Pan-STARRS observed multiple epochs over four years, yielding proper motion catalogs for Taurus and Upper Scorpius.



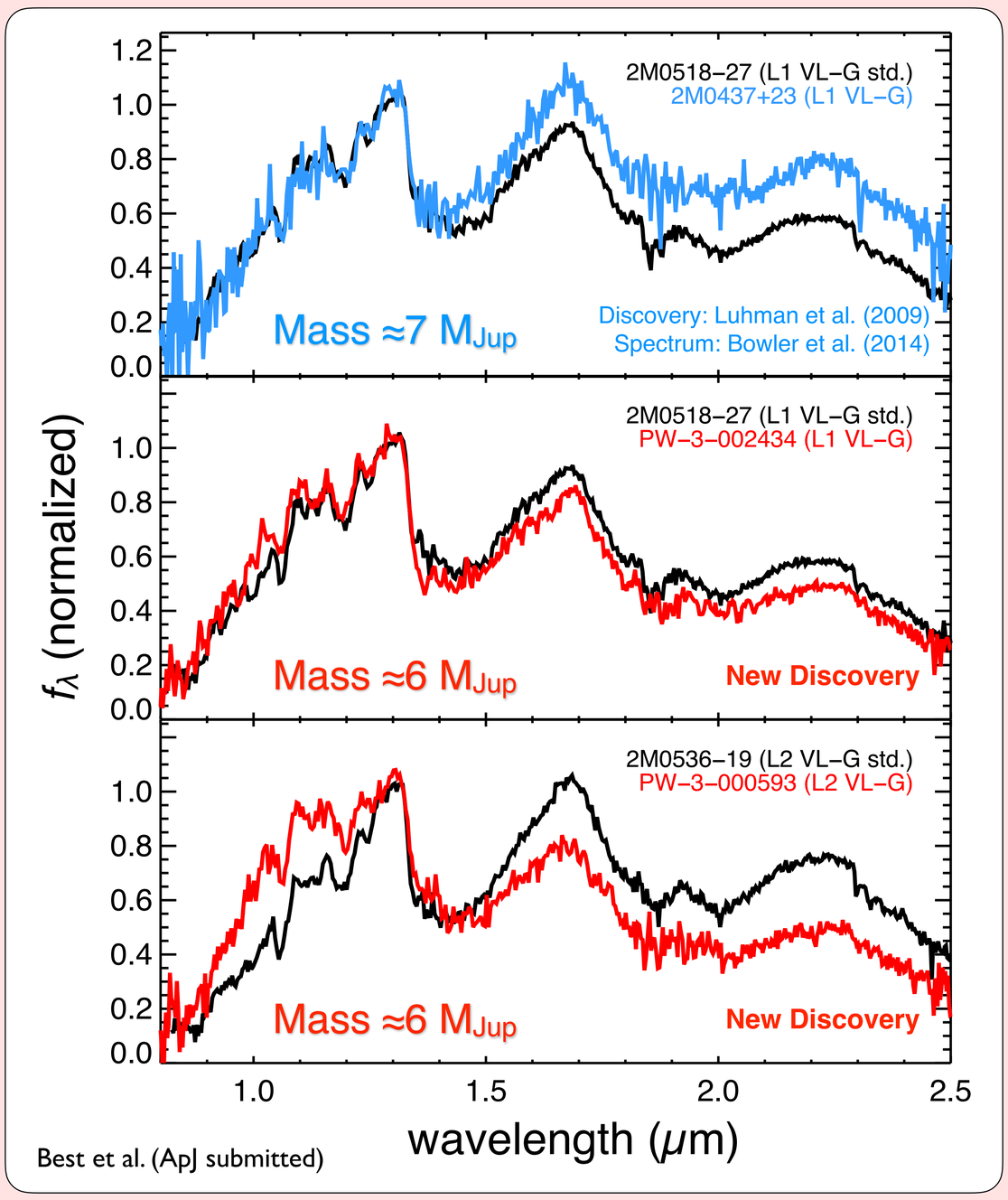
Best et al. (ApJ submitted)

Gray points: 200 Taurus members with SpT ≳ M3 (Esplin et al. 2014).

Red points: Our new discoveries in Taurus.

We will publish low-mass proper motion catalogs for Taurus (200 objects) and Upper Scorpius (470 objects).

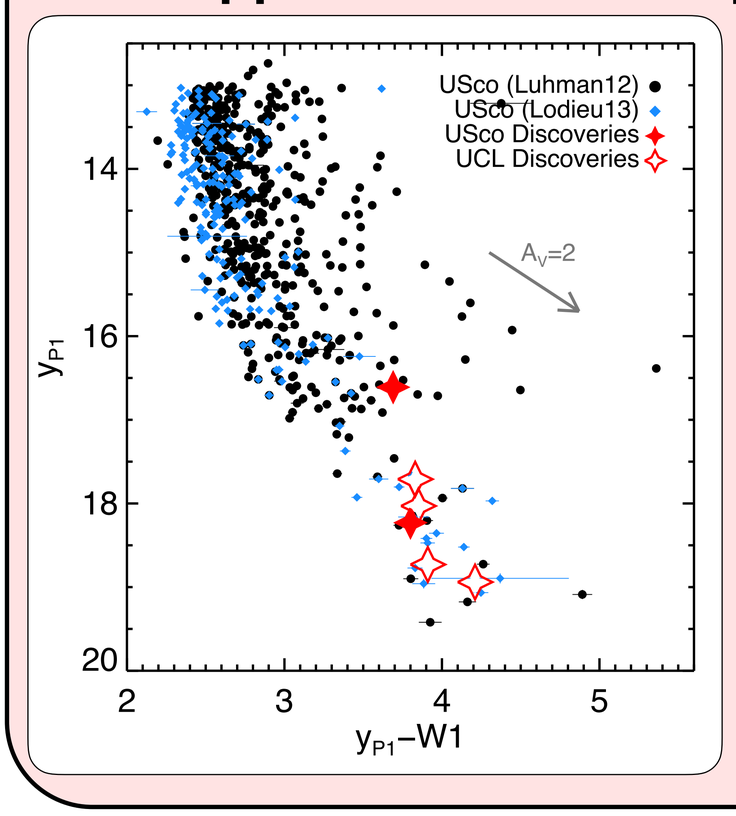
We discovered the two lowest-mass L dwarfs (≈6 M_{Jup}) in Taurus (1–2 Myr old).



Best et al. (ApJ submitted)

- Our discoveries have bluer near-IR colors than 2M0437+23 and many other young L dwarfs. **Very young low-mass brown dwarfs can have a variety of colors, even in the same star-forming region.**
- Masses estimated using the evolutionary models of Baraffe et al. (2015).

We discovered six M7–L1 dwarfs with masses ≈15–35 M_{Jup} in Upper Scorpius and Upper Centaurus-Lupus.



Black and blue points: Known Upper Scorpius members from Luhman & Mamajek (2012) and Lodieu (2013).

Red points: Our discoveries in Upper Scorpius (USco) and Upper Centaurus-Lupus (UCL), all spectroscopically confirmed.

Cool Stars 19, June 2016, Uppsala, Sweden