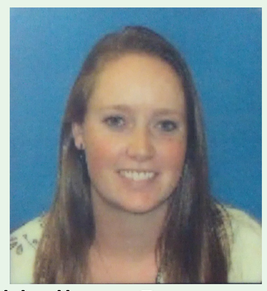
The Nearest Isolated Member of the TW Hydrae Association is a Giant Planet Analog

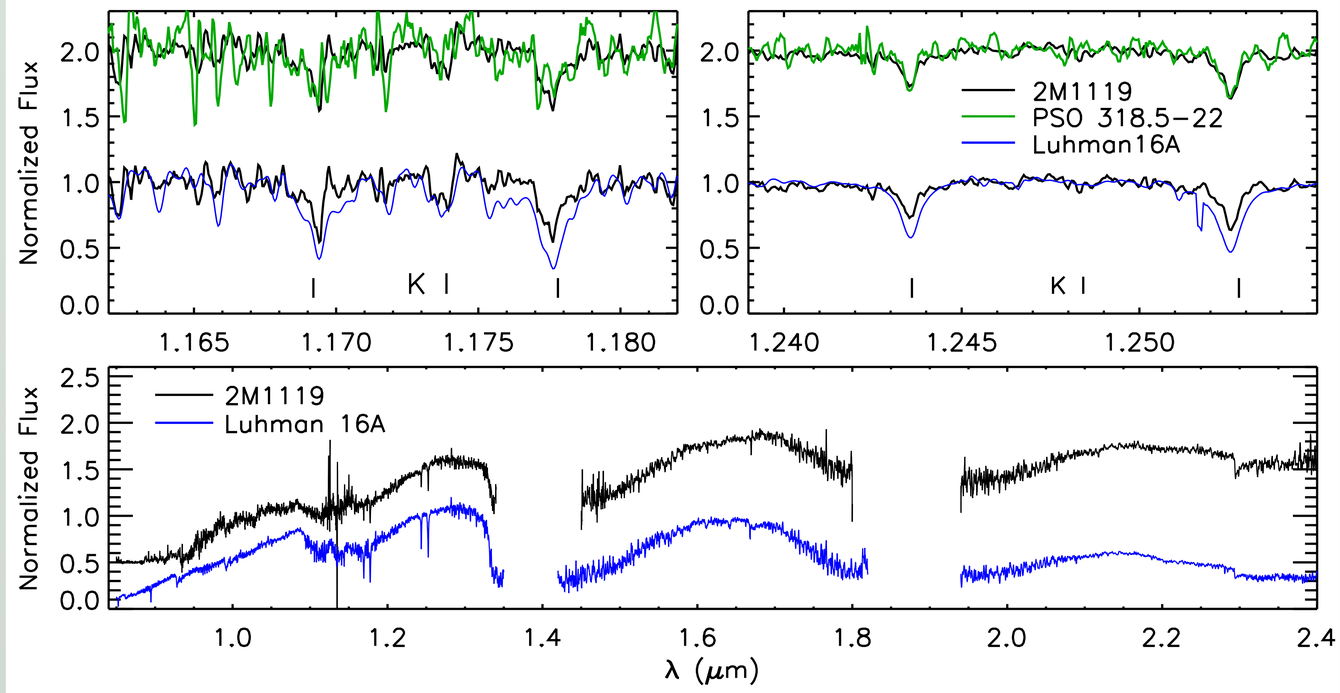
Kendra Kellogg[1], Stanimir Metchev[1], Jonathan Gagné[2,4], and Jacqueline Faherty[2,3,5]
[1]Western University Ontario, Canada, [2]Carnegie Institution of Washington DTM, USA, [3]American Museum of Natural History, USA, [4]NASA Sagan Fellow, [5]Hubble Fellow



kkellogg@uwo.ca

Abstract

In a recent search for unusually red L and T dwarfs, we identified 2MASS J11193254-1137466 as a likely young L7 dwarf and potential member of the TW Hydrae association. We present spectra that confirm the youth of this object. We also measure a radial velocity of 8.5 ± 3.3 km/s that, together with the sky position, proper motion and photometric distance, results in a 92% probability of membership in the TW Hydrae association, with a calibrated field contamination probability of 0.0005% using the BANYAN II tool. Using the age of TW Hydrae and the luminosity of 2MASS J1119-1137, we estimate its mass to be 4.3—7.6 M_{Jup}. It is the lowest-mass and nearest isolated member of TW Hydrae at a kinematic distance of 28.9 ± 3.6pc. It is also among the brightest isolated <10 M_{Jup} object discovered to date, second only to PSO J318.5-22 and at half the age.

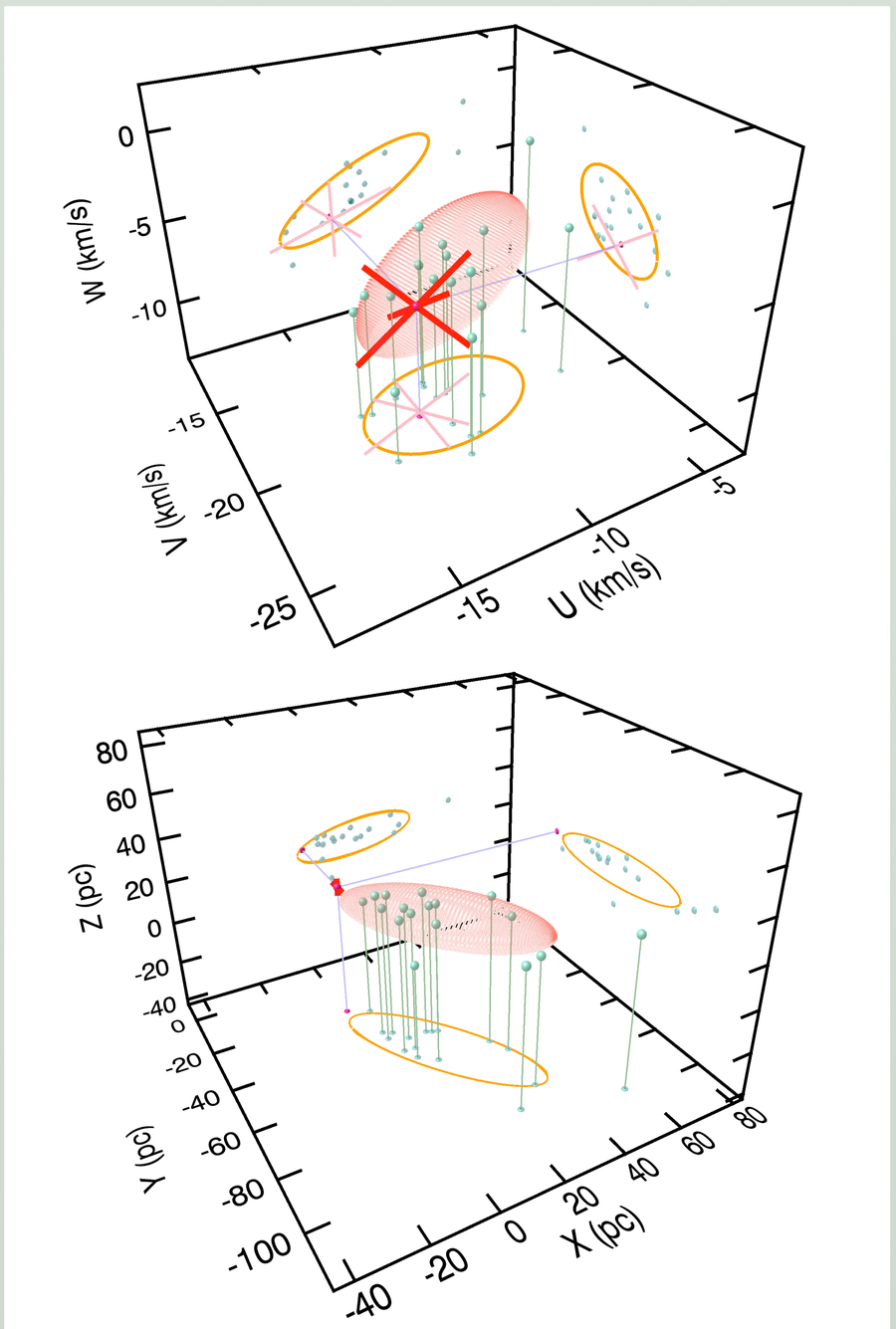


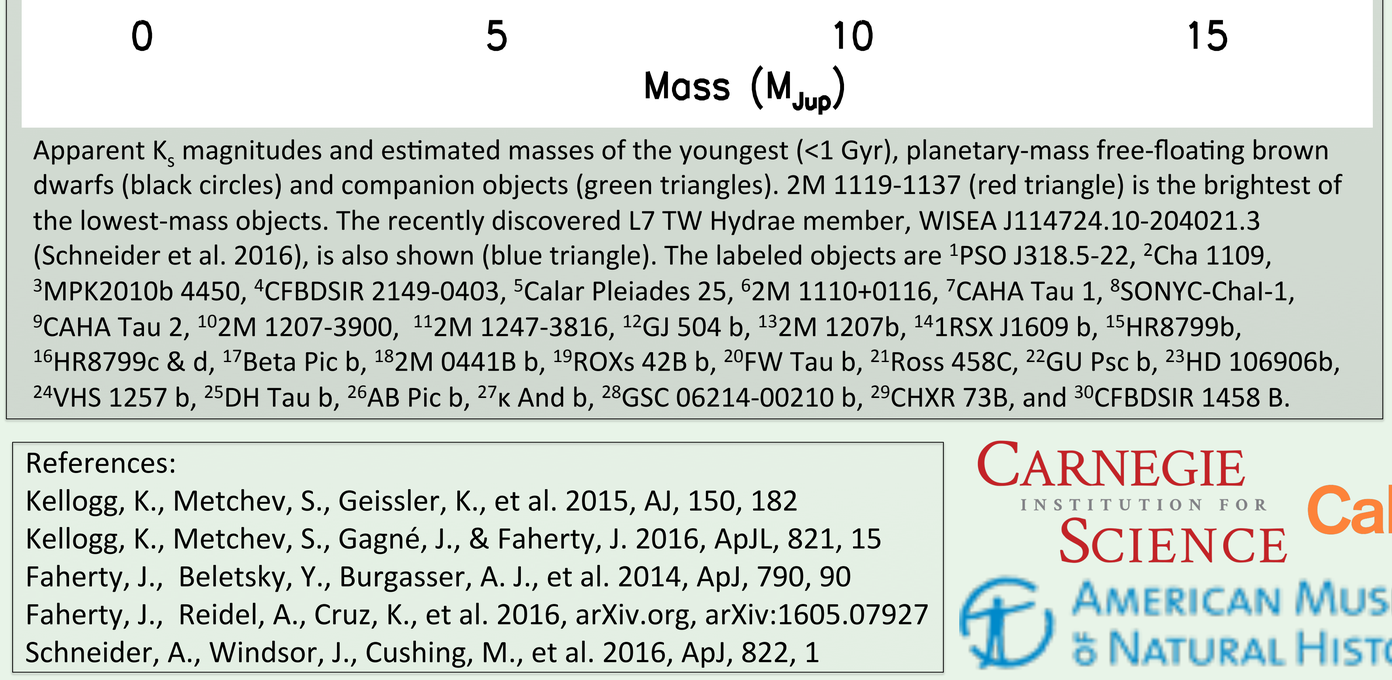
R~6000 FIRE spectra of 2M 1119-1137 (black), the young L7 dwarf PSO J318.5-22 (green; Faherty et al. 2016) and the old L7.5 dwarf Luhman 16A (blue: Faherty et al. 2014). 2M 1119-1137 and PSO J318.5-22 have lower surface gravities compared to Luhman 16A.

Characteristics of 2MASS 1119-1137

Right ascension	11:19:32.54	H (VHS)	15.844 ± 0.017 mag
Declination	-11:37:46.70	K_s (VHS)	14.751 ± 0.012 mag
Radial Velocity	8.5 ± 3.3 kms^{-1}	W1	13.548 ± 0.026 mag
$\mu_\alpha \cos\delta$	-145.1 ± 14.9 mas yr^{-1}	W2	12.883 ± 0.027 mag
μ_δ	-72.4 ± 16.0 mas yr^{-1}	log $L/L_\odot$	-4.39 ± 0.14
Y (VHS)	19.045 ± 0.093 mag	Age	10 ± 3 Myr
J (VHS)	17.330 ± 0.029 mag	Kinematic Distance	28.9 ± 3.6 pc
		Estimated Mass	4.3-7.6 M_{jup}

Galactic position and space velocity of 2M 1119-1137 (red sphere and red error bars) compared to known TW Hydrae bona fide members (green spheres) and the 1σ Gaussian ellipsoid spatial and kinematic models used in BANYAN II (orange ellipses).





Apparent K_s magnitudes and estimated masses of the youngest (<1 Gyr), planetary-mass free-floating brown dwarfs (black circles) and companion objects (green triangles). 2M 1119-1137 (red triangle) is the brightest of the lowest-mass objects. The recently discovered L7 TW Hydrae member, WISEA J114724.10-204021.3 (Schneider et al. 2016), is also shown (blue triangle). The labeled objects are [1]PSO J318.5-22, [2]Cha 1109, [3]MPK2010b 4450, [4]CFBDSIR 2149-0403, [5]Calar Pleiades 25, [6]2M 1110+0116, [7]CAHA Tau 1, [8]SONYC-Chal-1, [9]CAHA Tau 2, [10]2M 1207-3900, [11]2M 1247-3816, [12]GJ 504 b, [13]2M 1207b, [14]1RSX J1609 b, [15]HR8799b, [16]HR8799c & d, [17]Beta Pic b, [18]2M 0441B b, [19]ROXs 42B b, [20]FW Tau b, [21]Ross 458C, [22]GU Psc b, [23]HD 106906b, [24]VHS 1257 b, [25]DH Tau b, [26]AB Pic b, [27]κ And b, [28]GSC 06214-00210 b, [29]CHXR 73B, and [30]CFBDSIR 1458 B.

Take-away

With R~6000 FIRE spectra we confirmed that 2MASS 1119-1137 is a very young brown dwarf in the TW Hydrae association. From the object's near-infrared absolute magnitudes and age, we determine a mass of 4.3-7.6 M_{Jup}. It is the nearest member of TWA, and the second brightest isolated <10 M_{Jup} object discovered to date. Hence, 2MASS 1119-1137 is an excellent benchmark for young, directly imaged extrasolar planets.

References:
Kellogg, K., Metchev, S., Geissler, K., et al. 2015, AJ, 150, 182
Kellogg, K., Metchev, S., Gagné, J., & Faherty, J. 2016, ApJL, 821, 15
Faherty, J., Beletsky, Y., Burgasser, A. J., et al. 2014, ApJ, 790, 90
Faherty, J., Reidel, A., Cruz, K., et al. 2016, arXiv.org, arXiv:1605.07927
Schneider, A., Windsor, J., Cushing, M., et al. 2016, ApJ, 822, 1