New exoplanet candidates from the Palomar Transient Factory in Orion

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Young exoplanets

As of 1 June 2017, there are 3,610 confirmed exoplanets in 2,704 systems and 610 multiple planetary systems (Wikipedia). Most of them orbit Main Sequence stars.

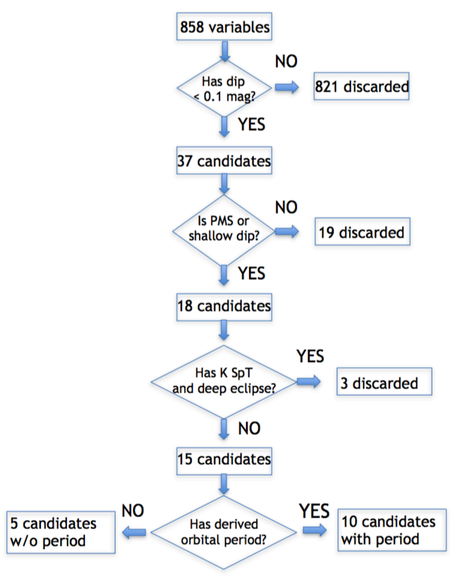
Disk dissipation lasts ~ 10 Myrs (Haish et al. 2001, Mamajek et al. 2009, Ribas et al. 2012) and Vesta's radionuclides indicate a few Myrs after the formation of the Sun (Yin et al. 2002)

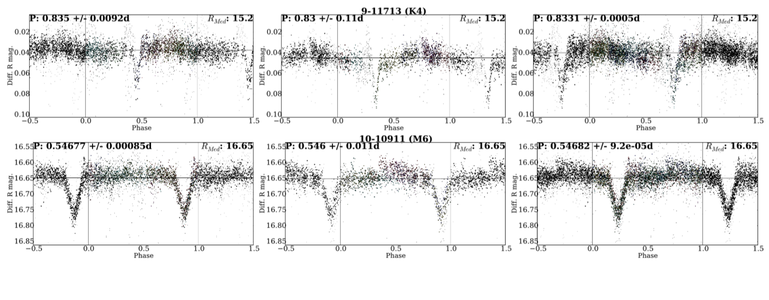
Finding exoplanets in young (~10 Myr) systems would set constraints on the time-scales for planet formation and migration to their inner orbits as well on their interaction with their primordial protoplanetary disks.

Analysis method

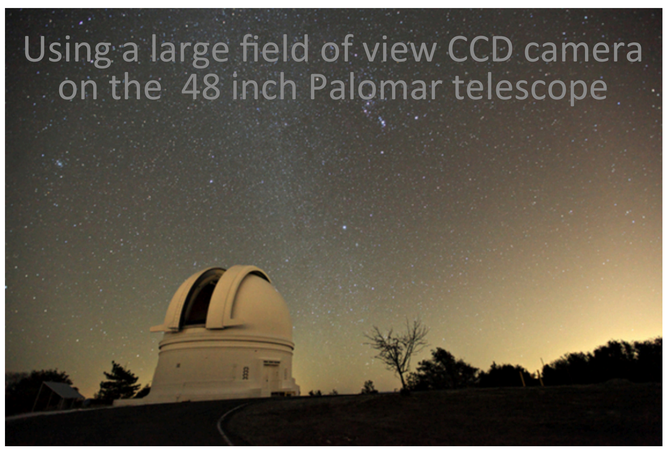
1. Determination of variability in the light curves via the Stetson index and visual inspection
2. Identification of repeated (3x) transit-like events in light-curves by eye
3. Membership analysis with ancillary photometry (R, PANSTARRS, 2MASS & WISE) in Color-color and color-magnitude diagrams

Workflow



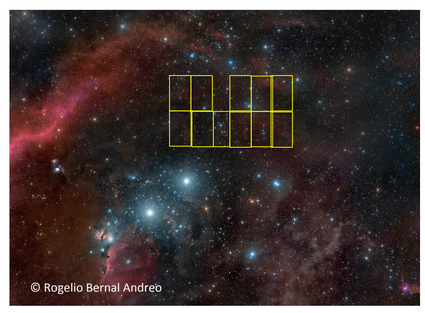


The Palomar Transient Factory



http://www.ptf.caltech.edu

The Palomar Transient Factory in Orion



Two runs pointing to 25 Ori (~ 10 Myr) in 2009 (40 nights) and 2010 (7 nights, consecutive)

R-band, 30-s exposures, 232,000 light-curves

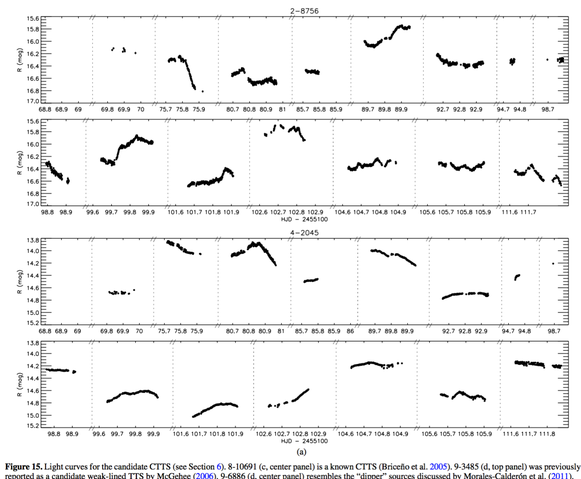
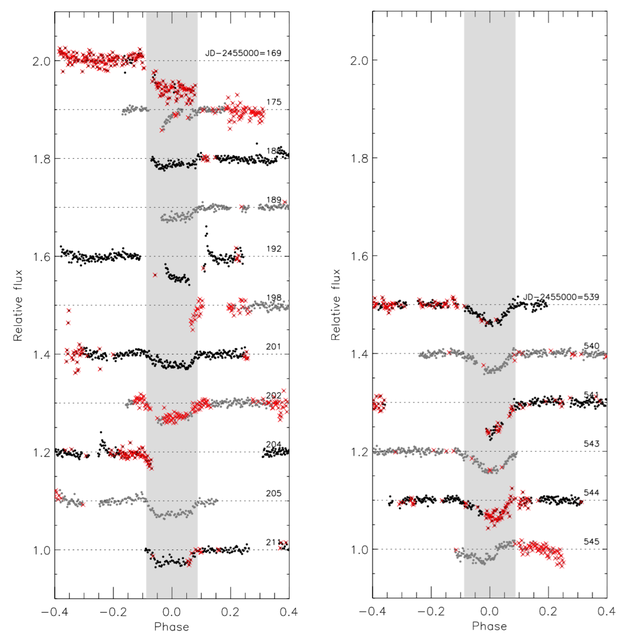


Figure 15. Light curves for the candidate CTTS (see Section 6). 8-10691 (c, center panel) is a known CTTS (Briceño et al. 2005). 9-3485 (d, top panel) was previously reported as a candidate weak-lined TTS by McGehee (2006). 9-6886 (d, center panel) resembles the "dipper" sources discussed by Morales-Calderón et al. (2011).

Determination of variability in the light curves via visual inspection

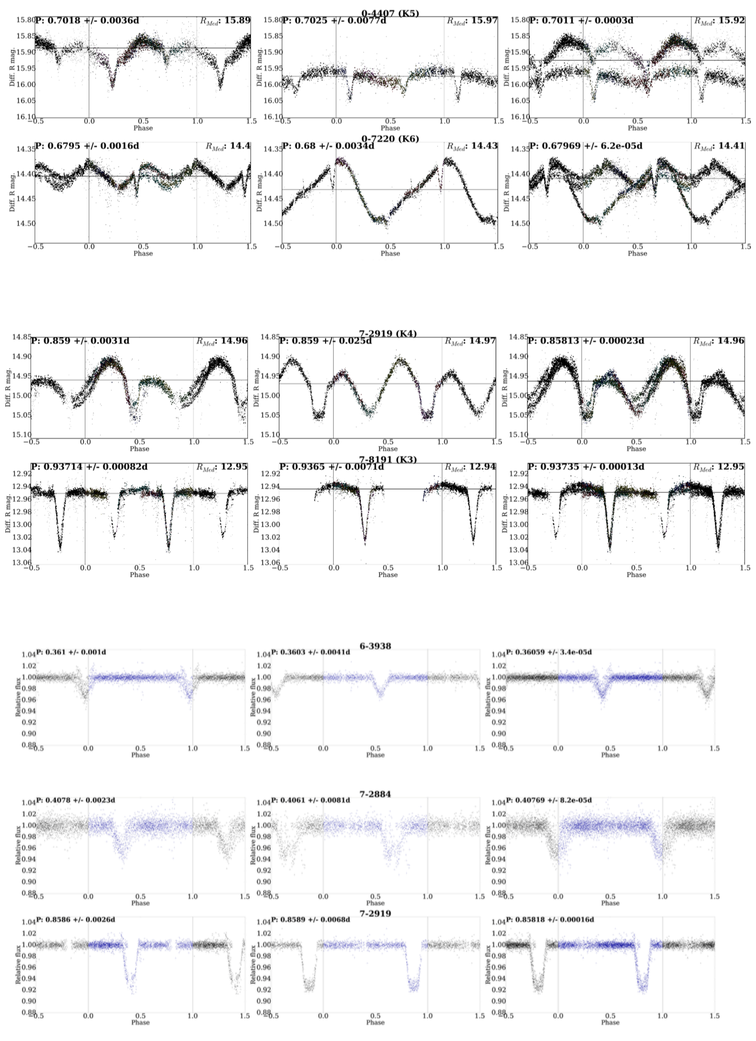
Van Eyken et al. (2011)

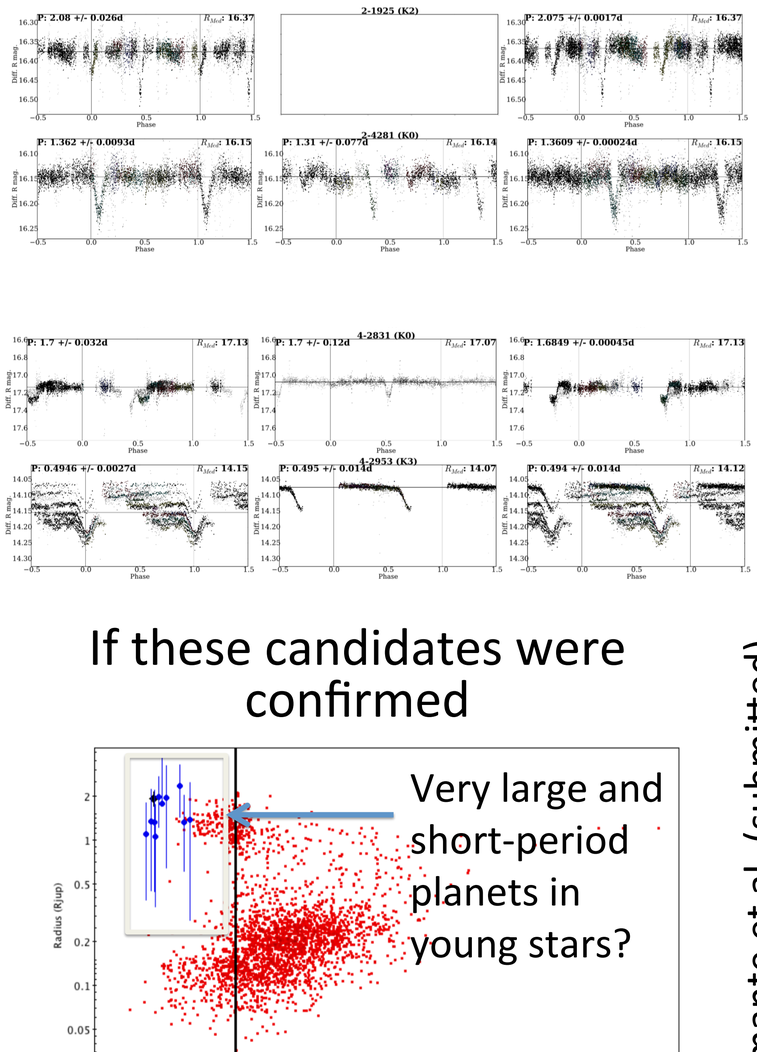


Whitening and folding light-curve to the transit period

Van Eyken et al. (2012)

New young exoplanet candidates





Bustamante et al. (submitted)

If these candidates were confirmed

Bustamante et al. (submitted)

Conclusions

1. With the Palomar Transient Factory data, 0.7% of the stars in the 25 Orionis were found to be variable
2. 15 exoplanet transit-like event were found in young stars of ~10 Myrs, 10 of them with orbital periods determined, to be followed up with Radial Velocity for confirmation
3. A large database of 858 new variable stars in the region has also been reported for follow-up