Radial Velocity Follow-up of SuperWASP Candidates with the Swiss Euler Telescope in La Silla

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SuperWASP

SuperWASP (Wide Angle Search for Planets) uses robotic installations on La Palma (Canary Islands, Spain) and at Sutherland (South Africa) to survey the sky for transiting exoplanets. At each site has eight wide field camera lenses arranged on a single equatorial fork mount (see picture to the right). WASP is responsible for the discovery of ~200 transiting exoplanets to date (whereas the first 142 are published, Hellier et al. 2017); more than any other ground-based survey.

WASP-south was recently equipped with new 85 mm lenses which increased the fields-of-view from 7.8º to 18º and pushed the brightness limit from Vmag 9.5 to ~7. The current configuration can detect transits with less than 1% depth.

… and Swiss Follow-up Activities

Follow-up activities with the Swiss 1.2 m Euler telescope in La Silla started this semester for the candidates from the 85 mm cameras at WASP-south. The high-resolution spectrograph CORALIE is used to check for spectral blends and radial velocity variation in phase with the ephemerides provided by SuperWASP. Once the planet has been confirmed, intense radial velocity measurements are commenced to measure the mass and orbital parameters of the system. The imager EulerCam is also used for transit confirmation as well as improved radius measurements. Priority is given to candidates around stars brighter than Vmag 12, with orbital periods longer than 5 days and Saturn-like radii.

The high-resolution spectrograph CORALIE

Since 1998 CORALIE (Queloz et al. 2001) has been performing high precision radial velocity measurements principally to search for giant planets in the southern celestial hemisphere. A precision of 3 m/s can be achieved, corresponding to the photon noise from a 1 hr exposure on a Vmag 10.5 star.

Several updates have been implemented over the previous years, including octagonal fibres, new cross-disperser and a Fabry-Perot calibration unit.

Resolution	50000
Wavelength range	3900 - 6800 Å
Magnitude limit	Vmag = 14.5

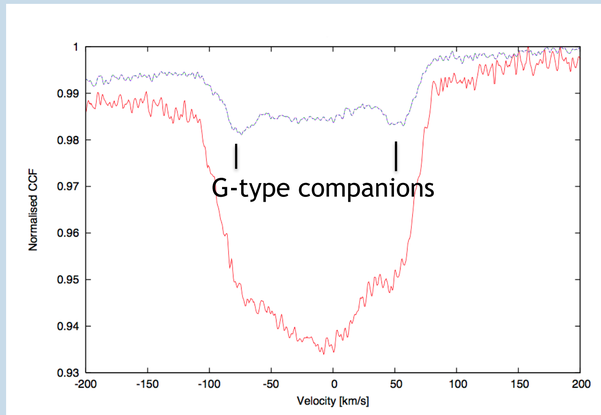
The 1.2 m Swiss Euler telescope in all it's glory. CORALIE is fiber-fed, whereas EulerCam is sitting in the cassegrain focus.
Credit: ESO/H.Zodet

Ongoing Semester 2017A

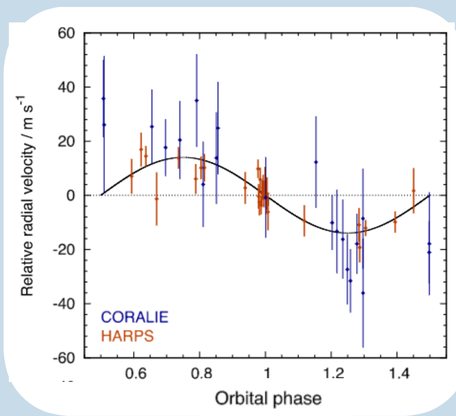
The photometric and spectroscopic follow-up of previous and new SWASP targets have been awarded 31 nights out of 75 allocated for observations of transiting exoplanets at the Euler telescope per semester. So far a number of EBLMs and blended binaries have been identifies, leaving a hand full of potential planet candidates behind.

An update to the data reduction software includes automatic computations of wide CCFs and an implementation of a F0 and an A0 mask for hot, early type stars, which have been numerous amongst the new SWASP candidates.

SB3: The CCFs to the right have been computed using G2 (blue) and A0 (red) masks, revealing a hot, fast rotating main star, with two locked G-type companions, revealing a triple system. The guide image showed no sign of visual binaries.



Recent Results

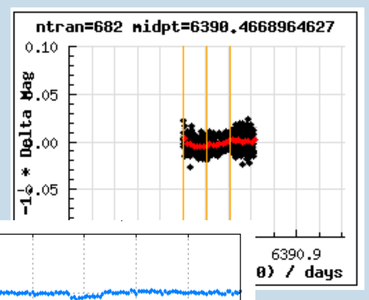


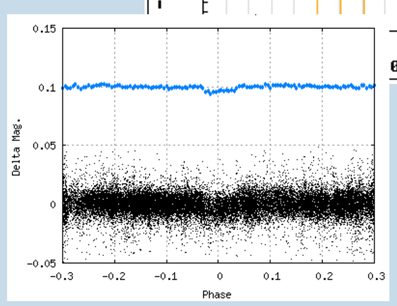
WASP 139b

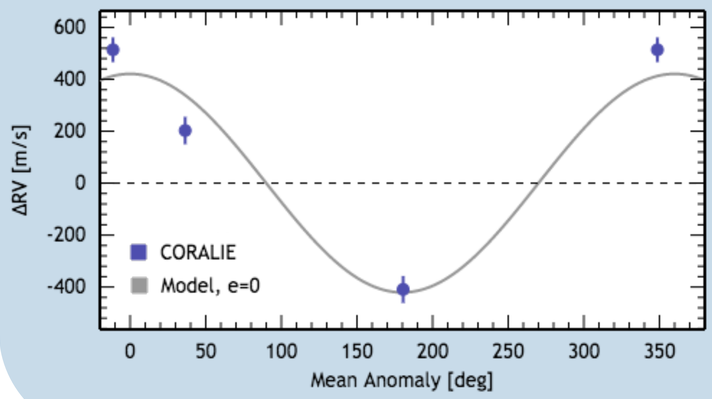
The lowest mass WASP discovery yet with just 0.12 Mjup. The fairly large radius of 0.80 Rjup made it detectable by SuperWASP and results in a low density, only 23 % of that of Jupiter.
This inflated 'super Neptune' is orbiting a metal-rich K0 star which appears to be anomalously dense. Several CORALIE and HARPS spectra were used to characterise the planet, as seen to the left.

1SWASPJNNNNNN-NNNNNN

A promising target from the 2017A semester is orbiting a Vmag 6.6, hot, A-type star with vsini ~100 km/s.
A single SWASP transit is displayed here with binned data points in red. The phase folded, co-added light curves are displayed with binned data points in blue, revealing a shallow transit of 0.3%, roughly corresponding to 1 Rjup around a mid-A star.







The brightness of the star enables a precision of ~100 m/s, despite the broad CCF. The amplitude of a circular orbit has been fitted using the SWASP ephemerides. The amplitude of 420 +/- 110 m/s corresponds to a planet of 4.3 +/-1 Mjup.

Future Work

A small selection of candidates are now in the process of being vetted for possible HARPS observations, which could reveal planets lighter than originally targeted by this investigation.
The Euler telescope will continue the follow-up of transiting exoplanets not only form SWASP, but also Kelt, NGTS and K2. The preparations for radial velocity follow-up of bright TESS targets have already begun, in order to coordinate the effort the best.

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