The EBLM Project

Orbital parameters, including spin-orbit angles, of Low Mass Eclipsing Binaries in WASP

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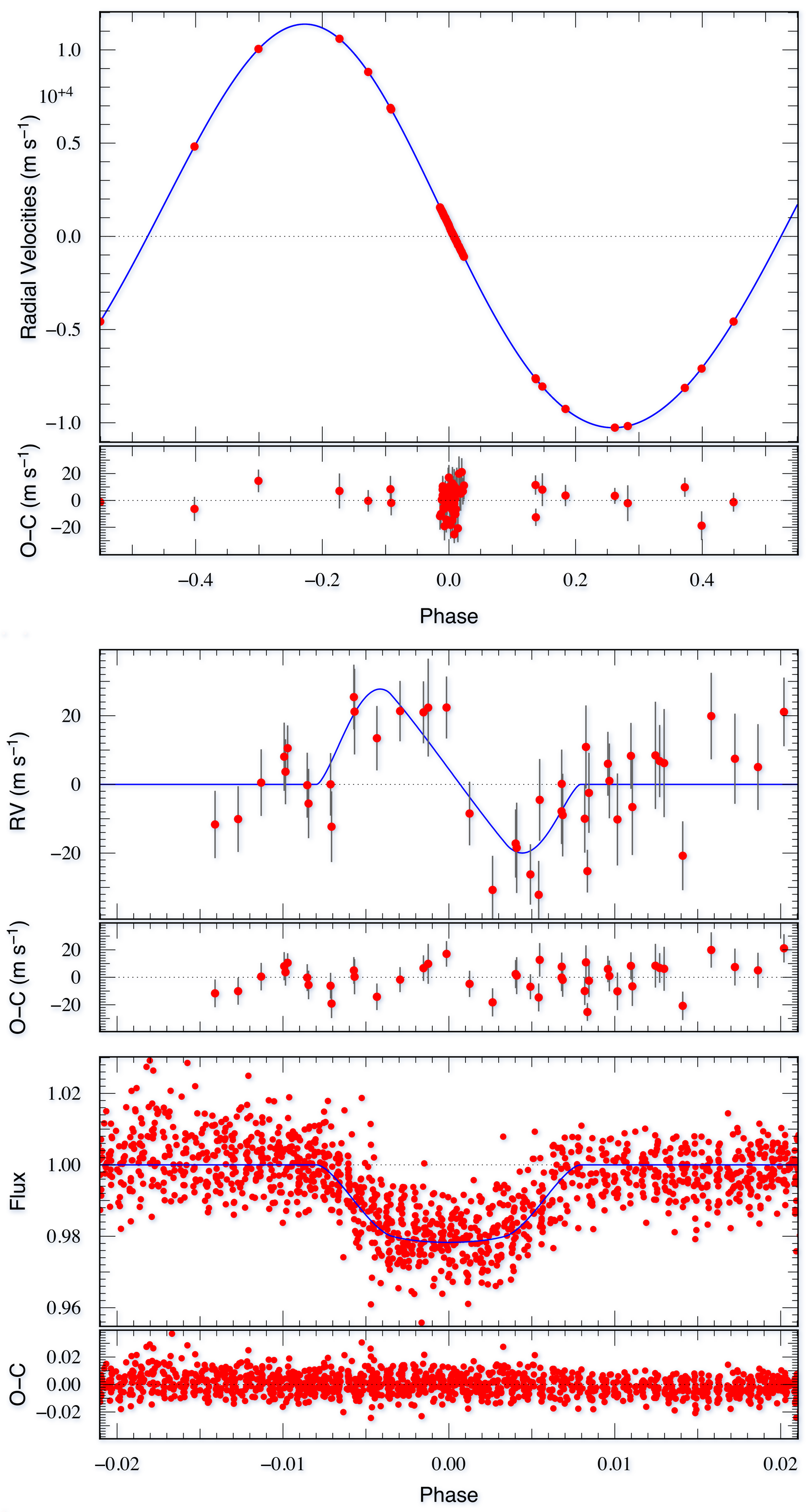
WASP (Wide Angle Search for Planets) (Pollacco et al. 2006) provides transiting planet candidates which are followed-up spectroscopically with CORALIE (Swiss Telescope, La Silla). Any object, either planet or EBLM (low mass eclipsing binary) is observed giving an unbiased survey of any transiting object below ~2.1 R_{jup}.

EBLMs are easy objects to follow-up and study using good photometry and radial velocity measurements in a similar fashion to the procedures used routinely for exoplanets.

Aims

- find eclipsing Brown Dwarfs,
- complete the largely empty mass-radius diagram for stars with masses < 0.4 $M_\odot$,
- explore the mass distribution separating stars from planets,
- extended sample to the exoplanets, especially with regards to their orbital parameters, long term variability and spin-orbit angles via the measure of the Rossiter-McLaughlin effect (Holt 1893, Rossiter 1924, McLaughlin, 1924, Queloz et al. 2000, Gaudi & Winn 2007).

Our first object J1219-39b



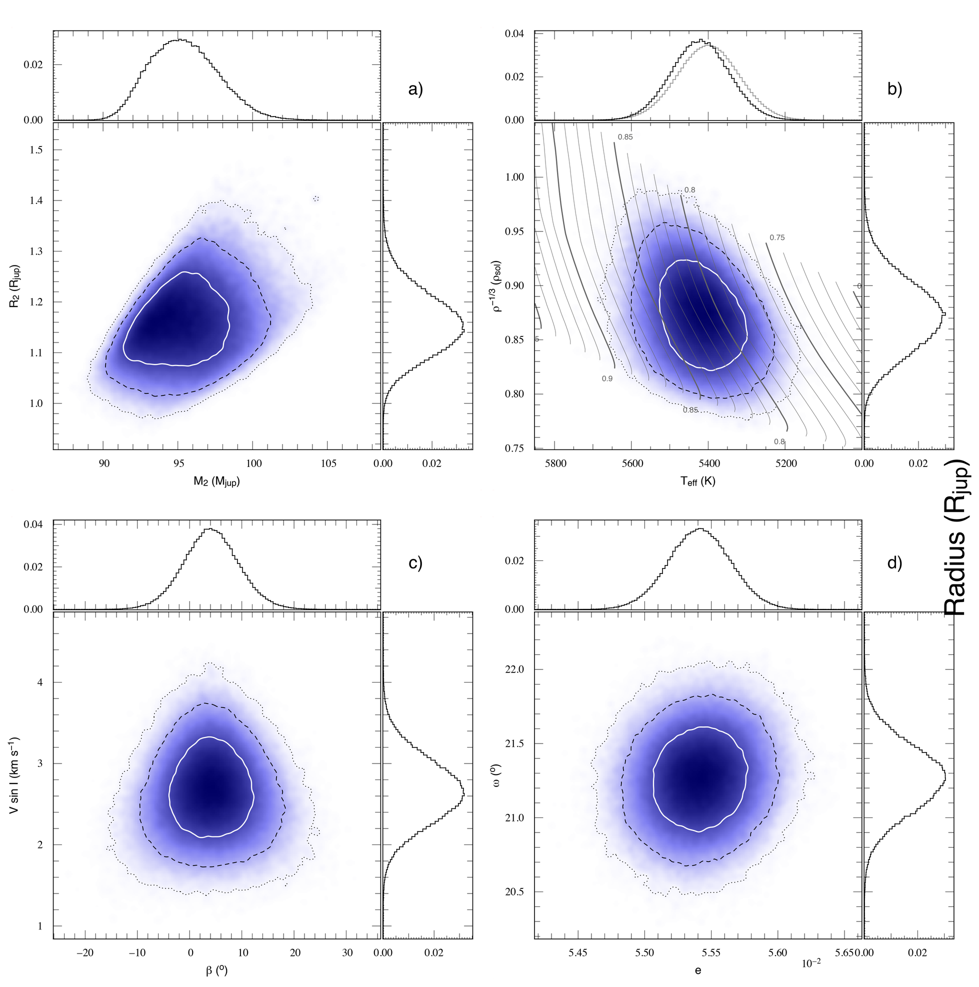
left (top to bottom): phased radial velocity data, (CORALIE on the Swiss 1.2m Euler telescope, La Silla) & residuals; zoom on the Rossiter - McLaughlin effect & residuals; WASP photometry & residuals.

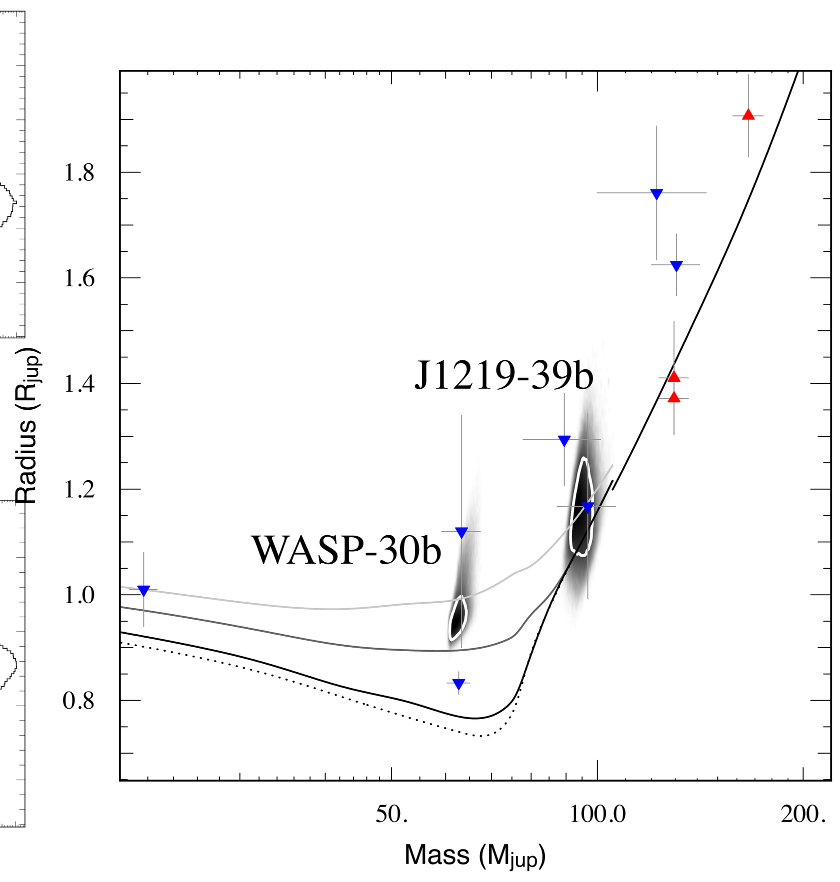
a, b, c, d: probability posterior distribution, output of a MCMC including interpolation in the Geneva stellar evolution tracks.

bottom: Mass-Radius plot (Baraffe models).

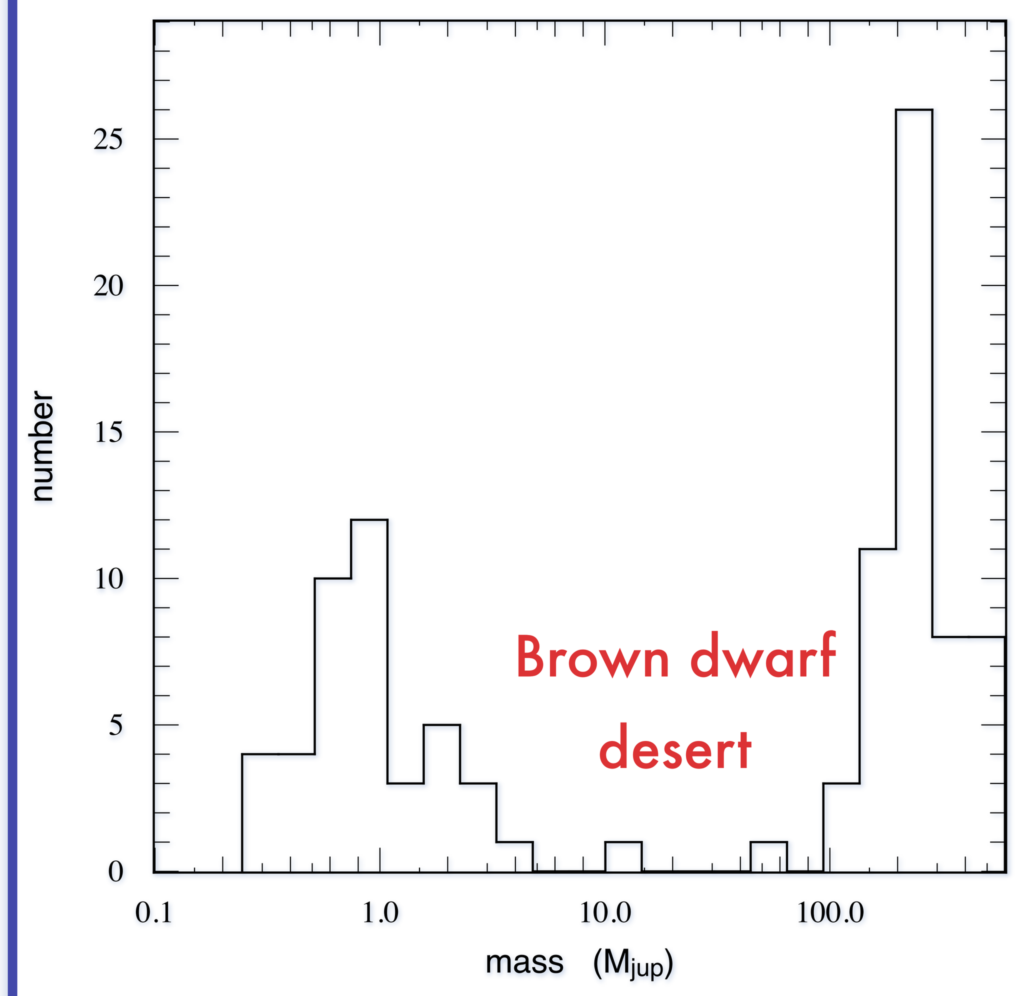
J1219-39b is a 95 M_{jup}, 1.1 R_{jup} star, on a non synchronous 6.76 day orbit with eccentricity 0.05. Spin-orbit angle β = 0°, thus coplanar.

Triaud et al. submitted





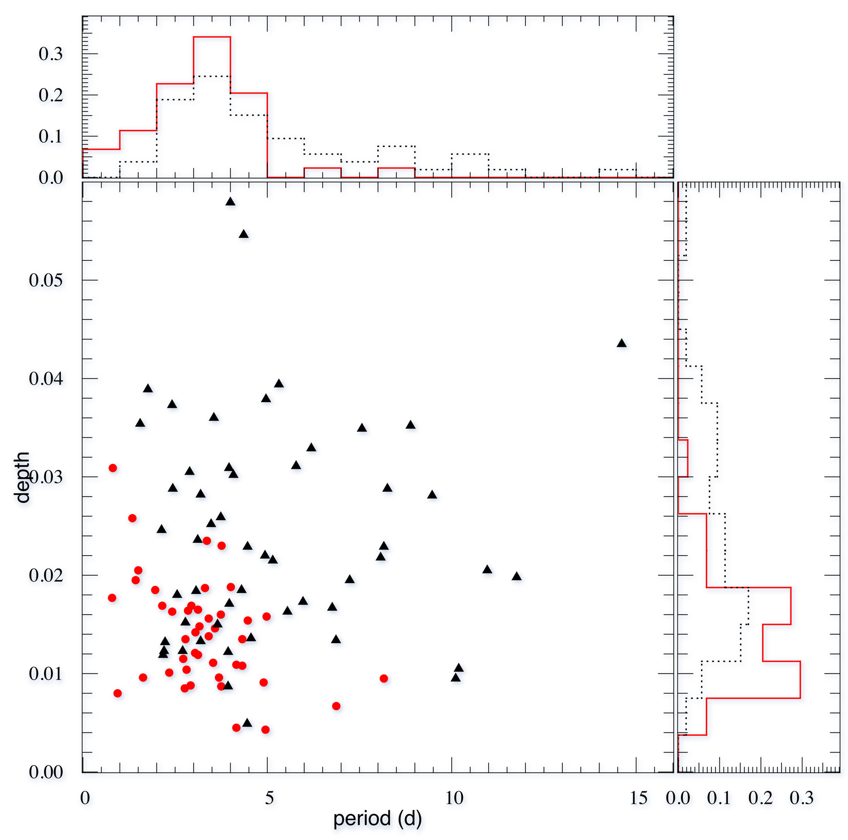
Transiting planets vs EBLMs

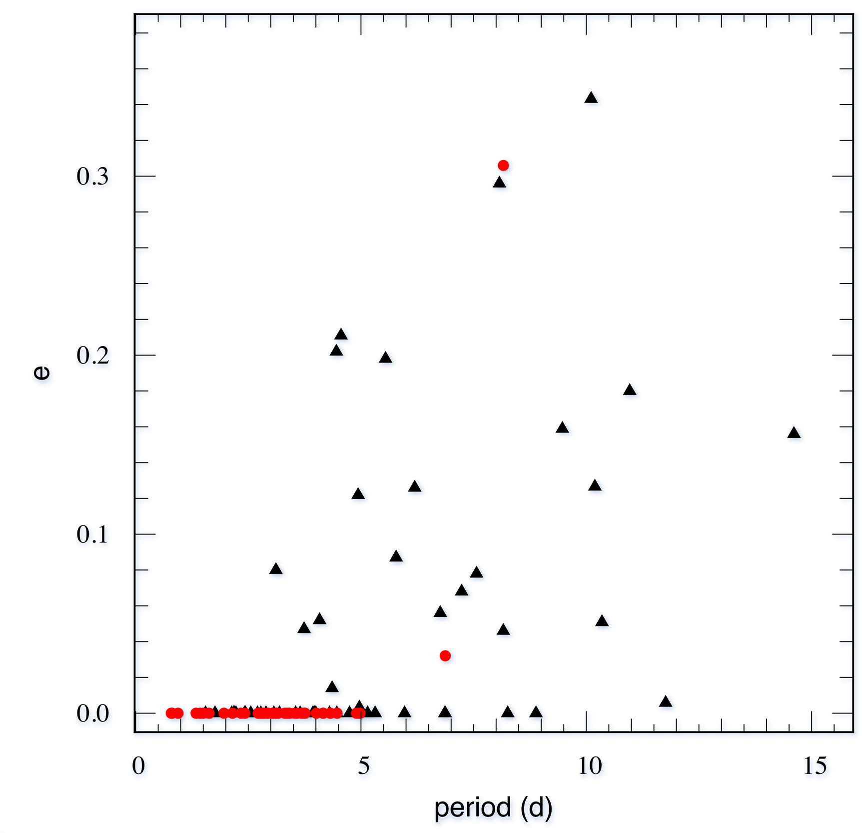


mass histogram: from 0.1 to 400 Mjup, clearly showing the brown dwarf desert. Biases at lower mass (depth too small to detect), and higher mass (depth too large to be considered a planet candidate).

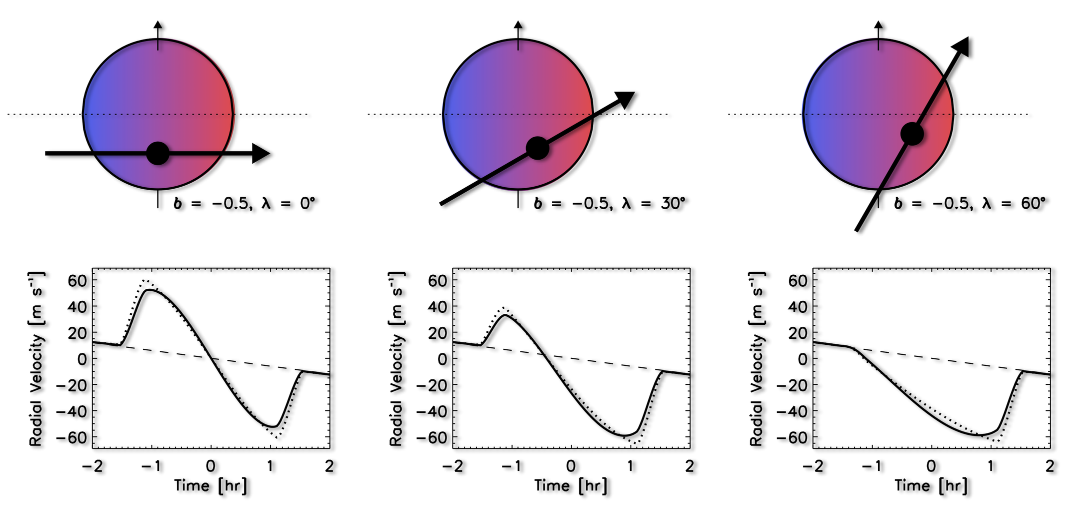
Eccentricity vs period: planets are in red, EBLMs in black. Eccentricities below 0.1 for planets are hard to determine. Nevertheless, stars appear eccentric at shorter orbital periods.

depth vs period: same colour scheme. We find a lack of large planets at periods above 5 days (potential for false planets in Kepler catalog). More stars at periods > 5 days, than planets (hot Jupiter peak at 3 days).





A spin-orbit angle survey



Measurements of the Rossiter-McLaughlin effect have shown planets can sometimes orbit on a retrograde orbit compared to the rotation of the star (eg. Triaud et al. 2010). Albrecht et al. (2009) have shown both components of DI Hercules (an EB) are on polar orbits.

We have measured the Rossiter-McLaughlin on nearly 20 EBLMs (7 displayed on this poster). So far all of them are aligned despite a variety of eccentricity, mass ratio, orbital periods, synchronous or non synchronous rotation and effective temperature of the primary (see Winn et al. 2010).

For three systems we have too low an amplitude to be measured with CORALIE. HARPS measurements may yet reveal a misaligned EBLM.