Kepler K2 observations of the hot Jupiter WASP-85b

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WASP-85 (1SWASP J114338.01+063349.4 = EPIC 201862715) is a $V = 10.7$ (Kep mag = 10.2), G8 star hosting a transiting hot Jupiter ($P = 2.656$ d, $R_{\rm p} = 1.2$ $R_{\rm jup}$, $M_{\rm p} = 1$ $M_{\rm jup}$), and is on-silicon for K2 Field 1. The discovery paper is in preparation (Triaud et al. 2014, in prep), but we are giving details of the planet here in order to bid for it to be a K2 target.

The star is a double star (CCDM J11436+0634AB) with components A ($V = 11.2$) and B ($V = 11.9$) separated by 1.6 arcsec. The planet orbits the A component, though a *Kepler* observation will record the combined light.

We currently have 20 000 photometric observations from WASP, covering 2008–2011, plus 44 RVs from Euler/CORALIE, 8 RVs from ESO 3.6-m/HARPS RVs on the A component and 5 on the B component. We also have 5 full or partial follow-up transit lightcurves from EulerCAM and TRAPPIST.

Science aims:

The preliminary analysis of our data finds a significant eccentricity of 0.1, which is unexpected for an orbit of only 2.6 days. If this is confirmed WASP-85b would be the shortest-period hot Jupiter with a substantial eccentricity. The high-quality *Kepler* photometry will give a phase curve for WASP-85 and allow us to look for the occultation of the planet, and thus confirm the eccentricity.

Such an eccentricity would imply that WASP-85b is in a dynamically young orbit, that has not had time to circularise through tides, and thus the system would be significant for understanding the dynamical origin of the hot-Jupiter population.

Further science aims include: (1) using the high-precision *Kepler* transit photometry to obtain the best parameterisation of the mass, radius and density of the planet, and (2) looking for TTVs or additional transits that would indicate a third body.

We request **short-cadence observations** (if sufficient slots are available) to (1) maximise the light-curve quality, given the 2.4-hr transit (Southworth 2011 MNRAS 417, 216 found a 2σ difference in a/R_* and a 60% difference in planet density in Kepler-5b comparing short- and long-cadence data), and (2) look for stellar oscillations that would yield the stellar mean-density and hence better parametrisation of the system.

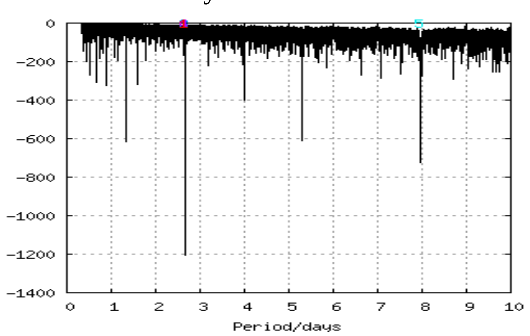

Fig. 1: Periodigram of WASP data.

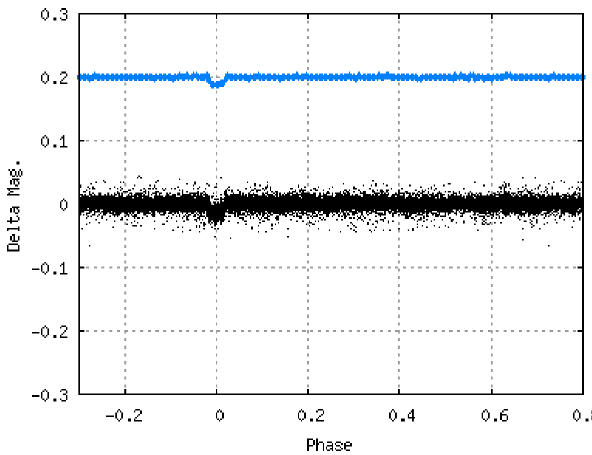

Fig. 2: Fold of WASP discovery data.

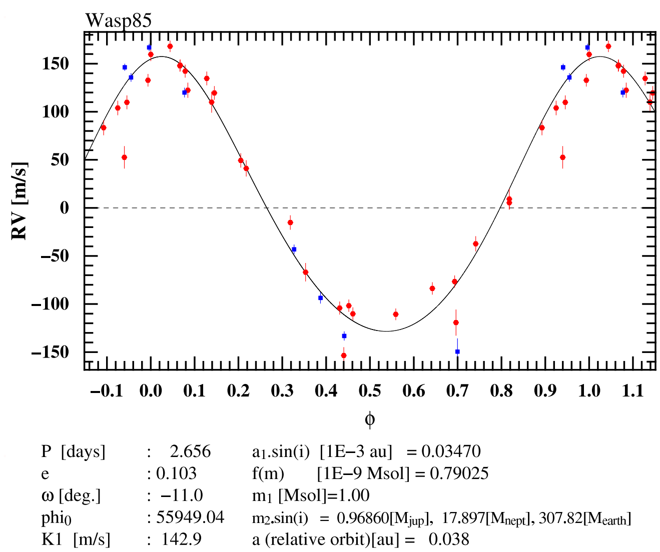

Fig. 3: Combined CORALIE/HARPS RVs for WASP-85.

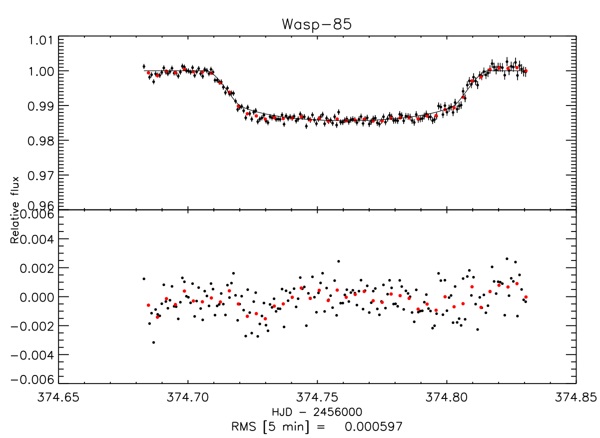

Fig. 4: EulerCAM transit of WASP-85b.