Discovery of WASP-85 Ab: A Hot Jupiter in a Visual Binary System

Summary

- WASP-85 Ab is a hot Jupiter planet orbiting the brighter component of BD+07°2474.
- Host star has super-Solar metallicity. Companion is a cooler K-dwarf of similar magnitude.
- Ca II H+K measurements suggest both are strongly active, particularly when compared to other hot Jupiter hosts.
- Photometry is strongly diluted by light from companion star, affecting planet radius estimate.
- HARPS radial velocities are uncontaminated.
- Our HARPS observations are undiluted.
- We use only HARPS data in our modelling.
- The primary effect of dilution is to decrease RV semi-amplitude for affected datasets.

Discovery of WASP-85 Ab:
A Hot Jupiter in a Visual Binary System

Summary

- WASP-85 Ab is a hot Jupiter planet orbiting the brighter component of BD+07°2474.
- Host star has super-Solar metallicity. Companion is a cooler K-dwarf of similar magnitude.
- Ca II H+K measurements suggest both are strongly active, particularly when compared to other hot Jupiter hosts.
- Photometry is strongly diluted by light from companion star, affecting planet radius estimate.
- HARPS radial velocities are uncontaminated.
- Joint MCMC fit of photometry (excluding K2) and HARPS spectroscopy.
- Bayesian priors placed on $T_{\text{eff}}$, $v\sin i$, $[\text{Fe/H}]$, and third light contribution.
- Analysis of K2 data ongoing.

- Our photometric observations contain light from both binary components.
- We add a third light component to the standard transit model to account for this.
- This level of contamination is included as an additional variables.
  - Defined per wavelength.
- If we don’t account for contamination, the $R_p$ decreases by 18%.
- We detect rotational modulation in the WASP lightcurve, indicating $P_{\text{rot}} = 14.6 \pm 1.5$ days for one of the stellar components.

- BD+07°2474 has been observed as part of K2 campaign 1.
- The two stellar components are indistinguishable in K2 data.
- The K2 long cadence lightcurve (top) clearly shows variability from stellar activity.
- Removing activity reveals a consistent transit shape.
- The depth is consistent with other lightcurves, accounting for dilution.
- CORALIE (blue squares) and SOPHIE (red circles) observations are also diluted by the stellar companion.
- Our HARPS (black triangles) observations are undiluted.
- We use only HARPS data in our modelling.
- The primary effect of dilution is to decrease RV semi-amplitude for affected datasets.

- Binary position angle shows a clear, long-term, negative trend.
- This suggests a binary period of $\geq 3000$ years.
- Variation in mean binary angular separation suggests the binary is inclined relative to our line of sight by $\approx 45^\circ$.
- The planet’s orbit is thus misaligned with the binary plane.