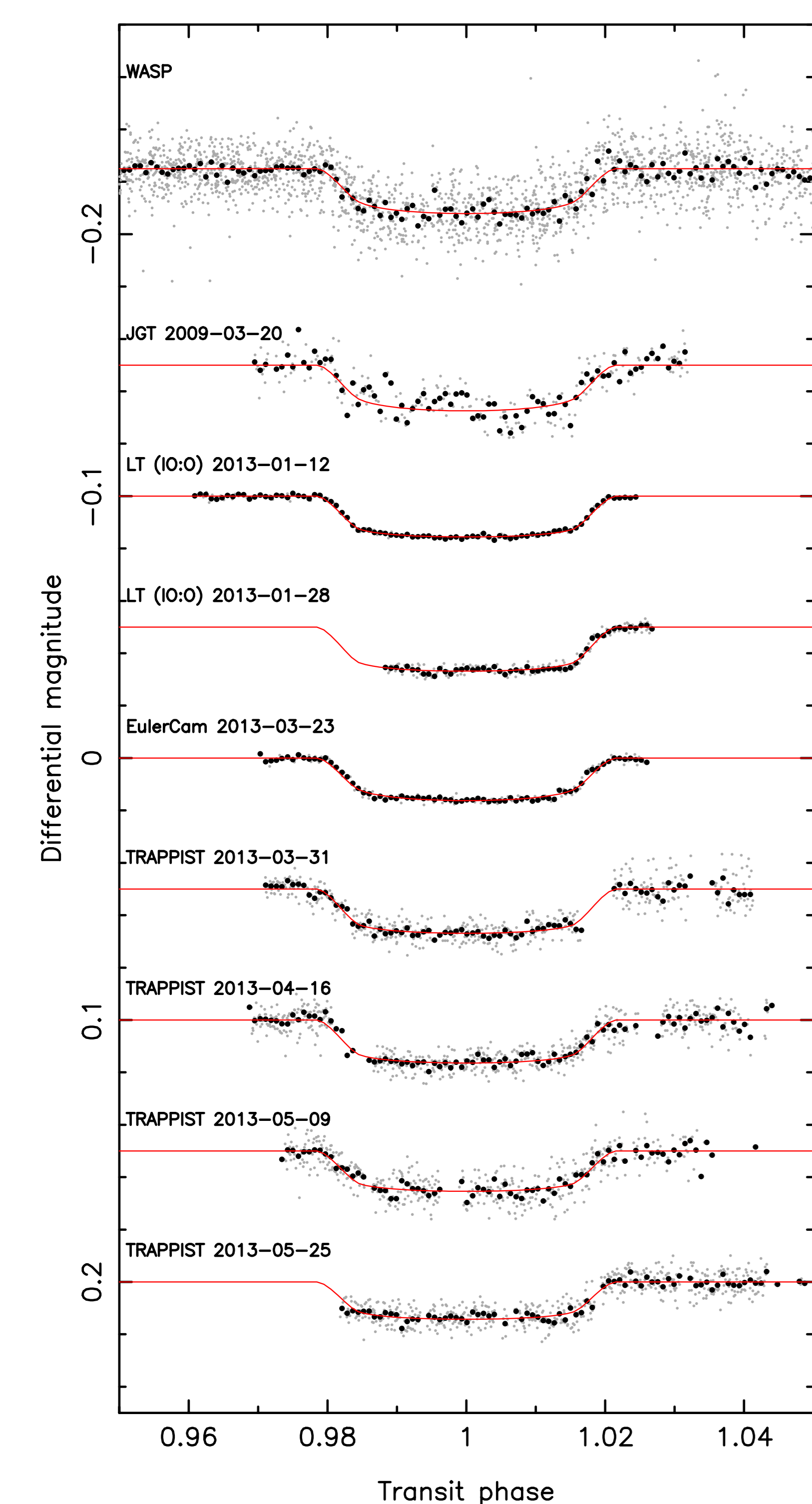


# Discovery of WASP-85 Ab: A Hot Jupiter in a Visual Binary System

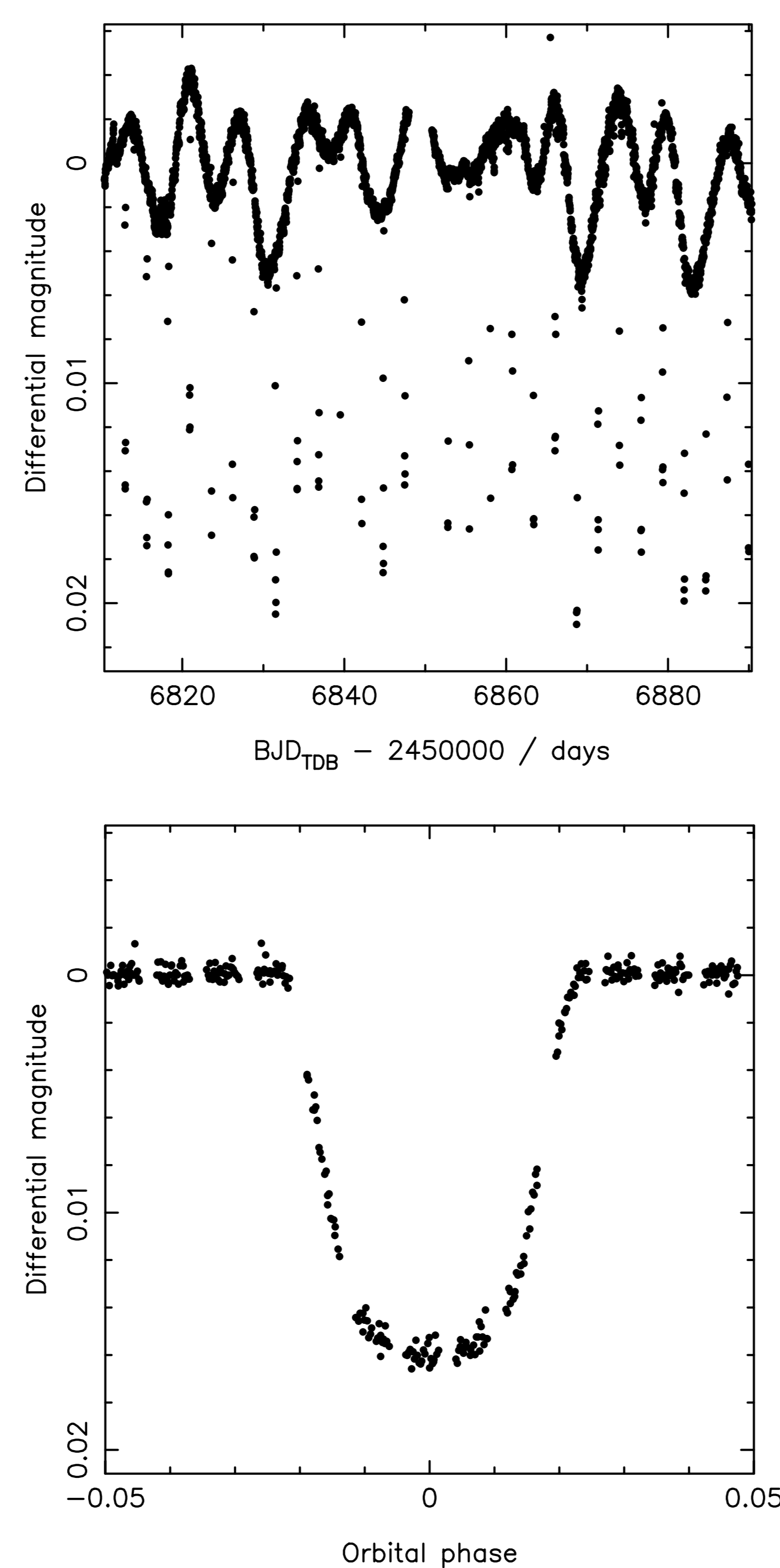
## Summary

- 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  $T_{\text{eff}}$ ,  $v \sin i_A$ , [Fe/H], and third light contribution.
- Analysis of K2 data ongoing.

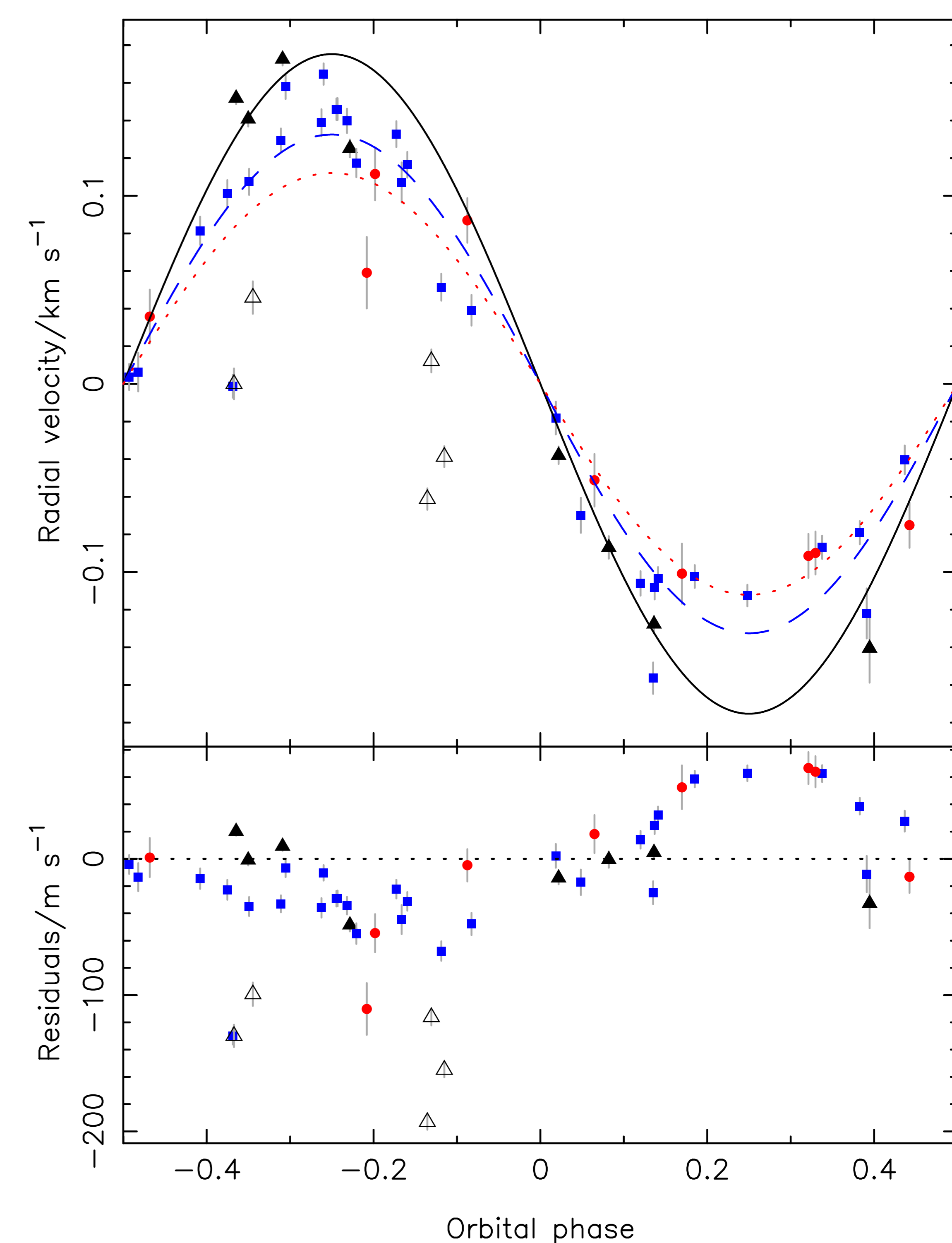
- $P = 2.66$  days
- $M_{\text{pl}} = 1.09 \pm 0.03 M_{\text{Jup}}$
- $R_{\text{pl}} = 1.44 \pm 0.02 R_{\text{Jup}}$
- $P_{\text{rot}} = 14.6 \pm 1.5$  days
- $v \sin i_A = 3.41 \pm 0.89$  km/s
- $T_{\text{eff}} = 5685 \pm 65$  K
- $b = 0.044^{+0.037}_{-0.028}$
- $i_{\text{orb}} = 89.72^{+0.18}_{-0.24}$
- $e = 0$



- 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 variable.
  - *Defined per wavelength.*
- If we don't account for contamination, the  $R_{\text{pl}}$  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.

