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J/A+A/579/A136 HAT-P-36 and WASP-11/HAT-P-10 light curves (Mancini+, 2015)

The GAPS Programme with HARPS-N at TNG.

VIII: Observations of the Rossiter-McLaughlin effect and characterisation of the transiting planetary systems HAT-P-36 and WASP-11/HAT-P-10.

Mancini L., Esposito M., Covino E., Raia G., Southworth J., Tregloan-Reed J., Biazzo K., Bonomo A., Desidera S., Lanza A. F., Maciejewski G., Poretti E., Sozzetti A., Borsa F., Bruni I., Ciceri S., Claudi R., Cosentino R., Gratton R., Martinez Fiorenzano A. F., Lodato G., Lorenzi V., Marzari F., Murabito S., Affer L., Bignamini A., Bedin L.R., Boccato C., Damasso M., Henning T., Maggio A., Micela G., Molinari E., Pagano I., Piotto G., Rainer M., Scandariato G., Smareglia R., Zanmar Sanchez, R.

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Abstract:

Orbital obliquity is thought to be a fundamental parameter in tracing the physical mechanisms that cause the migration of giant planets from the snow line down to roughly 10^{-2} au from their host stars. We are carrying out a large programme to estimate the spin-orbit alignment of a sample of transiting planetary systems to study what the possible configurations of orbital obliquity are and whether they correlate with other stellar or planetary properties.

We determine the true and the projected obliquity of HAT-P-36 and WASP-11/HAT-P-10 systems, respectively, which are both composed of a relatively cool star (with effective temperature $T_{\text{eff}} < 6100\text{K}$) and a hot-Jupiter planet.

Thanks to the high-resolution spectrograph HARPS-N, we observed the Rossiter-McLaughlin effect for both systems by acquiring precise (3-8 m/s) radial-velocity measurements during planetary transit events. We also present photometric observations comprising six light curves that cover five transit events, which were obtained using three medium-class telescopes. One transit of WASP-11/HAT-P-10 was followed simultaneously from two observatories. The three transit light curves of HAT-P-36 b show anomalies that are attributable to starspot complexes on the surface of the parent star, in agreement with the analysis of its spectra that indicates moderate activity ($\log R'_{\text{HK}} = -4.65\text{dex}$). By analysing the complete HATNet data set of HAT-P-36, we estimated the stellar rotation period by detecting a periodic photometric modulation in the light curve caused by star spots, obtaining $\text{Prot} = 15.3 \pm 0.4\text{days}$, which implies that the inclination of the stellar rotational axis with respect to the line of sight is $i = 65 \pm 34\text{degrees}$.

We used the new spectroscopic and photometric data to revise the main physical parameters and measure the sky-projected misalignment angle of the two systems. We found $\lambda = -14 \pm 18^\circ$ for HAT-P-36 and $\lambda = -7 \pm 5^\circ$ for WASP-11/HAT-P-10, indicating in both cases a good spin-orbit alignment. In the case of HAT-P-36, we were also able to estimate an upper limit of its real obliquity, which turned out to be $< 63^\circ$.

Description:

3 light curves of three transit events of the extrasolar planet HAT-P-36b and 3 light curves of two transit events of the extrasolar planet WASP-11b/HAT-P-10b. Three of the datasets were obtained using the Zeiss 1.23-m telescope (filter: Cousins I) at the Observatory of Calar Alto (Spain), two with the Cassini 1.52-m telescope (filter: Gunn r) at the Astronomical Observatory of Bologna in Loiano (Italy), and one with the IAC 80-cm telescope (filter: Cousins R) at the Teide Observatory on the island of Tenerife (Spain).

Objects:

RA	(2000)	DE	Designation(s)	(Period)
12 33 03.91	+44 54 55.2		HAT-P-36 = TYC 3020-2221-1	(P=1.32734683)
03 09 28.54	+30 40 24.7		WASP-11 = TYC 2340-1714-1	(P=3.72247967)

File Summary:

FileName	Lrecl	Records	Explanations
ReadMe	80	.	This file
h36ca1.dat	37	166	Photometry of HAT-P-36 on 2014-04-14 (I CA 1.23m)
h36ca2.dat	37	145	Photometry of HAT-P-36 on 2014-04-18 (I CA 1.23m)
h36lo.dat	37	98	Photometry of HAT-P-36 on 2013-04-14 (r Loiano 1.5m)

