Planetary transit observations at the University Observatory Jena: TrES-2

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Abstract

We report on observations of several transit events of the transiting planet TrES-2 with a 25 cm telescope of the University Observatory Jena. Between March 2007 and November 2008 ten different transits and almost a complete orbital period were observed. Overall, in 40 nights of observations 4291 exposures (in total 71.52 h of observation) of the TrES-2 parent star were taken. All TrES-2 observations were taken in I-band with 60 s exposure time. The results are presented in the box at the bottom.

Methods

For our TrES-2 observations, started in March 2007, we used 40 nights since March 2007 to November 2008. All TrES-2 observations were taken in I-band with 60 s exposure time. The results are presented in the box at the bottom.

Results

The following figures show the same light curves of TrES-2 (a & b and c & d) before and after using Sys-Rem.

Possible explanations

1. A nearby star could be within the aperture when doing the photometry. If this object is variable, it could produce a dip.
2. Background star
   - Origins of the dip by transiting a stationary background giant with a very low projected separation to the TrES-2 parent star. Both stars cannot be separated visually.
3. Companion
   - Origin of the dip by transiting a companion of the TrES-2 parent star (differences in inclination exaggerated).
4. An additional planet

Discussion and Outlook

Using a 25 cm Cassegrain telescope equipped with the optical CCD camera CTK of the University Observatory Jena we observed several transit events and almost a complete orbital period of the known exoplanet TrES-2. We determined the orbital period to be slightly smaller (~ 0.6 s) than previously expected. The mean photometric precision of the V = 11.4 mag star is 0.007 mag and the precision in the determination of the transit times is ~ 0.0017 d. This allows us to register transit time variations of around 150 s. The timing residuals are consistent with zero within the measurement errors. We did not find any indication of timing anomalies caused by additional planets or moons.

In our first observations of a transit of TrES-2 we could detect a second dip after the end of the transit. An indication of the existence of the dip is published by Broeg et al. (2005) was used to explain the dip and search for transit time variations for the next few years to decades. We are also working on methods to improve the precision of our transit times.

This year we will start our own search for planetary transits where we monitor different regions of young open clusters with our new CCD camera for the Schmidt focus of the 90 cm reflector. This camera will have a smaller pixel scale and a higher sensitivity. Our transit observations will benefit strongly from the new camera.

Instruments and Observations

We have three telescopes available, a 90 cm reflector, a 20 cm refractor and a 25 cm Cassegrain telescope (see box on the right side).

The Telescopes

CTK - Cassegrain-Teleskop CCD-Kamera

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