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FOLLOW-UP OF COROT TRANSITING EXOPLANETS WITH HARPS AND SOPHIE SPECTROGRAPHS

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Abstract. The CoRoT space mission is detecting every semesters several tens of exoplanets transiting candidates. Among this candidates, there are several background eclipsing binairies. The radial velocity follow-up, performed with the high-resolution spectrographs HARPS (3.6m ESO) and SOPHIE (1.93m OHP), consists to measure the mass of companions and allows to characterize the nature of transiting object. For the faintest target (14<mv<16) observed at low S/N, the moon background light may affect the spectra and introduce systematic errors in the Radial Velocity measurements. We studied the influence of this effect and optimized the data reduction pipeline in order to minimize it.

1 Introduction

The CoRoT mission is the first space mission dedicated to search extrasolar planets by the transit method. Transiting exoplanets are crutial for the global comprehension of planetary systems and compared planetology because they are the only ones were the density can be computed by measuring their radius and mass with two complementary methods. CoRoT planetary candidates radius is determined with CoRoT light curve. Their nature and their mass are established and measured with SOPHIE (1.93m - OHP) and HARPS (3.6m - La Silla) spectrographs. CoRoT detects every semester about 50 planetary candidates with a V-magnitude between 11.5 and 16. CoRoT already discovered the first transiting telluric planet (CoRoT-7b : Leger et al. 2009 and Queloz et al. 2009), the first transiting brown darf (CoRoT-3b : Deleuil et al. 2008) and the first planets around active stars (CoRoT-2b : Alonso et al. 2008 and Bouchy et al. 2008).

2 Radial velocity follow-up

SOPHIE is a high-resolution spectrograph installed on the 1.93m telescope of Haute Provence Observatory in France. All CoRoT planetary candidates with V-magnitude less than 15 are followed by SOPHIE with a radial velocity precision in the range 10-50 m.s^{-1}. In 2.5 years of CoRoT follow-up, we followed and solved more than 80 candidates.
HARPS is a high-resolution spectrograph installed on the 3.6m telescope of La Silla Observatory in Chili. HARPS can follow CoRoT planetary candidates until a V-magnitude of 16 with a precision better than 30 m.s^{-1}. In 2.5 years, we followed and solved more than 60 candidates.

3 The Moon background light

During observation in presence of the Moon, the Sun spectrum, reflected by the Moon and diffused by the atmosphere, is additionned with the star spectrum. For faint target, this additionnal spectrum could affect the measurement of their radial velocity. Indeed, the radial velocity is measured by calculating the Cross-Correlation Function (CCF) between an observed spectrum and a numeric mask. This CCF represents the average line of

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the spectrum. However, if the relative radial velocity of the Moon is close to the radial velocity of the star, the additionnal Sun spectrum lines could deform the spectrum lines of the star and affect the measurement of their radial velocity and bissector. This effect can be corrected only if the instrument is able to observe simultaneously the sky and the target in differents channel. The correction consist to substract the sky CCF from the star CCF.

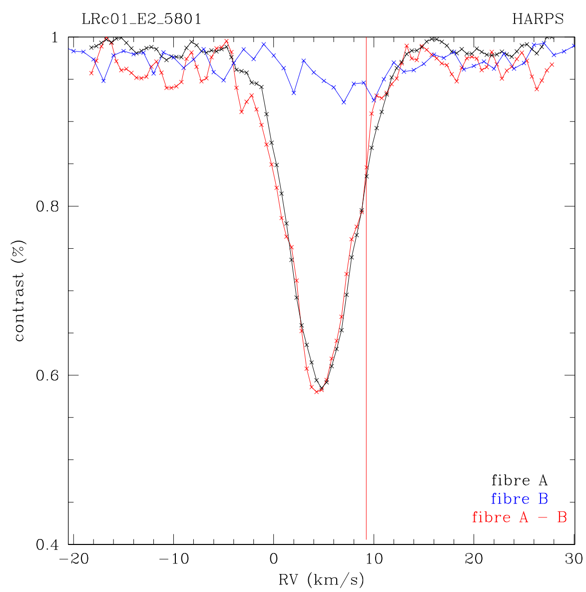

Fig. 1. Results of one observation of the CoRoT target LRc01_E2_5801 (V-magnitude = 16.2). Black curve shows CCF on the A fiber from HARPS (CoRoT target + sky), blue curve shows the CCF on the B fiber (only sky) and the red line indicate the theorical relative radial velocity of the Moon. Finally, the red curve is the result of the correction of the Moon background light. Amplitude of correction is -270 m.s^{-1}.

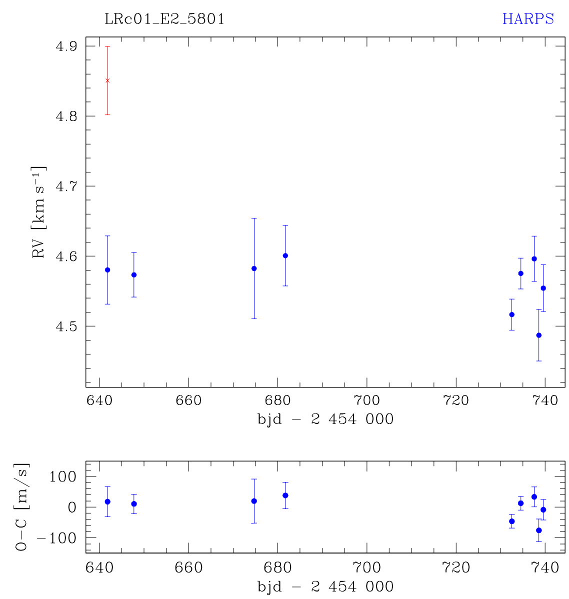

Fig. 2. Radial velocity measurements realised with HARPS of the CoRoT target LRc01_E2_5801 (V-magnitude = 16.2). The Moon background light affected observation showed in Fig. 1 is represented in red. Blue points are corrected or non-affected by the Moon background light.

On HARPS spectrograph, this effect appears for target fainter than 13th V-magnitude and may affect the radial velocity measurement with an amplitude of several hundred of m.s^{-1}.

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