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GTC/OSIRIS Transmission spectroscopy of the short period planet WASP-43b

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Abstract

Of the several extrasolar planets discovered to date, only a few of them have orbital periods of less than a day. Such planets are interesting candidates to study tidal effects and, in the case of short period Hot Jupiters, they offer an excellent oportunity to detect and study their atmosphere due to their generally large atmospheric scale heights.

We used Gran Telescopio de Canarias (GTC) instrument OSIRIS to obtain long-slit spectra in the optical range (520-1040 nm) of the planetary host star WASP-43 (and a reference star) during a transit event. We integrated the stellar flux of both stars in different wavelength regions producing several light curves and fitted transit models in order to obtain the star-to-planet radius ratio R_P/R_S across wavelength.

1. Introduction

WASP-43b was discovered by the Wide Angle Search of Planets team in 2011 (Hellier et al. 2011). It is a Hot Jupiter that orbits a K7V star with an orbital period of P = 0.8134 days, making it one of the most massive short period planets known to date. Gillon et al. (2012) presented a study of several transits observed with TRAPPIST, VLT near-IR photometry, and CORALIE radial velocities; improving the estimation of the parameters of the system. Recently, Blecic et al. (2013) measured the secondary eclipse of WASP-43b in the 3.6 μm and 4.5 μm bands using Spitzer, deducing a planetary brightness temperature of 1684 $\pm$ 24 K and 1485 $\pm$ 24 K respectively.

Here, we present the results of a full transit event of WASP- 43b obtained with OSIRIS (Optical System for Imaging and low Resolution Integrated Spectroscopy) at GTC.

2. Observations and methods

GTC instrument OSIRIS consists of two CCD detectors with a field of view (FOV) of 7.8 $\times$ 7.8 arcmin and plate scale of 0.127 arcsec/pix. We used OSIRIS in its long-slit spectroscopic mode, selecting the grism R1000R which covers the spectral range of 520-1040 nm, and a custom built slit of 12 arcsec of width. With such a wide slit, the spectral resolution is dominated by the seeing during the observations, which varied between 0.8 and 1.8 arcsec. This translates in an effective spectral resolution of R = 374 - 841 at 751 nm.

In order to get the transit parameters from the light curves (such as planet-to-star radius ratio R_p/R_s), we followed a Markov Chain Monte Carlo (MCMC) Bayesian approach (see Berta et al. 2012 and Murgas et al. 2012 for details) to get the distribution of probabilities of the fitted parameters and adopted the median of the distribution as the best fitted value (together with their 1-σ uncertainties). Then, we estimated the level of red noise in the curves using the method of Winn et al. (2008).

Here we will present refined planet parameters, the planet color signature and the transmission spectrum of WASP-43b.

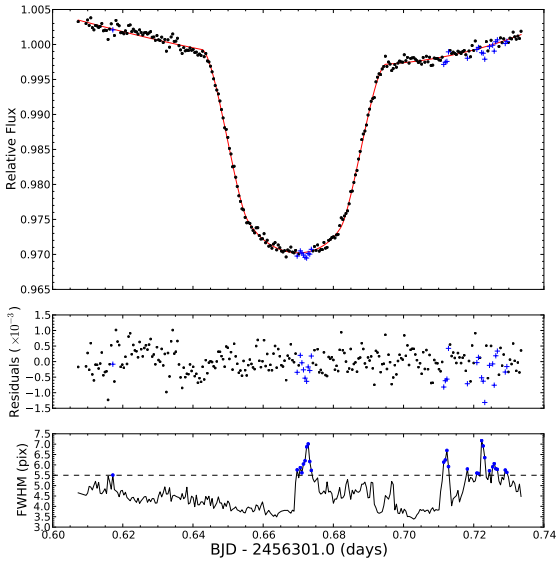

Figure 1: Top panel: GTC/OSIRIS WASP-43b white light curve and best fit found by an MCMC analysis; Middle panel: residuals of the fit; Bottom panel: FWHM of the spectra during the observations.

Acknowledgements

Based on observations made with the Gran Telescopio Canarias (GTC), instaled in the Spanish Observatorio del Roque de los Muchachos of the Instituto de Astrofísica de Canarias, in the island of La Palma.

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