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A homogeneous analysis of transit light curves of CoRoT-exoplanets

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Abstract

CoRoT discovered more than 17 exoplanets by now. The basic properties of these exoplanets have been determined via various fitting procedure, limb-darkening handling etc, as well as different versions of the data pipeline was used. The transit light curves of these objects will be studied here in a homogeneous way, e.g: the light curves were processed via the same way, the contamination factor was re-determined for all the host stars, the effect of limb darkening was handled homogeneously and we used the latest version of the data pipeline.

1. Introduction

CoRoT (Convection, Rotation and planetary Transit) is a 27 cm diameter space-telescope [1]. The goals of the mission are to obtain long-term photometric data sets for asteroseismological studies on relatively bright pulsating stars and to search for new transiting exoplanets. By now, CoRoT announced the discovery of 17 transiting objects, including the first superearth-type planet with measured radius (CoRoT-7b, [10, 13, 9]), the first temperate transiting planet with an orbital period of 95 days (CoRoT-9b, [5]). There are twelve hot Jupiters, one Saturn-sized object (CoRoT-8b [2]), and two brown dwarfs (CoRoT-3b, CoRoT-15b, see [6, 3]) among the other transiting objects discovered by CoRoT. Some of the twelve hot Jupiters found by the CoRoT mission represent very interesting examples, like hot Jupiters around extremely active stars (e.g. CoRoT-2b), very dense objects (e.g. CoRoT-14b), or rare examples of exoplanets around fast rotator stars (CoRoT-11b) or highly eccentric, but short orbits (e.g. CoRoT-10b with e=0.53, P=13.2 days).

Here we present a new, homogeneous and complete study of the CoRoT transit light curves.

2. On the need of a homogeneous study

The previous publications, in which the CoRoT detections were announced, used different approaches and techniques to study the transit events. This is due to the fact that the CoRoT Exoplanet Science Team (CEST) consists of different research group, which have their our computer codes and procedures. An interesting attempt was presented in [7], when the same transit light curve was analyzed by two different models (using the models of Gimenez [8] and of Mandel & Agol [11]) and three different optimization methods (Amoeba, Markov Chain Monte-Carlo and genetic algorithm). The results were in agreement with each other well within the error bars, which is quite satisfactory.

However, meantime new data pipeline versions were released, allowing us to improve the analysis based on new versions of the data reduction procedure. In addition, the method of the contamination factor calculation was improved ([2, 12]). The contamination factor gives an estimate of the fraction of the total observed flux that stems from different stars and not from the target object, due to the large PSF of CoRoT. We compare the new results to the previous numbers.

Behind these improvements, we modeled all the CoRoT transit light curves via the same way (data reduction, same free parameters, same fitting procedure, consequent estimation of uncertainties). Note that in the discovery papers we used different approaches. We also studied the performance of our fitting procedure [4], which will be also presented here.

The results of these modeling efforts will be presented on this conference.

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