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# CoRoT light curves of eclipsing binaries

## Characterization and periodicity

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**Abstract.** Binary stars are used to reproduce evolution stellar models and can provide orbital parameters, however the binary system suffers with the tidal force and achieve the equilibrium. We analyze the light curves in eclipsing binaries of the CoRoT mission by CLTC project, developed by authors. Our objective is to verify the rotation and binarity of the system. We define eccentricity and characterize the system. Maybe we can discover a planet.

**Resumo.** Estrelas binárias são utilizadas na reprodução de modelos de evolução estelar e podem fornecer parâmetros orbitais, no entanto os sistemas binários sofrem com a força de maré e alcançam o equilíbrio. Nós analisamos as curvas de luz de binárias eclipsantes da missão CoRoT através do projeto CLTC, desenvlvido pelos autores. Nosso objetivo é verificar a rotação e a binariedade do sistema. Nós definimos excentricidade e caracterizamos o sistema. Talvez possamoss descobrir um planeta.

**Keywords.** binaries: eclipsing – Stars: rotation – Stars: late-type

## 1. Introduction

In a binary system the two components are gravitationally bound to each other move in elliptical orbits around their common center of mass.These stars can provide more observable than simple stars. In a detached close binary, tidal evolution will continually change the orbital and rotational system parameters (Hut, 1981). In this way the system achieve the equilibrium, in other words, synchronization, circularization and all spins aligned.

All information we have of the stars are in its light, in eclipsing binaries the light curve have the primary and second eclipse periodically therefore we get the rotation and orbital period and the excentricity to characterizing the system and verify if the system is in equilibrium. To find binary stars with rotation period ($P_{rot}$) and orbital period ($P_{orb}$) measured, together with their eccentricities is not an easy task, systems circularizeds and synchronizesd are more hard yet.

Study circularization and synchronization times in Main-Sequence of detached Eclipsing Binaries (EBs) it is important to put an age constraint to the stellar evolution and for test models of tidal evolution. The ages of individual stars assume a particular importance, because they constitute the ticks of the abstract cosmic clock that tells us how various astronomical phenomena change over time (Barnes, 2009).

Getting the periods we have the circularization time and we can obtain an inferior limit of the age and better our understanding about evolution of the binary stars.

## 2. Methods

We selected eclipsing binaries from Convection, Rotation and planetary Transits -CoRoT mission. The CoRoT project, developed in the framework of project, the CNES small satellite programme with a wide european cooperation, has been set up in the early nineties, and was launched in 2006. It is dedicated to seismology and detection of telluric planets (Baglin, et al., 2006).

We choose only the spectral types F, G and K and close-detacheds systems.To analyse the systems we need three parameters, orbital and rotational period and eccentricity. The rotational period is a chalenge.

The project CTLC - CoroT Light Curves, is a simple tool, its works is down the light curve of CoRoT mission only by star ID, and make a reduction of the curve directly from the server of the CoRoT. Thereon we use the DiffeRential flUx Method of cuTting Off binariES - DRUM TONES [(Version 1.0.0). Zenodo. http://doi.org/10.5281/zenodo.1472861] - that is a differencial flux method to cut the eclipses and evidence the rotation and possible planets.

In the figure 1 we have the light curve of one eclipsing binary, first with rotation and eclipses, followed by fold of the binary, and the rotation peridiogram.

## 3. First Results

Zahn (1984) found syncronization period to binary stars with spectral type between F0 to F5 with about 1.21 days and G types with about 30 days. In according with Abt (2006) binary systems circularize with periods between 1 and 3 days.

Ours first are in according with the tidal theory of the Zahn and others literature works. How much lower the period easier verify the equilibrium.

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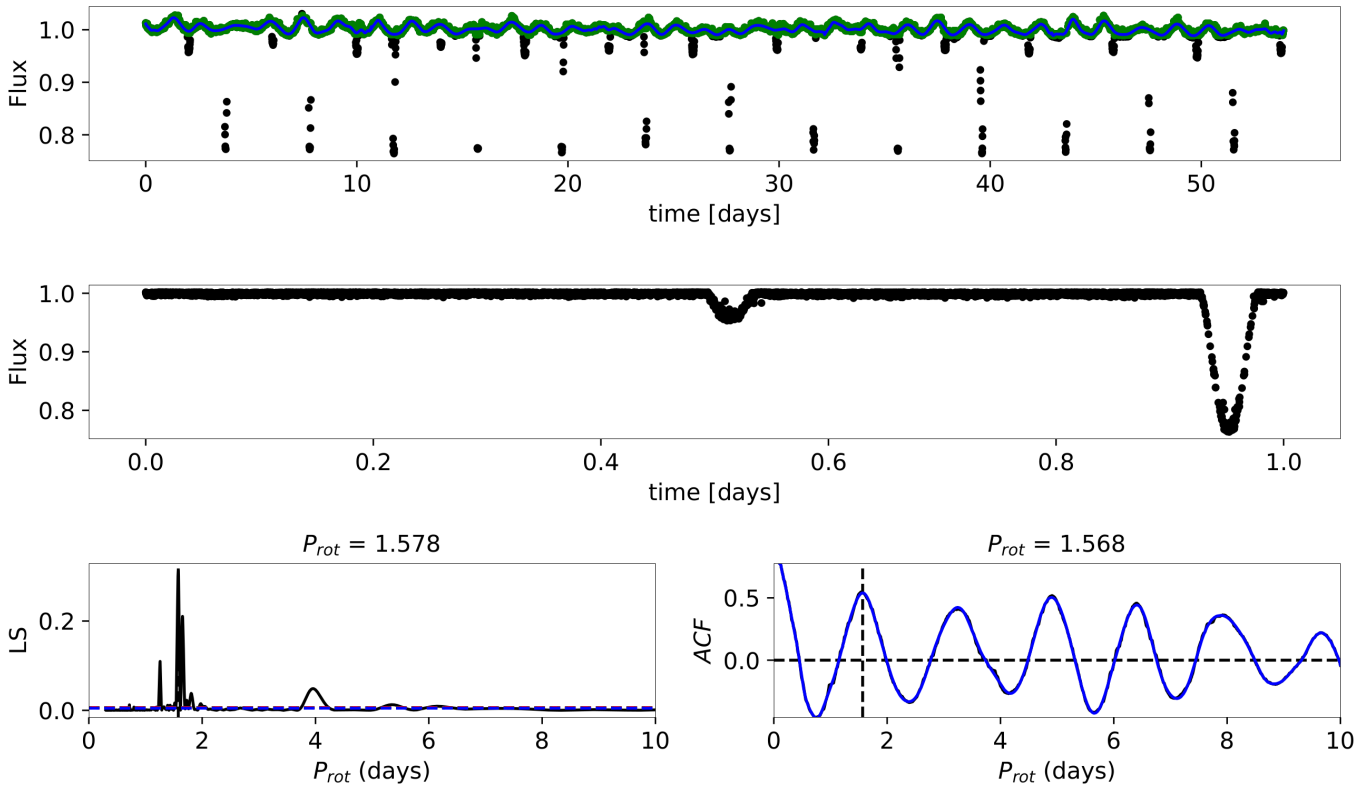


**Figure 1.** Top: Original light curve with eclipses and rotation. Midle: Only rotation (the eclipses were cutted by differential flux). Bottom: The Lomb Scargle (LS) detect the rotational period (left) and the Autocorrelation function (ACF) confirm the variation (right).

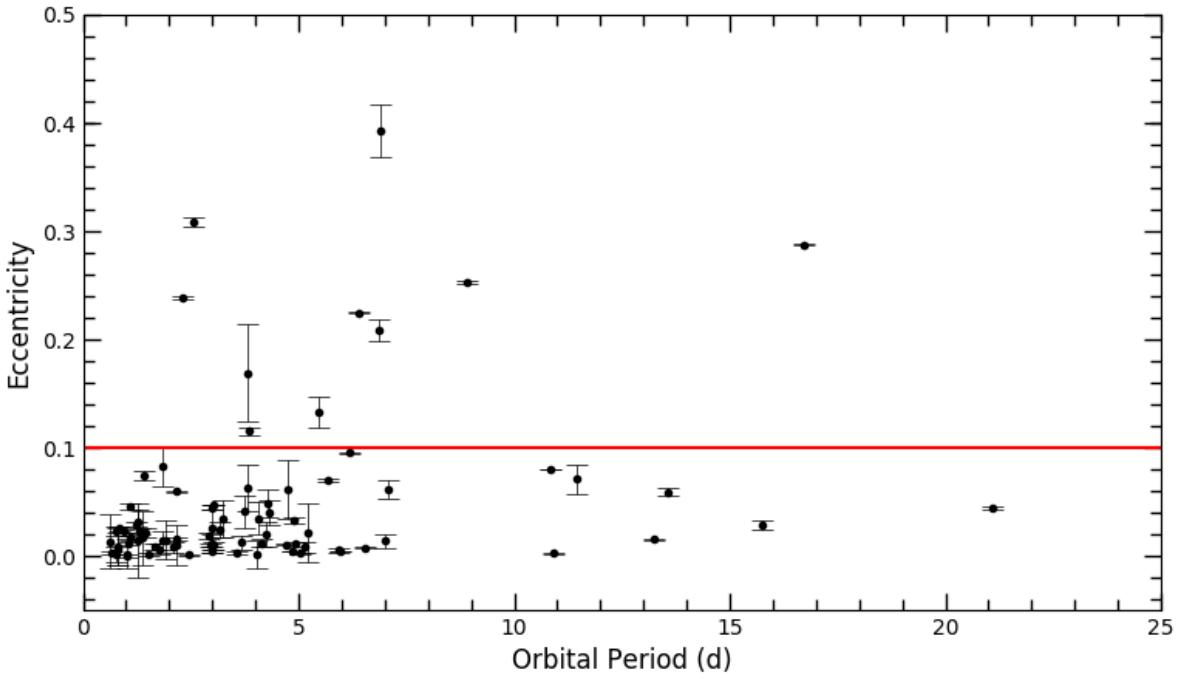


**Figure 2.** Circularization of eclipsing binaries. Below of the red line (e = 0.1) the systems are circularizeds or approximately circularized.