EPSC Abstracts
Vol. 5, EPSC2010-240, 2010
European Planetary Science Congress 2010

Programs of stellar light curves analysis for the purpose of extrasolar planets search

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Abstract

The prior results of stellar photometry within the framework of COROT space program are presented. Problems of COROT data processing and direction of investigations are discussed.

1. Introduction

Studying of fundamental physical processes in the solar and other stellar systems is one of the most actual directions in astrophysics. Data obtained by such spacecrafts as TRACE, STEREO, COROT are of great and constantly increasing importance. The set of programs for digital data processing was developed at the Radiophysical faculty of Nizhni Novgorod State University for the purpose of COROT light curves analysis. Some programs were discussed earlier [1-3].

2. Data analysis

COROT spacecraft photometric data are often influenced and corrupted by electromagnetic noise of various origins. Noise intensity is essential in comparison with stellar photometry data. Program serving for "cleaning" of stellar light curves is developed. Fig.1 shows a prepared light curve (LC) example of G7V star. Two types of intensity variations can be mentioned: short negative impulses (observed during Exo2b transit across stellar disc) and more powerful radiation of the star itself. Jupiter type planet Exo2b is one of the planets discovered by the COROT spacecraft on the orbit of the main sequence star G7V with unusual high photometric activity [1, 2]. The LC impulses emerging due to micro-eclipses of the star disc during the planet transit as well as periodic variations of the LC due to star rotation and star-planet interaction disturbances can be seen. An attempt to detect the variations of the LC during the continuance of the transit impulses is made in the present paper. The profiles of impulses averaged over 10 transits were studied, because separate impulses can be corrupted by noise. The next figure, Fig.2, presents the sequence - result of subtraction of 8 impulses pairs averaged over 10 transits and the average impulse. This sequence was analyzed using Sliding-Window Fourier transform with the 1024 samples length of window. The result of this analysis is presented in the Fig.3, where the spectrum averaged over 1010 instant spectra of noise is given. Fig. 3 shows the noise spectrum, where 3 peaks corresponding to the main frequency 0.12 mHz and its harmonics dominate. It is to be mentioned, that the main frequency period F1 (~2.3h) closely matches the entire duration of the transit impulse.

3. Figures

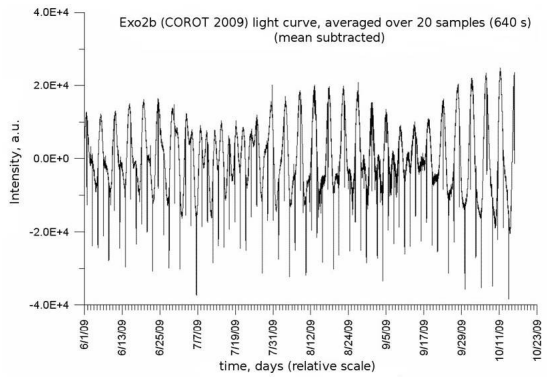

Figure 1: Exo2b light curve.

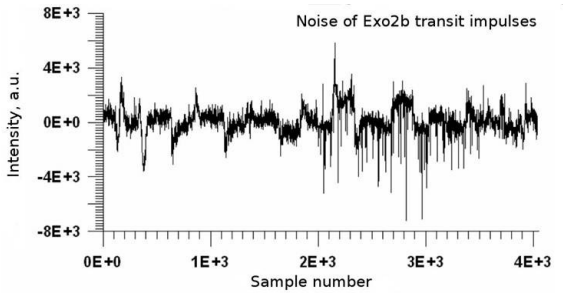

Figure 2: Noise of Exo2b transit impulses.

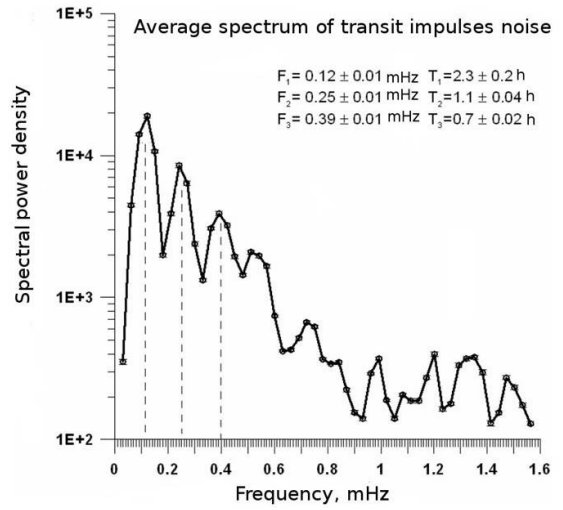

Figure 3: Average spectrum of transit impulses noise.

4. Conclusions

The results of present investigation show principal possibility of stellar seismic activity study using the planet transits observations. Some variations of stellar activity which can be detected in the COROT data can be perhaps explained as manifestation of star-planet magnetic connection and interaction. At the same time, there are preliminary results, because only averaged transit impulses were analyzed. The new set of programs for COROT data processing will be developed at the Nizhni Novgorod State University.

Acknowledgements

This study is supported by competitive contract with Federal Agency of Education, Russia, KD NK-21P and European Union grant № 228319 within the framework of EuroPlanet-RI FP7 project.

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