Characterization of Exoplanets and Exoplanetary Systems: Transition from CoRoT & Kepler to TESS & PLATO

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Abstract

Before the launch of CoRoT in December, 2006, only 19 transiting exoplanets were known. Since then, the ground- and space-observatories increased their number over 1100. These remarkable sample allowed us to explore the basic properties of planets and planetary systems and yielded many surprises, including the fact, that there is only one exoplanetary system similar to our own Solar System (Kepler-90) and there is a lack of small planets with measured mass and radius in the habitable zones (Rauer et al 2014).

It was clearly seen before the CoRoT & Kepler era, that we need as precise planetary masses and radii as 5% (Valencia 2007, Seager et al. 2007, Grasset et al. 2007) and it became clear fast that for rocky planets we need as precise masses and radii as 1% for bulk characterization (e.g. Wagner et al 2011) or even 0.1% in radius for atmospheric studies.

There are many factors which makes difficult to reach these precision limits, including observational, technical and physical reasons. In this talk we review the techniques of extraction of information from transit light curves and summarize the problems related to this process. Special attention is given to limb darkening, optimization technics, as well as for the systematics of input stellar parameters and astronomical constants used.

CoRoT & Kepler made not only the first step to peer into the details of the variety of exoplanetary systems and gave the first measures of planetary parameters, but they have their own fingerprints in the improvement of our knowledge on stellar astrophysics and star-planet interactions etc. The lessons learned have high impact when we design the operation and data analysis of such future missions like CHEOPS, TESS and PLATO. PLATO will be able to outperform the precision of all other previous attempts in determination of planetary radii and to give the targets to have the precise values of planetary masses. Beyond the bright targets and photometric precision, methods also should be improved to get the maximum content of information which will be encoded into the PLATO light curves.

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