Three dimensional spin-orbit determination: joint analysis by asteroseismology, transit lightcurve and Rossiter-McLaughin effect

Othman Benomar*†[1], Kento Masuda‡[1], Hiromoto Shibahashi[1], and Yasushi Suto[1]

[1]University of Tokyo, School of science – Hongo 7-3-1, Bunkyo-ku, Tokyo, 113-0033, Japan

Abstract

In exoplanet systems, the three dimensional spin-orbit angle (phi) is a function of,
- The projected spin-orbit angle onto the sky-plane (lambda).

- The inclination of the planetary orbit (I0)

- The stellar inclination between the stellar spin-axis and the line of sight (Is).

The Rossiter-McLaughuin effect is a spectroscopic effect that has now been used on more than 70 stellar systems to determine lambda (Winn 2010) as well as whether the exoplanets are in prograde or retrograde orbits, relative to the star rotation. In transiting systems, I0 is very well determined from the transit lightcurve, because necessarily close to 90 degrees. In addition, asteroseismology successfully determined Is in numerous stars (e.g. Benomar et al. 2009, Chaplin et al. 2013) because the visibilities of the m-component of the non-radial modes vary significantly with this angle (Gizon & Solanki, 2003). However so far, no publication refers to a joint analysis that completely characterizes the orbital parameters of an exoplanetary system by taking advantage of results from asteroseismology.
Here, we will show how asteroseismology has the potential to help us to fully characterize the orbital parameters of the exoplanets orbiting bright stars. We will also show results of joint analyses of some very interesting planetary systems.

*Speaker
†Corresponding author: othman.benomar@astron.s.u-tokyo.ac.jp
‡Corresponding author: masuda@utap.phys.s.u-tokyo.ac.jp