Obliquity Variations of Habitable Zone Planets Kepler-62f and Kepler-186f. Y. Shan and G. Li, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA, vshan@cfa.harvard.edu

Introduction: Obliquity variations play important roles in the climate and habitability of a planet, as they determine the latitude distribution of stellar radiation [e.g., 1]. Orbital modulations caused by planetary companions and planetary spin axis precession due to the torque from a host star may lead to resonant interactions and cause large amplitude obliquity variations [e.g., 2, 3]. Here, we select Kepler-62f and Kepler-186f from the list of habitable zone planets in multi-planet systems [4], and we characterize the parameter space where their obliquity angles are stable, which could represent a condition more favorable to habitability.

Methods: We use a numerical approach to calculate the obliquity evolution of planet Kepler-62f and Kepler-186f. An example of the obliquity variation of Kepler-186f is shown below.

Results: We find that the obliquity of both Kepler-62f and Kepler-186f have small variations in the low obliquity regime, assuming the planets are Earth analogues. However, the high obliquity regions allow moderate variabilities. In addition, farther planetary companions and/or the existence of a satellite may render the low obliquity region unstable. Better constraints on the existence of additional planetary companions and large satellites can further predict the variability of the obliquity angle.

References: