



## **Cassini State Transitions with a fossil figure**

Isamu Matsuyama and James Keane

University of Arizona, Lunar and Planetary Laboratory, Planetary Sciences, United States (isamu.lpl@gmail.com)

The Moon has experienced large obliquity variations during Cassini state transitions which greatly impact tidal heating, and the long-term stability of polar volatiles. It has been known for centuries that the lunar rotational and tidal bulges are much larger than expected. The South Pole-Aitken basin can explain a large fraction of the excess deformation. Accounting for the contribution of this basin (and other large basins), the remaining excess deformation arises due to a fossil figure established when the Moon orbited much closer to Earth than it does today. Previous studies assume that the present, excess deformation is entirely preserved throughout Cassini state transitions. This ignores basin contributions to the excess deformation, and requires an interior with infinite rigidity. We consider Cassini state transition models that take into account basin contributions to the excess deformation, and the effect of finite rigidity on the fossil figure.