



## **Constraints on the interior structure of Enceladus from the measured physical libration**

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Libration is a variation around steady rotation of a celestial body due to the tidal torques from other nearby bodies. With imaging or laser-ranging technologies, the libration amplitude could be measured and yield information about the interior of the librating body. The Cassini-observed libration amplitude implies that the core of Enceladus, a major satellite of Saturn, is decoupled from the icy shell, immersed in a subsurface global ocean (Thomas et al., 2016).

We aim to study the icy shell-core gravitational interaction in Enceladus, which resembles the mantle-inner core gravitational system of the Earth. Therefore, we follow Chao (2017)'s approach to formulate the gravitational interaction within the system, using multipoles to characterize mass and density distribution. We also construct a simple model for Enceladus by using constraints on the physical state of Enceladus, such as the total mass, mean radius, and mean moment of inertia. Finally, we use the measured libration amplitude to derive the relation between the triaxiality of the icy shell and the difference of equatorial principal moments of inertia of the core. It provides us another approach to understand whether or not the internal state of Enceladus is under hydrostatic equilibrium.