EGU2020-8210
https://doi.org/10.5194/egusphere-egu2020-8210
EGU General Assembly 2020

Cassini state of Galilean Moons: Influence of a subsurface ocean

Alexis Coyette[1], Rose-Marie Baland[2], Anne Lemaitre[1], and Tim Van Hoolst[2]
[1]University of Namur, Naxys, Mathematics, Namur, Belgium (alexis.coyette@unamur.be)
[2]Royal Observatory of Belgium, Brussels, Belgium

Large moons such as the Galilean satellites are thought to be in an equilibrium rotation state, called a Cassini state (Peale, 1969). This state is characterized by a synchronous rotation and a precession rate of the rotation axis that is equal to the precession rate of the normal to its orbit. It also implies that the spin axis, the normal to the orbit and the normal to the Laplace plane are coplanar with a (nearly) constant obliquity.

For rigid bodies, up to 4 possible Cassini states exist, but not all of them are stable. It is generally assumed that the Galilean satellites are in Cassini State I for which the obliquity is close to zero (see e.g. Baland et al. 2012). However, it is also theoretically possible that these satellites occupy or occupied another Cassini state.

We here investigate how the interior structure, and in particular the presence of a subsurface ocean, influences the existence and stability of the different possible Cassini states.

References :

Baland, R.M., Yseboodt, M. and Van Hoolst, T. (2012). Obliquity of the Galilean satellites: The influence of a global internal liquid layer. Icarus 220, 435-448.

Peale, S. (1969). Generalized Cassini's laws. Astron. J. 74 (3), 483-489.