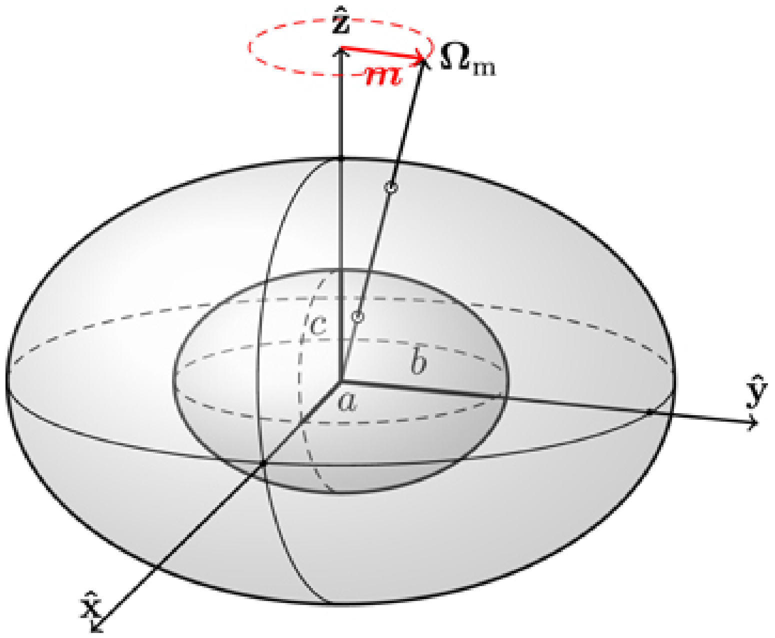
EPSC Abstracts
Vol. 14, EPSC2020-853, 2020
https://doi.org/10.5194/epsc2020-853
Europlanet Science Congress 2020

Planetary inertial modes and their relation to nutations

Jérémy Rekier[1], Santiago Triana[1], Antony Trinh[2], and Véronique Dehant[1]
[1]Royal Observatory of Belgium, Bruxelles, Belgium
[2]Lunar and Planetary Lab, University of Arizona Tucson, AZ

Inertial modes are global oscillations that take place inside rotating objects, such as stars and planets with a fluid core and/or liquid ocean, which result from the restoring effect of the Coriolis force. Experimental studies in laboratory have shown that these modes can be excited by the action of tidal deformation at the fluid boundary as well as precession of the rotation axis. However, the influence of inertial modes on the rotation of planets remains unclear. As these modes have frequencies contained within the band $-2<\omega<2$ (in diurnal frequency units), they are natural candidates to explain the small discrepancies observed in the nutation signal of the Earth in the nearly diurnal to long period time scales. The obvious example being the simplest inertial mode, the so-called 'Spin-Over mode' (SOM), which is often identified to the 'Free Core Nutation' (FCN) in the literature. A better knowledge of these inertial modes and the way they are linked to rotational modes can help to characterize and constrain the interior of other terrestrial planets by observing their rotation (Mars, Mercury, etc.).

Here we present a unified description of the rotational and inertial modes of a simple planetary model with a solid mantle and a fluid core. We clarify the link between the SOM and the rotational modes such as the FCN, Chandler Wobble (CW) and the Tilt-Over mode (TOM). We also investigate how the presence of a solid inner core, a magnetic field, density stratification and viscosity within the fluid core affect the frequencies and coupling between the rotational and inertial modes.



$\hat{\mathbf{z}}$
$\boldsymbol{\Omega}_\mathrm{m}$
$\boldsymbol{m}$
c
b
a
$\hat{\mathbf{y}}$
$\hat{\mathbf{x}}$