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Planetary core flows and dissipation driven by precession.

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Precession of planets or moons affects internal liquid layers by driving flows, instabilities and possibly dynamos. The energy dissipated by these phenomena can influence orbital parameters such as the planet's spin rate. However, there is no systematic study of these flows in the spherical shell geometry relevant for planets, and the lack of scaling law prevents convincing extrapolation to celestial bodies. We have run more than 900 simulations of fluid spherical shells affected by precession, to systematically study basic flows, instabilities, turbulence, and magnetic field generation.
This presentation covers the hydrodynamics in our simulations, we show that the presence of an inner core does not affect significantly the onset of instabilities. We propose scaling laws for the onset of instabilities and the associated dissipation showing that the boundary layer plays a dominant role. Finally, we discuss the dissipation in the lunar core through its history in the light of our results and the work of Sous et al. 2013.
Further results regarding the dynamo regimes are presented by R. Laguerre in the same session.