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Precession of a two-layer Earth: contributions of the core and elasticity

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The Earth's internal structure contributes to the precession rate in a small but non-negligible amount, given the current accuracy goals demanded by IAG/GGOS to the reference frames, namely 30 μas and 3 μas/yr. These contributions come from a variety of sources. One of those not yet accounted for in current IAU models is associated to the crossed effects of certain nutation-rising terms of a two-layer Earth model; intuitively, it gathers an 'indirect' effect of the core via the NDFW, or FCN, resonance as well as a 'direct' effect arising from terms that account for energy variations depending on the elasticity of the core. Similar order of magnitude reaches the direct effect of the departure of the Earth's rheology from linear elasticity.
To compute those effects we work out the problem in a unified way within the Hamiltonian framework developed by Getino and Ferrándiz (2001). It allows a consistent treatment of the problem since all the perturbations are derived from the same tide generating expansion and the crossing effects are rigorously obtained through Hori's canonical perturbation method. The problem admits an asymptotic analytical solution. The Hamiltonian is constructed by considering a two-layer Earth model made up of an anelastic mantle and a fluid core, perturbed by the gravitational action of the Moon and the Sun. The former effects reach some tens of μas/yr in the longitude rate, hence above the target accuracy level. We outline their influence in the estimation of the Earth's dynamical ellipticity, a main parameter factorizing both precession and nutation.