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The elasto-viscous equilibrium tide in exoplanetary systems

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Abstract

Earth-like planets have viscoelastic mantles. Moreover, giant planets may have viscoelastic cores. As for the fluid parts of a body, the tidal dissipation of such solid regions, gravitationally perturbed by a companion body, highly depends on its internal friction, and thus on the rheology, as well as on its size. Therefore, modelling this kind of interaction presents a high interest to provide constraints on planets properties.

Here, we examine the equilibrium tide in the solid part of a planet, taking into account the presence of a fluid envelope. We first present the equations governing the problem, and show how to obtain the different Love numbers that describe its deformation. We discuss how the quality factor Q depends on the chosen viscoelastic model. Finally we show how the results may be implemented to describe the dynamical evolution of planetary systems.

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