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A study regarding the stability of the primordial crust of asteroid Ceres

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Ceres is a particular object of the solar system, since it is a “transition body“ between the icy satellites of the outer solar system and the rocky bodies of the inner part. Probably it is differentiated [1,2], i.e. it has a core made of “rock” (silicates) with a weak presence of metals, a large icy mantle and a rocky crust. In particular, it has been proposed the existence on the surface of the ammoniated phyllosilicates, compatible with an outer solar system origin [3]. Also water in clay minerals, brucite, and iron-rich serpentine have been proposed to exist on the surface [4].
Ice directly on the surface regolith seems to be very unstable: numerical simulations of [5] indicate that it can last for very few orbits.
A crust made of a mixture of ice and rock is potentially unstable. In the solar system, for example, Callisto has such a crust but its surface temperature is below the critical temperature for the Rayleigh-Taylor instability [6]: this seems not to be the case of Ceres.
In this work, we verify the stability of the primordial crust, by assuming a certain initial composition (ice and rock) and thickness. We assume a post-differentiation Ceres, made of three layers (rocky core, icy mantle and crust). The key role is played by the viscosity of the layers, which influenced the survival or not of the primordial crust. We applied the method of the parametrized thermal convection widely diffused in literature.
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