SPHを用いた潮汐力による加熱効果と内部海形成メカニズムへの応用
Numerial simulation of tidally induced internal heat generation using SPH and its application for internal ocean formation

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There are some traces of Inner-Sea in Icy moon found in our Solar System, like a plume of water vapor of Europa acquired by Hubble Space Telescope and Tiger Stripes of Enceladus observed by the Cassini. Since liquid water is essential for the origin of life, it is important to understand the system of the development of Inner-Sea in Icy moon.

It is considered that the tidal heating caused by tidal acceleration melt inner icy layer resulting the presence of liquid water beneath its surface. In order to account the presence of liquid water, we need to understand the distribution of inner energy and consequently liquid water. This requires carrying out fluid numerical calculation adding tidal heating. Therefore, we introduced viscous term being proportional to pressure to SPH (Smoothed Particle Hydrodynamics) simulations.

At the first step to check the effect of the viscous term, we performed SPH simulations of the tidal heating in the case that tidal deformation is relatively large. We rotated differentiated Titan-size object around Saturn-mass material point with the orbital radius being 1.1 times of its Roche limit. As a result, we found that the thermal energy increased in the inner region of icy layer. It should also be noted that, using the current numerical resolution it is too coarse to represent theoretical thickness of internal ocean.

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