

Numerical simulation of Tidal Heating using SPH and its application to inner sea formation

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There are some traces of liquid in icy moons, such as a plume of vapor of Europa acquired by Hubble Space Telescope and tiger stripes of Enceladus observed by Cassini. Since liquid water is essential for the origin of life, it can be important to understand the development of inner sea and also the temperature distribution inside of such icy moons.

It is considered that the tidal heating caused by tidal acceleration melts the inner icy layer which results in the presence of liquid water beneath its surface. Thus, we aim at simulating the tidal heating of an icy moon by 3-dimensional numerical fluid calculation in Smoothed Particle Hydrodynamics (SPH) method. As the tidal heating model, we apply the viscosity model which was used for numerical calculation of tidal stripping.

It is confirmed that this viscosity model lead to qualitatively correct result about tidal disruption, but the possibility of its application to tidal heating is not validated. Therefore, as a first step, we tried to compare the result of this simulation with the result which is estimated theoretically. We made a rotation of a differentiated Titan-sized tidally locked object around a Saturn-mass material point with the radius of orbit being 1.1 times larger than its Roche limit. We also considered how to applicate this simulation to the calculation of actual icy moons. We will report the progress.

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