Numerical simulation of circumplanetary disk formation for estimating the disk size and surface density

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Circumplanetary disks are possible targets for future observations and include some information on planet formation. Numerical simulation is useful to predict such observations.
To investigate the structure of circumplanetary disk and its environment, extremely high resolution is required. Hence we parallelize a three-dimensional hydrodynamic simulation code of static mesh refinement method. The parallelized code enables us to compute 10 times higher spatial resolution than previous studies. When 15 times Hill radius is adopted as the computational domain in the radial direction, the finest spatial resolution is 10^{-3} of the Hill radius which is comparable to the present Jovian radius. The resolution is sufficient to investigate circumplanetary disk structure.
We perform a numerical simulation of circumplanetary disk formation around a planet embedded in protoplanetary disk. We consider a local rotating Cartesian coordinate. The coordinate is rotating around a star with Keplerian angular velocity and curvature is neglected. Basic equations of inviscid fluid hydrodynamic without self-gravity are solved. Some symmetric boundary conditions are imposed to accelerate the calculation, in which rotational, periodic, and mirror symmetries are imposed as radial, azimuthal and vertical directions respectively. The other side boundaries in the radial direction and in the vertical direction of computational domain are connected to unperturbed flow.
In this resolution, the angular momentum of the initial condition can not be neglected. Then a artificial retrograde circumplanetary disk forms potentially and the disk is not dissipative even in long time integration. To avoid the problem, we introduce sink cells around protoplanet. Finally, a prograde disk is formed.

Acknowledgement: The computation was carried out using the computer facilities at Research Institute for Information Technology, Kyushu University.

Keywords: circumplanetary disk, hydrodynamics, numerical simulation

