Radiation Hydrodynamic Simulations of Circumplanetary Disk Formation

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Circumplanetary gaseous disks are thought to form during the gas-accretion phase of giant planet formation. They are important objects to study because they control the final mass and thermal history of the gas giants themselves, and govern the formation of their regular moons. In order to study when, where and how moons formed, we need a better understanding of the structure of circumplanetary disks, especially their temperature. In this work, we performed radiation hydrodynamic simulations of a protoplanetary disk with a planet embedded. The adaptive mesh refinement technique is employed to increase the resolution of the simulation in the vicinity of the planet. Circumplanetary disks are known to have high temperature at the beginning of their formation, and applying an adiabatic equation of state can overestimate the temperature. Thus, we implemented a tabulated equation of state in which the dissociation of molecular hydrogen and other relevant thermochemical reactions are considered. We discuss the density and temperature distribution of the circumplanetary disks formed in our simulations, with a focus on the difference from the simulation with a purely adiabatic equation of state.

Keywords: circumplanetary disks, gas giants, radiation hydrodynamic simulations

