Migration of small solid bodies in circumplanetary gas disks

KEIJI OHTSUKI[1], SHUMPEI SHIMIZU[1,2], HIROSHI KAWAMURA[1], RYO SUETSUGU [1]

[1]Kobe University, Kobe 657-8501, Japan
(*correspondence: ohtsuki@tiger.kobe-u.ac.jp)
[2]NTT Data Corporation, Tokyo 135-6033, Japan

Regular satellites of the giant planets such as the Galilean satellites of Jupiter are thought to be formed in the circumplanetary disks. Orbital decay of solid bodies is caused by different mechanisms depending on their sizes. When the solid bodies are small, aerodynamic gas drag is dominant [1]. Sufficiently small bodies are coupled to the gas and would be supplied to the circumplanetary disks with the inflowing gas (e.g., [2]). Planetesimals that are large enough to become decoupled from the motion of the gas can be captured by gas drag from the circumplanetary gas disk [3, 4]. While the so-called type-I migration is important in the late stage of satellite formation, orbital evolution by aerodynamic gas drag governs the orbital evolution of small solid bodies, and dynamical evolution of such small bodies in the circumplanetary gas disks would be important for the growth of protosatellites and radial mixing in the disk.

In the present work, we examine orbital evolution of small sold bodies in circumplanetary gas disks and the probability of capture of such bodies by a growing protosatellite (Shimizu & Ohtsuki, in preparation). We find that the collision probability has a peak at a certain size of migrating bodies. This is because the time scale of the orbital decay varies depending on the size of planetesimals. We will also discuss effects of gravitational interaction between planetesimals.

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