

Orbital evolution of a planet due to tidal interaction with a three-dimensional protoplanetary disk

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Tidal interaction between a planet and gas disk has been investigated by many authors. In most of the studies, however, disks are assumed to be infinitely thin. We performed a linear calculation of the tidal interaction between a planet and a three-dimensional gas disk and obtained the migration speed of a planet exactly. The inner disk exerts the positive torque on a planet while the outer one exerts the negative torque. Since the sum of them leads to the net tidal torque on the planet, the three-dimensional effect can significantly change the net torque and the migration speed.