Migration of Protoplanets: Two-Dimensional Hydrodynamical Simulations

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We present the results of the hydrodynamical simulations of the gravitational interactions between a protoplanet and a protoplanetary disk. We found that a circum-planetary disk forms and spiral shock waves arise in the circum-planetary disk. The gravitational torque exerted on the planet and the speed of the planet's migration are calculated. These values are compared to those obtained by the previous linear calculations.