

Using Density Wave Theory as a Tool to Find Young Planets in Birth

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There are emerging evidences (e.g. from ALMA and Near-IR scattered images) that protoplanetary disks have rich structures similar to galactic disks. Both spiral arms and gaps have been observed recently in protoplanetary disks, which gives us great hope that we might be able to use the density wave theory to find young planets in birth for the first time. We have carried out a series of work using both analytical and numerical tools to study how planets interact with protoplanetary disks. These work focus on density waves in non-isothermal disks, planet gap opening in MHD turbulent disks, and planets' effects on dust particles/planetesimals in protoplanetary disks. New phenomena have been observed in simulations and understood analytically, which may provide us a necessary tool to digest future observations (e.g. ALMA).