A Hybrid Scenario for Jovian Planet Formation

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We explore a hybrid scenario for gas giant planet formation in which the efficiency of core accretion is greatly enhanced by various effects of gas and/or particle subdisk self-gravity. This scenario could be a more attractive model than considering either the effects of core accretion or gravitational instability in isolation and may proceed in a variety of ways. First, a hybrid mechanism for Jovian planet formation results naturally from considering the migration-induced pileup of mm-sized grains from which km-sized planetesimals form (as discussed in *Youdin and Chiang*, 2004), resulting in an enhanced dust/gas ratio in the inner regions of the solar nebula. This results in enhancing a growing core's feeding zone size and drives down protoplanetary core formation timescales. Second, the presence of an overdense, self gravitating, gaseous ring acts to trap mm-sized grains near such regions, locally halting their inward migration and triggering planetesimal formation and possibly runaway core accretion on short timescales. Connections between the latter hybrid scenario and layered disk evolution, as well as sites of planet formation, are also considered.

[a] Youdin, A.N., and Chiang, E.I., Particle Pile-ups and Planetesimal Formation, *ApJ*, **601**, 1109-1119, 2004.