Observational constraints on disk evolution and the initial steps towards planet formation

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Planet formation is expected to occur in circumstellar disks during the first few Myrs of the stellar pre main sequence evolution. In the core accretion paradigm of planet formation, the solid component of the disks (the dust) grows and coagulate to form planetesimals and rocky cores of planets. We have been conducting extensive surveys and detailed studies of individual objects at millimetre wavelengths of the dust emission from circumstellar disks in the Taurus, Ophiuchus and Orion star forming regions with the aim of relating the grain growth signatures with environment and young stellar object properties. The millimeter emission from the dust in the disk midplane is related to the opacity per gram of dust, which in turn is related to the composition and size of dust grains. We find evidence for large (at least millimetre-size) grains in almost all the systems in our survey. We also discuss the evidence for grain populations segregation in disks as constrained with high angular resolution millimeter observations. We discuss the remarkably low dispersion of properties in our samples in the context of evolutionary models of dust populations in disks. Our results suggest that grain growth occurs early in the life of disks and that, contrary to simple model expectations, large grains are retained in the outer disks for relatively long timescales (few to several Myrs). We discuss possible models that can solve the discrepancies with observations as well as observational tests in disks around sub-stellar young stellar objects that will provide critical constraints on the model assumptions and on the initial conditions for planet formation.