Grain alignment in the protoplanetary disks

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Magnetic fields play crucial roles in the evolution of accretion disks; however, the structure and strength of magnetic field have not yet been constrained well by observations. In the ISM field, the polarized emission from dust grains is often used as a diagnosing tool of the magnetic field, since non-spherical grains tend to be aligned with respect to the magnetic field. If dust grains in protoplanetary disks are actually alined with the magnetic field, we can constrain the magneticfield in disks by using dust polarimetry observations. This motivated us to study the grain alignment in the disks. We estimate several timescales relevant for the grain alignment in disks based on the state-of-the-art alignment theory of the radiative torque. As a result, we show that the grain alignment is not expected at the midplane of the disk owing to the strong damping effect of gas drag force as well as an inefficiency of internal relaxation. However, in the surface layer of disks, dust grains might be aligned with magnetic fields depending on the amount of superparamagnetic, or ferromagnetic, inclusions.