Ensemble study on the efficient radiative alignment fraction of interstellar grains

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The radiative torque (RAT) mechanism is, based on a number of earlier studies, the most promising way of explaining observed polarization arising from aligned grains. The efficiency of grain alignment by an anisotropic radiation flow for an extensive ensemble of grain shapes, grain sizes (a), and wavelength (λ), can be described by a single parameter, $q^{\max}$ which depends on the aforementioned quantities. In certain situations, where the dynamical timescales so allow, dust polarization by grain alignment can be summarized using a single derived parameter, the fraction $f_{\mathrm{high}J}$ of the grain population for which a particularly stable dynamical state exists.

In this presentation, we explore the behavior of $f_{\mathrm{high}J}$ for different grain ensembles with different distributions of $q^{\max}$, when the relative importance of magnetic relaxation and drag effects is varied. We find that the studied grain ensembles exhibit values of $f_{\mathrm{high}J}$ dependent on both the relative orientation of the scattering plane and external magnetic field and the distribution of $q^{\max}$. These results have important implications on the expected dust polarization in different astrophysical conditions and e.g. pave way for better observational constraints of interstellar dust properties.