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Dust growth under different plasma conditions in protoplanetary disks[1] CHUCHU XIANG, LORIN MATTHEWS, AUGUSTO CARBALLIDO, TRUELL HYDE, Baylor University — Coagulation of dust aggregates plays an important role in the formation of planets and the evolution of protoplanetary disks. As cosmic dust becomes charged in the radiative plasma environment, the trajectories of colliding dust grains can be altered by the electrostatic force acting between them, affecting their coagulation probability. This study compares the dust growth in protoplanetary disks with different turbulence strengths and different plasma conditions, i.e. the ratio of free electrons to free ions. A Monte Carlo approach with a simple kernel based on the radius of the grains is used to choose potential colliding pairs and calculate the elapsed time between collisions. The actual collision outcome is determined using a detailed model of the collision which takes into account the aggregate morphology, trajectory, orientation, and all forces acting on the colliding grains. A statistical analysis of the collision outcomes is used to determine collision probability as well as the physical characteristics of the resulting aggregates for both charged and uncharged grains. Preliminary results show that charged aggregates tend to be more porous than neutral particles, and more highly charged particles experience less restructuring as a result of gentler collisions. In regions with weak turbulence, both the collision rate and the number of bouncing collisions are lower for highly charged grains, and the probability of hit-and-stick collisions leading to aggregate growth is a balance of the collision and bouncing rates.

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