117th MSS-Seminar
Wednesday, March 21st, 15:30
Nägelsbachstr. 49b

Aggregation and Fragmentation in Granular Gases

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We analyze the behavior of granular gases, comprised of dissipative particles, which may aggregate or break at collisions, depending on the impact speeds. We introduce two threshold energies for the kinetic energy of inter-particle relative motion, E_{agg} and E_{frag}. These energies demarcate impacts with various collision outcomes. Namely, the collisions may result in aggregation, rebound or fragmentation of particles. We analyze different fragmentation models, including the model of complete decomposition into monomers and fragmentation with a power-law debris size-distribution. We start from Enskog-Boltzmann equation for the mass-velocity distribution function and derive a set of Smoluchowski-like equations for number densities of aggregates of different size and their partial temperatures. We analyze these equations analytically and numerically and find numerous kinetic regimes, as well as steady-state distributions. We show that for a reasonable range of parameters, corresponding to natural systems, one observes a power law for a steady-state distribution of particles size with an exponential cutoff. An application of our theory to Saturn Rings allows to explain the observed size distribution of the rings particles.