

Theoriekolloquium

Am **8. April 2010** um **14.15 Uhr** in **W2 1-143** hält

Herr Jens Zahnw (ICBM Oldenburg)

einen Vortrag mit dem Titel

Particle dynamics in fluid flows

In many natural problems and technical applications ranging from cloud physics, sediment and plankton dynamics in the ocean to chemical engineering, powder technology and protoplanetary discs the dynamics of individual particles suspended in a fluid are of great interest. Often particles can be assumed to be much smaller than the overall domain and are dispersed throughout the fluid, meaning they are not heavily concentrated. In this case the dynamics of the particles is mainly determined by the interaction of the particles with the surrounding fluid as opposed to particle-particle interactions.

In recent years, there has been an increased focus on problems where the particle velocity can deviate significantly from that of the surrounding fluid. These so-called "inertial" particles can show a dynamics that is completely different from that of particles following the fluid, such as clustering in certain regions of the flow and the appearance of caustics. These inertial effects are believed to play an important role for example for the initiation of rain in clouds. In particular, the collision statistics of particles can be greatly affected by the detachment of the particles from the fluid.

One of the most interesting questions in inertial particle dynamics is when an active interaction between the particles in form of collisions is included in the description. Here, two such examples of inertial particle dynamics where particles interact upon collision are discussed.

For liquid drops, such as raindrops, collisions can lead to coalescence, creating larger particles. Additionally, large drops can break up, for example due to shear forces in the fluid, creating a group of smaller particles. This combination of particle collision, coalescence and breakup leads to a distribution of particles of various sizes, which approaches a steady state for long times. This steady state changes as a function of particle and flow properties. The steady state size distribution can be found both numerically and analytically to depend strongly on the breakup process.

For solid particles, such as sediment in the ocean aggregation upon collision and subsequent fragmentation can lead to large fractal-like clusters, held together by van-der-Waals forces and often exopolymers that act like a glue. The fractal-like structure typical of many real aggregates can be included in a simplified particle model in form of an effective size and density of the aggregates. While a detailed physical description of the fragmentation mechanism is still missing, it can be found that for large ensembles of particles fragmentation will probably be the main process that determines the total size distribution of the aggregates.

Interessierte sind herzlich eingeladen.

gez. Prof. Dr. Andreas Engel