Spherical Plasma Chambers for Complex Plasmas

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A complex or dusty plasma consists of electrons, ions and micron-sized particles. Due to the different mobilities of ions and electrons each dust particle typically acquires a negative equilibrium charge. Confined in the plasma volume due to the strong sheath electric fields, the microparticles can form regular, ordered structures or show a fluid like behavior as a result of their mutual interaction.

Due to their weight, the microparticles tend to sediment forming small vertically extended dust clouds. Only for sizes close to a micron and below particles fill a substantial volume of the discharge under gravity conditions. Anisotropic plasma fluxes with its connected ion flow cause undesired streaming in the particle cloud in the usually used cylindrical discharge geometries. Even dust free regions might appear as a result of an ion wind. We believe that this influence can be strongly reduced in a spherical-like plasma geometry. In order to archive such a situation, we developed spherical shaped discharge chambers. Our multi-electrode, dodecahedron-like discharge chamber promises to support us with time-averaged, quasi-isotropic plasma conditions by switching the plasma generation electrodes at high frequencies. The dust with its high inertia is expected to “see” the averaged isotropic plasma background only.

We will discuss the initial developments of spherical discharge chambers for microgravity dusty plasmas research and show the latest results on plasma simulations and dust behavior in those systems.

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