EkoPlasma – Experiments with Grid Electrodes in Microgravity

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The EkoPlasma (formerly PlasmaLab) project is a Russian-German cooperation building the future laboratory for the investigation of complex plasmas under microgravity conditions on the International Space Station (ISS). Following PK-4, EkoPlasma will provide a flexible research platform for the complex plasma community. It is designed to extend the accessible experimental parameter range by several magnitudes, and to cover a large variety of research topics such as phase transitions, binary mixtures, liquids, driven systems or anisotropic particles. Within the project, a new plasma chamber, the Zyflex chamber, has been developed. The Zyflex chamber is a large, cylindrical plasma chamber with parallel, rf-driven electrodes and a flexible inner geometry. It offers not only methods of particle manipulation, but also allows for direct manipulation of plasma parameters (e.g. n, T_e, n_e).

A new type of rf-electrodes have been designed for the Zyflex chamber: A conductive grid separates the volume of plasma production from the main chamber volume containing the microparticles. Electrons can pass the grid – depending on the grid bias and electron energies – and produce a secondary plasma on the other side. There, due to the absence of heating mechanisms, T_e is low, and its quantity can be controlled by e.g. varying the dc bias of the grid [1], which, in turn, could allow a control of the particle charge. Further, the plasma related forces acting on microparticles injected into the secondary plasma are weak due to the absence of strong electric fields, therefore decreasing disturbing influences on the particles.

Two parabolic flight campaigns have been recently performed with the grid electrodes. First results of the experiments are presented, showing that the central void can be removed, and the effect of the grid voltage on the particle charge and the overall particle dynamics is investigated. To support the microgravity results, measurements of the plasma parameters of the secondary plasma were performed on ground.

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References

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