Complex Plasmas Under Microgravity

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Complex plasmas consist of micrometer-sized particles embedded in a low temperature plasma. Gravity is one of the strongest forces acting on the microparticles and pulls the particles towards the lower sheath edge. In order to perform experiments in the plasma bulk, gravity has to be compensated for (e.g., by thermophoresis [1]), or experiments need to be performed in weightlessness.

Weightlessness can be achieved by dropping the experimental setup, either in a drop tower, inside a plane during a parabolic flight, inside a rocket on a parabolic trajectory, or in orbit around Earth (typically using the International Space Station). All of these options have distinct advantages and disadvantages.

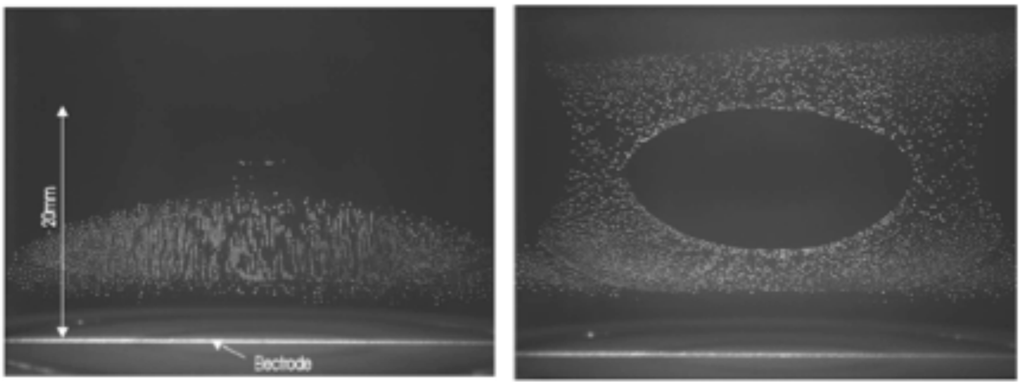

Figure: Complex plasma in gravity (left) / weightlessness (right). From [1].

When weightless, the complex plasma fills a bigger region of the plasma chamber. Nevertheless, new phenomena appear, for instance, a central, particle-free void is formed that is caused by the ions pushing the particles away from the center of the plasma chamber [2].

Despite these complications, weightless complex plasmas offer the possibility to study many fascinating phenomena that are not easily accessible on ground – for instance, three-dimensional crystallization [3], wave formation and propagation [4], and vortices [5].

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