Analyses of plasma spheroids in dusty plasma by RF discharge in argon

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Plasma spheroids appear in dusty plasma by RF discharge in Argon. Their movement, quantity and velocity can be controlled by the experimental conditions such as the gas flow rate, the pressure and the RF power. Spheroids are analysed by Optical Emission Spectroscopy. They are also studied for their interactions with the particle cloud formed by hydrogenated carbon particles.

Dust particles are previously produced by PECVD in a RF capacitive discharge (13.56 MHz) under a pressure of 120 Pa in pure CH_4 [1] or in a N_2-CH_4 gas mixture [2]. Then, RF discharges are realised in Argon. Instabilities appear in the plasma for specific experimental conditions (gas flow rate, pressure, RF power). They look like plasma glow spheroids turning along the circumference of the space between electrodes (Fig. 1). Depending on the experimental conditions, it is possible to control their speed, and also the spheroids number, which are distributed at equal distance from each other.

Studies reported this kind of instabilities [3,4], but usually they appear as two sets of spheroids turning in opposite direction of rotation: one set of spheroids turning along the circumference of the top electrode, and the other one near the bottom electrode. In our vacuum chamber, we have only one set of spheroids in the inter-electrode space, which is typically 2.5 cm.

A 2D-mapping of spheroids is performed by Optical Emission Spectroscopy. In the same time during the discharge, the particles are in levitation between the electrodes. The interaction of the plasma spheroids with the particles is studied and discussed, in particular the repulsive effect put in evidence using laser light scattering by particles, when the spheroids go into the particle cloud.

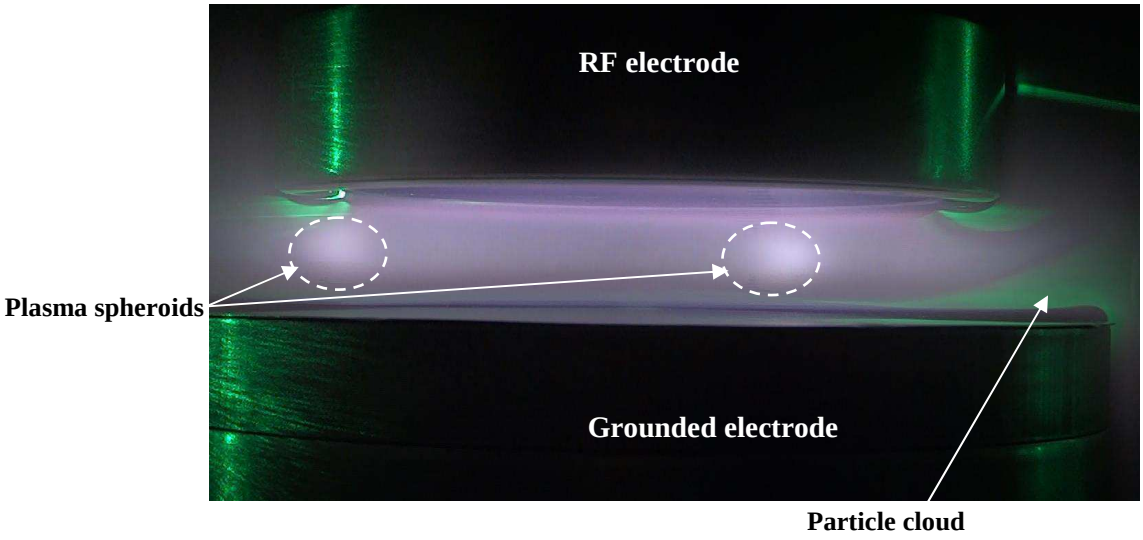

Fig. 1: Plasma spheroids in the discharge. The particle cloud is evidenced in green colour by laser light scattering.

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