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The effect of discharge frequency on the charge of dust particles

T. ANTONOVA, S.A. KHRAPAK, C.-R. DU, B. STEFFES, H.M. THOMAS, G.E. MORFILL, Max-Planck-Institute for Extraterrestrial Physics, D-85741, Garching, Germany, THEORY/COMPLEX PLASMA TEAM — The effect of varying excitation frequency of a capacitively coupled gas discharge results in certain changing of plasma properties, which can be important for industrial plasma applications as well as for fundamental plasma studies. In this presentation we estimate the influence of the discharge excitation frequency on the charge of dust particles injected externally in the plasma. The experiments are performed in the chamber with two parallel plate electrodes, the upper one is radio-frequency driven and the lower one is grounded. The micrometer sized particles are injected in the discharge and levitate in the plasma sheath near the lower electrode. The particles are illuminated using the diode laser and their positions are recorded by the CCD camera. The experiments are performed in argon gas at pressures of 20, 50 and 80 Pa with the discharge frequencies varied between 13.56 and 200 MHz. The particle charge can be estimated from their positions in the (pre)sheath region using the force balance condition and a suitable model for the pre-electrode sheath area. On the other hand it can be estimated from the balance of electron and ion fluxes absorbed on the particle surface. In order to account for varying discharge frequency we employ frequency dependent Margenau electron velocity distribution.

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