Single particle dynamics in a radio-frequency produced plasma sheath

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Recently different research groups have investigated the motion of a single dust particle levitated in a rf plasma.
In our experiment a spherical melamine formaldehyde particle with a diameter of 9.19 µm is suspended in the plasma sheath above the lower electrode in a radio-frequency GEC discharge in argon at pressures between 1 and 100 Pa and discharge powers between 1 and 20 W.
The particle is confined in a parabolic like potential trap shaped by an aluminum ring positioned around the center at the lower electrode.
For the illumination we used a thin horizontal laser sheet. The scattered light is recorded with a long distance microscope and a 4 Megapixel CMOS camera at different frame rates. Precise measurements with the same particle for various discharge parameters were conducted. The particle positions were compared for same recordings using 8 and 16 bit images.
From the measurements we obtained the mean squared displacement, velocity autocorrelation and corresponding Fourier spectra. This yields information about the particle's kinetic temperature, neutral gas friction coefficient, potential trap frequency and disturbance sources. We observe inhomogeneous and anisotropic velocity variations and discuss their possible origin.