

# Star-shaped Density Fluctuations In A Capacitively-Coupled Low Pressure, Xenon RF Discharge

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Dust induced highly regular instability was observed in modified parallel plate CCP rf plasma. Two grid system is inserted parallel to the electrodes and each of them can be grounded/floating/biased independently. In particle free discharge plasma is homogeneous while grids are floating. Grounding the grids standing filamentation appear in lower part of discharge as few separated bright stripes origin from the center of electrode outwards. Changing the bias of the grids number of filaments and their visibility was changing. Introducing the microparticles in the plasma the filaments become more regular and bright and dark regions start switching with frequencies ranging from 3 to 20 Hz giving impression of rotation. This type of rotational instability was reported in [1] under different plasma conditions with high densities of grown nano-particles in plasmas.

The frequency of rotation can be controlled by rf power and grid bias as shown in Fig. 1. Detailed imaging of metastable density changes during the rotation was done by recording the LIF emission sliced at different radii. Densities of 1s5 state at different radii in same phase of rotation were shown in Fig. 3.

Position of the particles was recorded by laser light scattering. Thanks to the high regularity of rotation it was possible to synchronize particle cloud scan with rotation of filaments so position of each particle within the period was reconstructed giving us quasi 3D time resolved measurements. Snapshot of particle cloud shape is presented in Fig. 2.

[1] D. Samsonov and J. Goree, *Instabilities in a dusty plasma with ion drag and ionization*, *Phys Rev E*, **59**, 1047-1058, (2009)

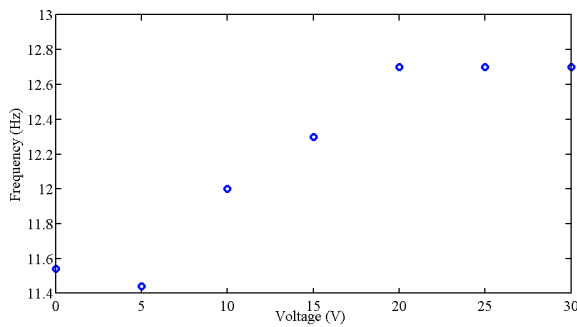


Figure 1

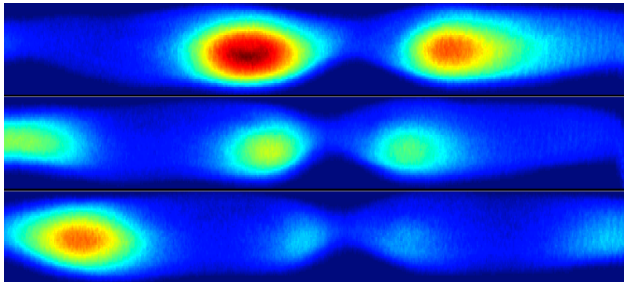


Figure 3

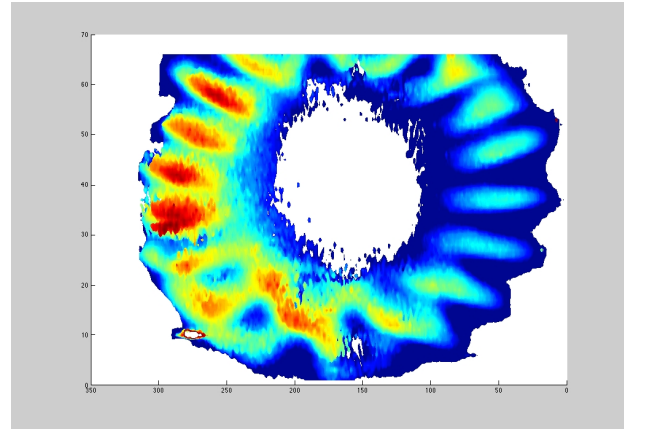


Figure 2