Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Shear flow instability observed in highly dissipative complex plasma HUBERTUS THOMAS, RALF HEIDEMANN, SERGEY ZHDANOV, ROBERT SUETTERLIN, GREGOR MORFILL, Max Planck Institute for extraterrestrial Physics — Complex Plasma is perfectly suited to study phenomena in fluid dynamics at the kinetic level of single particles. In this presentation its special properties allow the study of a shear flow instability of Rayleigh-Taylor type. The flow appears at the interface between two 3-D complex plasma clouds. The first cloud forms a toroidal vortex with poloidal flow and the second is stable, trapped in a stagnation zone. Experiments are performed in a parallel plate symmetrically driven rf discharge in argon. Gravity is partially compensated through a thermophoretic force. The microparticles (1.28 μm in diameter) are distributed all over the plasma volume and form a 3-D distribution. The flow is studied in 2-D at the kinetic level by resolving the trajectories of individual microparticles with high time and high spatial resolution. Hydrodynamic quantities such as flow velocity, vorticity and enstrophy density are determined and show that the two stream interface between flow and stagnation zone breaks up into a well developed multi-stream network due to Rayleigh-Taylor type perturbations. The origin of the observed instability is addressed theoretically.

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Date submitted: 06 Sep 2011 Electronic form version 1.4