Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Agglomeration of Microparticles in Complex Plasmas CHENG-RAN DU, HUBERTUS THOMAS, ALEXEI IVLEV, UWE KONOPKA, GREGOR MORFILL, Max Planck Institute for Extraterrestrial Physics, Garching 85741, Germany — Dust agglomeration plays an important role in astrophysics, atmospheric science, fusion physics as well as plasma physics. Usually, microparticles in plasmas acquire rather high negative charges on the surface so that the Coulomb repulsion prohibits their agglomeration. In our experiment, we excited strong dust-acoustic waves by decreasing gas pressure in a capacitive discharge. Using high-speed camera during this unstable regime, it was possible to resolve the motion of individual microparticles and to show that the relative velocities of a fraction of particles were sufficiently high to overcome the mutual Coulomb repulsion and hence to result in agglomeration. After increasing pressure to a level where the dust cloud was stabilized, we observed the agglomerates directly with a long distance microscope. The agglomeration rate deduced from our experiments is in good agreement with theoretical estimates. The aggregates are stable since the attractive force due to van de Waals interaction and "charge discreteness" can provide a sufficient binding of highly charged microparticles in plasmas. Our experiments unambiguously show, for the first time, that even highly charged microparticles can form stable agglomerates.

Cheng-Ran Du
Max Planck Institute for Extraterrestrial Physics, Garching 85741, Germany

Date submitted: 08 Jul 2010 Electronic form version 1.4