Geophysical Research Abstracts,
Vol. 11, EGU2009-117, 2009
EGU General Assembly 2009

Rarefactive solitary waves in a complex (dusty) plasma

S. Zhdanov, R. Heidemann, R. Suetterlin, H.M. Thomas, and G. Morfill
MPE, Theory/Complex plasmas, Garching, Germany (zh@mpe.mpg.de)

We address the dynamics of nonlinear solitary waves which are impact-excited in a dense complex (dusty) plasma using a neon rf gas discharge at pressures 20-35 Pa. Complex (dusty) plasmas are low pressure, low temperature plasmas containing microparticles. These microparticles are highly charged up by collecting plasma ions and electrons. They can be visualized individually with scattered light from a laser beam, which is recorded with a CCD camera. A gas temperature gradient of 500K/m is applied to balance gravity and to levitate the particles in the bulk plasma. The solitary wave structures we observe propagating in the complex plasma cloud are dominantly of a rarefactive type, hence resemble so called dark solitons (or holes, or gray solitons if mobile) important in a number of applications. The wave is exited by a short voltage pulse on the electrodes of the discharge chamber. It is found that the propagation time of the dark soliton is approximately 20 times longer than the damping time. Note that the physical mechanism, determining the behaviour of rarefactive solitary waves is still under debate. Therefore, the search for physically realistic systems that can support stable solitary holes is of considerable interest. The excitation and free propagation of the nonlinear dissipative structure can be observed because the complex plasma is in an active under-critical state for the pressure range used in the experiments. Complex (dusty) plasmas provide an excellent experimental system for such nonlinear structures.