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Dust cluster explosion

KHARE AVINASH, Department of Physics and Astrophysics University of Delhi, Delhi India

A model for the dust cluster explosion where micron/sub-micron sized particles are accelerated at the expense of plasma thermal energy, in the afterglow phase of a complex plasma discharge is proposed. The model is tested by MD simulations of dust particles in a confining potential. The nature of the explosion (caused by switching off the discharge) and the concomitant dust acceleration is found to depend critically on the pressure of the back ground neutral gas. At low gas pressure, the explosion is due to unshielded Coulomb repulsion between dust particles and yields maximum acceleration while in the high pressure regime it is due to shielded Yukawa repulsion and yields much feebler acceleration. These results are in agreement with recent experimental findings. Our simulations also confirm a recently proposed electrostatic (ES) isothermal scaling relation, $P_E \propto V_d^{-2}$(where P_E is the ES pressure of the dust particles and V_d is the confining volume).