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Charge Separation and Isolation in Water and Ice Particles on Strong Impacts

Bernd Abel (4,1), Alexander Beinsen (1,4), Esteban Vöhringer-Martinez (2), Frank Wiederschein (2), Helmut Grubmüller (2), Frank Postberg (3,5), Ralf Srama (3), and Sasha Kempf (3)

(1) University of Goettingen, (2) MPI Göttingen, (3) MPI Heidelberg, (4) University Leipzig, (5) University of Heidelberg

Charge separation is a general phenomenon in nature. There has been vivid speculation and discussion about charge separation in condensed matter on strong impacts. Here we show that charge separation naturally occurs if water aggregates or particles with embedded charge carriers, e.g. ions, encounter a high energy impact even though no plasma occurs and involved kinetic energy are much below any molecular ionization energy. We find that the charge distribution in the fragments follows approximateley a Poisson distribution with deviations for larger ion concentrations. We present a microscopic theoretical model (based upon MD and MC calculations) of the charging mechanism of fragments, that appears to be relevant for the understanding of a larger range of phenomena related to charges and charge separation in Nature. We compare with laboratory laser desorption experiments and discuss the impact of the current results for the detection of slow (ice) particles in past and future space missions.