

Charge on dust particle in presence of supra thermal electrons

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Complex plasmas, i.e. plasmas containing macroscopic bodies (e.g. colloidal "dust" particles) in addition to electrons, ions, and neutrals, are open systems. Parameters of the macroscopic particle component such as particle charge thus appear as a function of not only their "internal" characteristics (size, shape, material, etc.), but also as a function of "external", with respect to that component, plasma conditions (e.g. plasma density and temperature). Therefore, the grain charge (which is in simplest approximation proportional to the product of the surface potential by its radius) is not necessarily linear function of the grain size.

In this paper, we report on the experiments dedicated to clarify the dependence of the dust charge as a function of its size in an rf-discharge plasma. The experiments are complemented by modelling the charge behaviour of a dust particle in the sheath region. Among possible contributions to the particle charging, we single out the effects of suprathermal electrons (STE). We demonstrate that the presence of STE can indeed cause the observed non-linear behaviour of the charge on the size of a levitating particle.