Wake Field Effects on the Particle Interaction in a Strongly Magnetized Plasma

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The interaction of micrometer-sized particles confined in the sheath of a capacitively coupled radio frequency discharge is mainly influenced by the presence of streaming ions, which form a positively charged wake behind the particles. This can lead to alignment of the particles parallel to the ion flow by wake attraction.

The particle interaction parallel to the ion flow is strongly non-reciprocal due the asymmetry of the wake field and is further enhanced by the decharging of the lower particle [1].

Strong magnetic fields add a new and challenging feature to dusty plasma. Only a few experimental studies about the modification of the charge process and the particle dynamics by the magnetisation of electrons and ions exist. One would expect a weakening of the interparticle forces and the decharging process by the suppression of Coulomb scattering of the ions due to their magnetisation.

Phase-resolved resonance measurements up to magnetic inductions of 2.5 T showed such a decay of the interparticle forces [2]. On the other hand, the decharging process seems to be unaffected by the magnetic field.

We present a systematic extension of these experiments, which shows that the particle interaction in a magnetized plasma critically depends on the parameters of the specific two-particle-system, e.g., mass and interparticle distance.

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References