

Effect of ion mean free path length on plasma polarization behind a dust particle in an external electric field.

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In this paper, the effect of an external electric field on plasma polarization around dust particles with different radii and for different ion mean free path lengths is considered for the process of resonant ion-neutral charge exchange collisions using a self-consistent numerical simulation method. Plasma parameters around a dust particle, both in an external field and in a plasma flow, are usually modeled with the help of two methods: LR (Linear Response) [1] and PIC ("particle-in-cell") [2]. However, in most works that use these methods, the influence of ion collisions is usually neglected [2]. In this work, a recently developed [3] self-consistent iterative method is applied for determining plasma parameters in collisional plasma for different ions mean free path lengths. It is shown that a positive potential peak is formed in polarized plasma behind the dust particle (in the wake). It is also demonstrated that for different parameters (dust particle radius or charge, ion mean free path length) a dipole moment formed in plasma can be fitted with a single curve. The received data are found to be in good agreement with recently obtained results for the collisionless case [2].

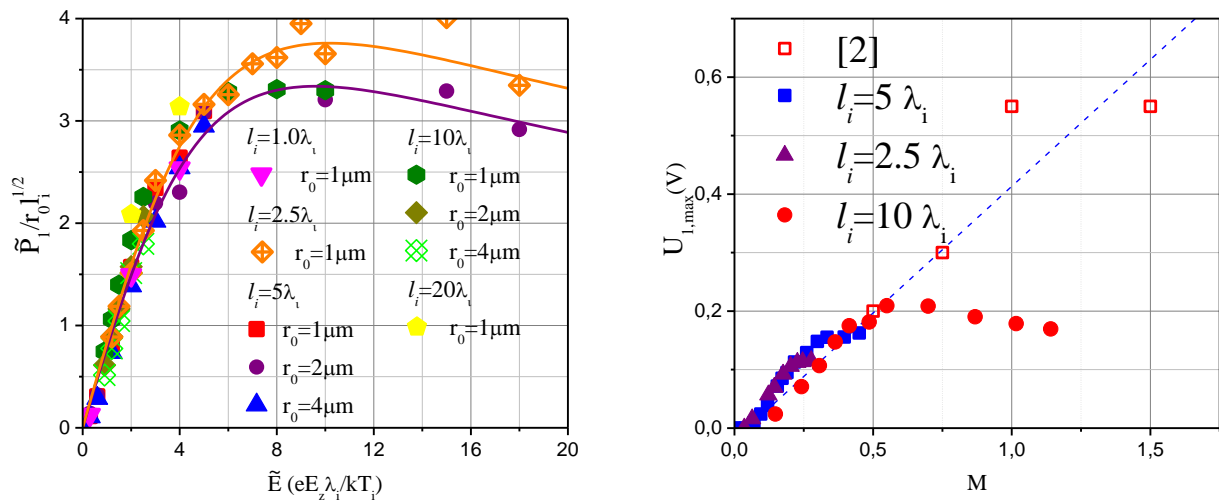


Fig.1. (Left) A normalized dipole moment of an ion-electron cloud around a dust particle in an external electric field. (Right) Dependence of the first potential peaks in the wake behind the dust particle on the Mach number obtained in this paper and in [2].

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