Influence of dust grains and external magnetic field on the propagation of ion-acoustic waves in a two-electron temperature plasma

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Abstract

An experimental study has been conducted to investigate the effect of dust grains and external magnetic field on the propagation of ion-acoustic waves (IAWs) in a two-electron temperature plasma. The two-electron temperature plasma is obtained by diffusing two plasmas of different characteristics produced in multi-dipole magnetic cages of different surface field strengths. Traces of two electron groups with distinct temperatures and densities are observed in the diffusion region [1]. Dust particles are introduced into the plasma in the diffusion region where IAWs are excited. The phenomenon of secondary electron emission takes place from the dust grains due to which a rise in the bulk electron population is observed [2]. Consequently, a reduction in the phase velocity of IAWs is observed. Additionally, an external magnetic field is applied perpendicular to the propagation of IAWs. An increase in the phase velocity is observed in the presence of a magnetic field which also modifies the plasma collisionality and in turn, significantly affects the damping of the IAWs. The study reveals that IAWs can be treated as a suitable diagnostic tool for confirming SEE from dust grains and characterising a magnetized plasma [3]. Furthermore, the method of production of two-electron temperature plasma is itself a novel one where the electron temperatures towards the magnetic cage with higher surface field strength closely resembles with the electron temperatures of divertor regions in fusion devices [4]. To the best of our knowledge, such a study of IAWs in the presence of dust grains and external magnetic field in a two-electron temperature plasma is reported for the first time.

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