

EXPERIMENTAL TEST OF THE ROLE OF ION-ION INSTABILITY IN DETERMINING ION LOSS FROM A TWO-SPECIES PLASMA

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Recent experiments have shown that ions in plasmas containing two ion species reach a common velocity at the sheath-presheath boundary [1]. A new theory [2] suggests that collisional friction between the two ion species enhanced by two stream instability dominates the drift velocity of each ion species near the sheath edge but also suggest that there are differences in ion the velocity at the sheath-presheath boundary given by $[2/\alpha(v_{th1}^2 + v_{th2}^2)]^{1/2}$. This suggests that significant differences in velocity will occur as the relative concentration varies and that when the concentrations are very different, each species velocity approaches the individual Bohm velocities. We report the first experimental test of this model. We measure ion velocity distribution functions (ivdfs) near sheath edge in an Argon/Xenon plasma as a function of the concentration ratios. The relative concentration of the two ion species is determined by the Ion Acoustic Wave phase velocity measurements, the ivdfs are determined by Laser Induced Fluorescence, the electron temperature is measured by Langmuir probe and the plasma potential is measured by emissive probe.

[1] Lee, D; Hershkowitz, N; Severn, GD. Appl. Phys. Lett. 91, 041505 (2007)

[2] S.D. Baalrud, J.D. Callen, and C.C. Hegna, Phy. Rev. Lett. 103. 205002 (2009)

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