MEASUREMENT OF MAGNETIZED PRESHEATHS USING LASER-INDUCED FLUORESCENCE IN ARGON PLASMAS

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The classic Bohm's Criterion is valid only for unmagnetized, weakly-collisional plasmas. For magnetized plasmas where the magnetic field is obliquely incident to the boundary, Chodura[1] and later Riemann[2], claimed that the presheath, accelerates ions to the sound speed along the magnetic field lines. After this an additional "magnetic presheath" must exist, which scales with the ion gyro radius, and accelerates the ions from the sound speed along the magnetic lines of force, to the sound speed perpendicular to the boundary. Riemann and Franklin[3] claimed that both the presheath and magnetic presheath had a single structure. Previous experiments[4,5] attempted to verify the presheath scale lengths by measuring plasma potential structures, however none actually measured ion flow velocity, and as such their presheath lengths were not properly defined. Kim et. al.[4] found that in magnetized and collisional plasmas, the presheaths had two distinct potential structures, one that scaled with the ion collision length and on that scaled with the ion gyro radius, contrary to Riemann and Franklin's claims.

In this work the authors investigate magnetic and collisional presheath scale lengths in an inductive Argon plasma, using laser-induced fluorescence to measure ion flow speed thus and define the presheath boundaries. The scale lengths and presheath potential structures are compared to theory presented by Chodura, Riemann and Franklin.

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