

P4.3004 One dimensional kinetic model of an inverted sheath in a bounded plasma system

Thursday, 11 July 2019 14:00 (2 hours)

See full abstract here :

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.3004.pdf>

A one-dimensional kinetic model of an inverted sheath [1] is presented. The model is based on a bounded plasma system model, introduced by Schwager and Birdsall [2]. A onedimensional bounded plasma system is considered. The system is bounded by two very large planar electrodes perpendicular to the x axis. The left hand electrode is called collector and the right hand electrode is called the source. The source is at zero potential, which is taken as the reference. The collector is electrically floating with respect to the source. The source injects electrons (plasma electrons) and singly charged positive ions into the system, both with half-Maxwellian velocity distributions and different temperatures. Collector absorbs all the particles that reach it, but it also emits electrons (emitted electrons) also with halfMaxwellian velocity distribution and their own temperature. It is assumed that potential decreases monotonically from the collector to the source. Based on this assumption and the assumption that the energy of the particles is conserved cutoff Maxwellian distribution functions of all 3 particle species are "derived". Zero moments of the distribution functions give particle densities and first moments give fluxes. Based on this the Poisson equation and the floating condition of the collector is written. At a certain position the plasma is neutral and at this point the potential has inflection point. Two first integrals of the Poisson equation give 2 equations that give electric fields at the collector and at the source. The floating condition, the neutrality condition at the inflection point and 2 electric field conditions give 4 basic equations of the model from which the floating potential, the inflection point potential and electric fields at the source and at the collector can be found, if the other parameters are selected. It is then shown that stable inverted sheath [1] potential profiles are possible in such a bounded plasma system, provided that injections of positive ions and emitted electrons are both sufficiently large.

References

[1] M. D. Campanell, A. V. Khrabrov and I. D. Kaganovich, Phys. Rev. Letters, 108, 255001 (2012).

[2] L. A. Schwager and C. K. Birdsall, Phys. Fluids B, 2, 1057, (1990).

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Session Classification: Poster P4

Track Classification: LTPD