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P2.4011 BO: A Unified Tool for Plasma Waves and Instabilities Analysis

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See full abstract here:
http://ocs.ciemat.es/EPS2019ABS/pdf/P2.4011.pdf

A unified numerically solvable framework for dispersion relations with an arbitrary number of species drifting at arbitrary directions and with Krook collision is derived for linear uniform/homogenous kinetic plasma, which greatly extended the standard one [say, T. Stix, {\em Waves in Plasmas}, AIP Press, 1992]. The purpose of this work is to provide a kinetic plasma dispersion relation tool not only the physical model but also the numerical approach be as general/powerful as possible. As a very general application example, we give the final dispersion relations which assume further the equilibrium distribution function be bi-Maxwellian and including parallel drift, two directions of perpendicular drift (i.e., drift across magnetic field), ring beam and loss-cone. Both the electromagnetic and electrostatic versions are provided, with also the Darwin (a.k.a., magnetoinductive or magnetostatic) version. The species can be treated either magnetized or unmagnetized. Later, the equations are transformed to the matrix form be solvable by using the powerful matrix algorithm [H. S. Xie and Y. Xiao, Plasma Science and Technology, 18, 2, 97, 2016], which is the first approach can give all the important solutions of a linear kinetic plasma system without requiring initial guess for root finding and thus can be extremely useful to the community. To the best of our knowledge, the present model is the most comprehensive one in literature for the distribution function constructed bases on Maxwellian, which thus can be applied widely for study waves and instabilities in space, astrophysics, fusion and laser plasma. We limit the present work to non-relativistic case.

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