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Electrostatic instabilities induced by counter streaming ions in supersonic wake¹ CHUTENG ZHOU, I.H. HUTCHINSON, CHRISTIAN BERNT HAAKONSEN, MIT PSFC — The wake behind an object moving at supersonic speed in a plasma contains a region of depleted density into which the plasma expands. This replenishing mechanism results in counter streaming ion beams accelerated by ambipolar electric fields, which can be inherently unstable. It is widely believed, for example, that the intense electrostatic noise in the central lunar wake arises from such instabilities. To understand better this and related phenomena, a code has been developed to calculate the linear wave growth rates in the Vlasov-Poisson system for arbitrary ion distribution functions. The research aims to give a comprehensive description of the electrostatic instabilities and their parametric dependences. A contour plot of maximum growth rates in parameter space will be presented in cases where the ion distribution function can be represented by a sum of Gaussians. Our calculations consider unequal beams and oblique modes in contrast to previous published results, which mostly treat equal beams and parallel propagation. We further apply our methods to investigate the regions of electrostatic instabilities in the wake of high Mach number plasma flow.

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