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Ambipolar acceleration of ions in a magnetic nozzle ALEXEY AREFIEV, BORIS BREIZMAN, Institute for Fusion Studies, The University of Texas at Austin — We consider collisionless plasma flow through a nozzle that has a magnetic mirror configuration. The incoming subsonic flow of cold ions is accelerated towards the mirror by an ambipolar electric field resulting from the electron pressure. The flow velocity achieves the speed of sound in the mirror, after which the flow becomes supersonic and further accelerates downstream. For incoming Maxwellian electrons, plasma density upstream from the mirror satisfies the Boltzmann relation, with $n \propto \exp(|e|\varphi/T)$, where φ is the electrostatic potential. Downstream from the mirror, the Boltzmann relation is no longer valid as some areas of phase-space become depleted in a collisionless flow. The depletion results from the nonmonotonic nature of the effective potential $U = \mu B - |e|\varphi$ for electrons with sufficiently large magnetic moment μ. We examine how the depletion of the electron population affects the profile of the electrostatic potential, the plasma density profile, and the ensuing ion acceleration.

Alex Arefiev
University of Texas at Austin

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