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Perpendicular shocks in multi-component plasmas ANNE STOCKEM, LUIS O. SILVA, GoLP/Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisboa, Portugal, RICARDO A. FONSECA, GoLP/Instituto de Plasmas e Fusão Nuclear - Laboratório Associado, Instituto Superior Técnico, Lisboa, Portugal; DCTI, ISCTE - Lisbon University —
We investigate the formation of perpendicularly magnetized collisionless shocks in multi-component plasmas with theory and particle-in-cell simulations. The magnetohydrodynamical jump conditions are extended for plasmas consisting of electrons and a mixture of positrons and ions. We find that the shock speed is decreased if either the ion fraction or the ion mass are increased. Furthermore, the dependence of the jump conditions on the actual particle distribution functions is discussed, which we observe to be low for a strongly magnetized plasma. Our two-dimensional simulations confirm the theoretical results. We find that in a mixed plasma the light positron species is accelerated efficiently in the early stage of shock formation, confirming previous 1D results. For a realistic proton to electron mass ratio we observe that the electron and positron spectra are equal, in contrast to the case of low mass ratio simulations. The dependence of particle acceleration and the shock properties on the mixture and the magnetization also shows new behavior previously not reported in electron-positron or electron-ion relativistic shock simulations.

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