

Particle acceleration at quasi-perpendicular non-relativistic high Mach number shocks

Wednesday, 27 October 2021 15:00 (20 minutes)

Electron and ion acceleration at a non-relativistic collisionless shocks is studied by employing large scale one-dimensional particle-in-cell (PIC) simulations in the de-Hoffmann and Teller (dHT) frame of reference. We demonstrate that diffusive shock acceleration of both electrons and ions occurs in quasi-perpendicular shock configurations at large Alfvén Mach numbers. We also identify the role of precursor waves on the electron energization in the upstream region. The emergence of a significant non-thermal ion component holds important implications for observations of hadronic emission from collisionless shocks occurring for example in supernova remnants, and colliding stellar winds.

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Session Classification: Session 3