

PIC simulations of strongly magnetized parallel collisionless shocks in pair plasmas

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Collisionless shock waves are frequently treated/modelled as a collisional, fluid MHD discontinuity. In light of this, using PIC simulations of non-relativistic, parallel collisionless shocks, we detail the deviation of collisionless shocks from MHD predictions for varying magnetization/Alfvénic Mach numbers. We show that for sufficiently large upstream magnetic fields, the shock compression ratio is dramatically reduced, in agreement with the predictions of Bret & Narayan 2018 [1]. Additionally, we examine the role of field strength on the shock width and on the generation of energetic particles. This work reinforces a growing body of work that suggest that modelling many astrophysical systems with only a fluid plasma description omits potentially important physics [2].

[1] Bret, Narayan, J. Plasma Phys. (2018), **84**, 905840604.

[2] Haggerty, Bret, Caprioli, MNRAS **509**, 2084–2090 (2022).