Width of a shock from the collisional to the collisionless regimes

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While the front of a fluid shock is a few mean-free-paths thick, the front of a collisionless shock can be orders of magnitude thinner. By bridging between a collisional and a collisionless formalism, we assess the transition between these two regimes. We consider non-relativistic, un-magnetized, planar shocks in electron/ion plasmas. In addition, our treatment of the collisionless regime is restricted to high Mach number electrostatic shocks. We find that the transition can be parameterized by the upstream plasma parameter Λ which measures the coupling of the upstream medium [1].

References

[1] A. Bret and A. Pe'er, Journal of Plasma Physics, Journal of Plasma Physics, 87, 905870204 (2021).