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Two-dimensional particle simulation of a quasi-perpendicular shock with a shock rest frame model

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A full particle simulation study is carried out on the reformation of a quasi-perpendicular collisionless shock with a relatively low Alfvén Mach number ($MA = 5$). Recent self-consistent hybrid and full particle simulations have demonstrated that ion kinetics are essential for the non-stationarity of perpendicular collisionless shocks, which means that physical processes due to ion kinetics modify the shock jump condition for fluid plasmas. However, it is a heavy task to conduct large-scale full particle simulations of collisionless shocks to include electron kinetics. In the present study, we have performed a two-dimensional (2D) electromagnetic full particle simulation with a "shock-rest-frame model". The simulation domain is taken to be larger than the ion inertial length in order to include full kinetics of both electrons and ions. We discuss the effect of electron kinetics to the shock reformation at a quasi-perpendicular shock.

Keywords: shock wave, full-particle simulation, quasi-perpendicular, low Alfvén Mach number