Physics > Plasma Physics

Microinstabilities at perpendicular collisionless shocks: A comparison of full particle simulations with different ion to electron mass ratio

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A full particle simulation study is carried out for studying microinstabilities generated at the shock front of perpendicular collisionless shocks. The structure and dynamics of shock waves are determined by Alfven Mach number and plasma beta, while microinstabilities are controlled by the ratio of the upstream bulk velocity to the electron thermal velocity and the plasma-to-cyclotron frequency. Thus, growth rates of microinstabilities are changed by the ion-to-electron mass ratio, even with the same Mach number and plasma beta. The present two-dimensional simulations show that the electron cyclotron drift instability is dominant for a lower mass ratio, and electrostatic electron cyclotron harmonic waves are excited. For a higher mass ratio, the modified two-stream instability is dominant and oblique electromagnetic whistler waves are excited, which can affect the structure and dynamics of collisionless shocks by modifying shock magnetic fields.

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