S001-45
A 会場 ：11/6　AM1 （9:00-10:30）
09:55〜10:10

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Role of magnetized electrons in Weibel-dominated collisionless shocks

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It is known that Weibel instability is the dominant instability in high Mach number collisionless shocks. These Weibel-dominated shocks are promising candidates for cosmic ray accelerators and have been studied extensively by theory, simulation, and laser experiments.

Since the kinetic energy is sufficiently larger than magnetic energy, most studies ignore the background magnetic field. However, PIC simulation results of collisionless shocks, in which a finite background magnetic field is imposed, show that the shock dynamics depend on background magnetic field strength. Whether the electron is magnetized or not could drastically change the magnetic field structure and electron heating efficiency in linear and nonlinear evolution.

In this study, we investigate the Alfven Mach number dependence on the ion Weibel instability by theory and 2D PIC simulations. The magnetized electrons increase the growth rate of the Weibel magnetic field, especially at long-wavelength and near parallel propagation angles. In nonlinear stages, the magnetized electrons create a strong beam-aligned magnetic field which leads to spontaneous magnetic reconnection in the nonlinear stage, which was found in previous 2D shock simulations.

By performing 2D PIC simulations with periodic boundary conditions, we confirmed the larger magnetic field amplification, reconnection, and more efficient electron heating in the Weibel instability with magnetized electrons.