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Plasma waves around separatrix in collisionless magnetic reconnection with weak guide field YANGAO CHEN, Peking University, KEIZO FUJIMOTO, NAOJ, CHIJIE XIAO, Peking University, HANTAO JI, PPPL —
Electrostatic and electromagnetic waves excited by electron beam around the separatrix region are analyzed in detail during the collisionless magnetic reconnection with a weak guide field by using 2D particle-in-cell simulation with the adaptive mesh refinement. Broadband electrostatic waves are excited both in the inflow and outflow regions around the separatrices due to the electron bump-on-tail, two-stream, and Buneman instabilities. In contrast, the quasi-monochromatic electromagnetic waves are excited only in the inflow side of the separatrices due to a beam-driven Whistler instability. The localization of the Whistler waves is attributed to the non-uniformity of the out-of-plane magnetic field By. The Whistler instability is suppressed in the outflow side where By is too small for the oblique propagation. The electrostatic waves with distinct speeds can explain the in situ spacecraft observations. From the causality point of view, the waves are generated as the consequence of the electron bulk acceleration to thermalize the particles through wave-particle interactions. These simulation results provide guidance to analyze high-resolution wave observations during reconnection in the ongoing and upcoming satellite missions, as well as in dedicated laboratory experiments.

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