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Structure characteristics of three-dimensional magnetic reconnection in SPERF-AREX for simulated magnetopause events

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The Space Plasma Environment Research Facility (SPERF) constructed at the Harbin Institute of Technology in China aims to experimentally simulate the magnetosphere plasma processes. The Asymmetric Reconnection EXperiment (AREX) is one of its major components to study the asymmetric reconnection dynamics relevant to the magnetopause reconnection.

In AREX, the reconnection process is driven by a set of flux cores through coil-current-ramp-up to interact with a dipole magnetic field generated by the dipole coil.[1] A wide range of plasma parameters can be achieved through inductive plasma generation with flux cores and electron cyclotron resonance (ECR) plasma source and cold cathode discharge plasma source around the dipole coil.[2,3] Different reconnection regimes and geometries can be produced by adjusting plasma parameters and coil configurations as well as coil current waveforms.[4]

In this work, the Hall effect and its geometric characteristics in typical AREX reconnection processes are numerically studied.[5] In the X-line geometry, the Hall field features in cross section perpendicular to the X-line, which are mostly analogous to the typical 2D Hall quadrupole structure. In the null-separator geometry, along the separator, the magnetic field configuration near a magnetic null also demonstrates the typical quadrupolar pattern, which is distorted away from the nulls. The primary experimental results in AREX are also discussed.

References

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