

Structure characteristics of three-dimensional asymmetric magnetic reconnection in SPERF-AREX experiments

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The Space Plasma Environment Research Facility (SPERF) has been put into operation at Harbin Institute of Technology in China. There are three sub-systems in SPERF, Dipole Research EXperiment (DREX)^[1], Asymmetric Reconnection EXperiment (AREX)^[2], and Tail Reconnection EXperiment (TREX)^[3]. DREX provides a laboratory platform to simulate radiation belt physics process, e.g., trapping, acceleration/loss, and transport of energetic charged particles, as well as wave excitation and configuration polarization, in a dipole magnetic field relevant to the inner magnetosphere. AREX provides a unique experimental platform to study the 3D asymmetric reconnection dynamics relevant to the interaction between the interplanetary and magnetospheric plasmas. TREX provides a research platform to understand the physics processes in magnetotail, e.g., the dipolarization front formation and the magnetotail reconnection.

In this work, the forced three-dimensional (3D) asymmetric magnetic reconnection processes in Asymmetric Reconnection EXperiment (AREX) are emphasized. In AREX, the forced reconnection process is driven by a set of flux cores through coil-current-ramp-up to provide the plasma and the magnetic pressure interact with a dipole magnetic field generated by the dipole coil.^[4] 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. Different reconnection regimes and geometries can be produced by adjusting plasma parameters and coil configurations as well as coil current waveforms.

From the experiments, the Hall effect and the corresponding fine structures can be clearly observed in SPERF-AREX experiments consistent with the numerical results of the experimental process^[5-6]. The reconnection electric fields in the asymmetric reconnection will be also reported in detail.

References

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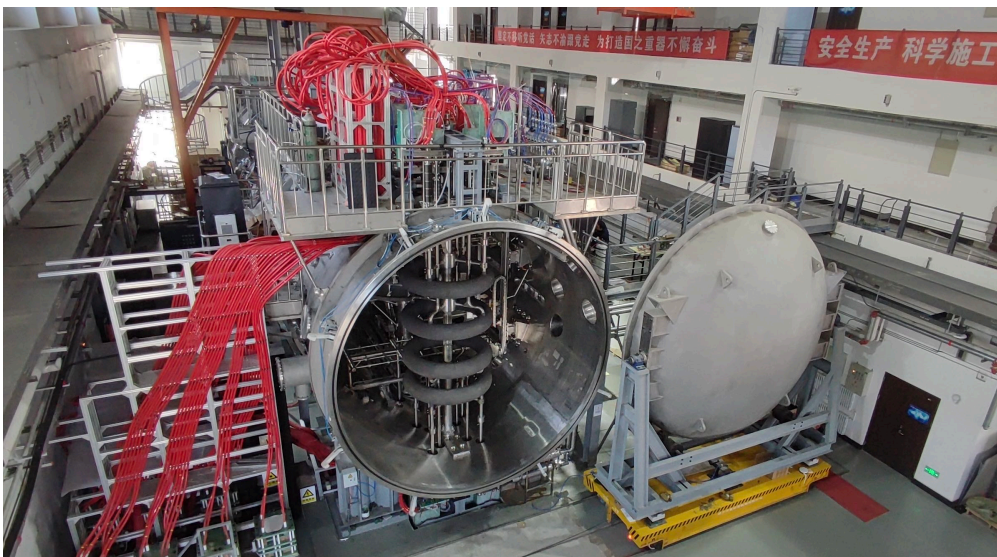


Figure 1. The SPERF device