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Introduction to SESRI-SPERF, Fundamental Design and Research

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A ground-based experimental device for laboratory simulation of space environment, the Space Environment Simulation and Research Infrastructure (SESRI), is starting its operation phase currently at Harbin Institute of Technology (HIT) in China. The Space Plasma Environment Research Facility (SPERF) is one of the most important components of SESRI. The SPERF provides a remarkable experimental platform, with a well-designed set of coils and plasma sources, for laboratory simulation of geospace plasma physics processes. The facility consists a chamber of three sub-systems for magnetosphere plasma studies, Dipole Research Experiment (DREX), Asymmetric Reconnection Experiment (AREX), and Tail Reconnection Experiment (TREX), as well as an independent chamber for simulating the plasma environment of high-speed civil aviation and aerospace transportation system in airline-flight-mode. The DREX1 provides a laboratory platform for simulating radiation belt physics process, e.g., trapping, acceleration/loss, and transport of energetic charged particles in a dipole magnetic field relevant to the inner magnetosphere. The AREX[2] provides a unique experimental platform to study 3D asymmetric reconnection dynamics relevant to the interaction between the interplanetary and magnetospheric plasmas. The TREX provides a research platform to understand the physics processes in magnetotail, e.g., the dipolarization front formation and propagation. The plasma environment of high-speed civil aviation and aerospace transportation system in airline-flight-mode on the other hand is designed to investigate the control and communication development demands and challenges for hypersonic vehicles[4]. We will present an overview of the fundamental design of SPERF, including the plasma sources, the plasma diagnostics, and the important coils, as well as recent progresses in research of space plasma environment researches.

References

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