BOSTON UNIVERSITY

Boston University College of Arts & Sciences
Center for Space Physics

2022—2023 SPACE PHYSICS SEMINAR SERIES

Fluid simulation of Farley-Buneman instabilities: Model description and potential applications

Coupling between the magnetosphere and the high latitude ionosphere can produce currents that drive Farley-Buneman instabilities, generating a spectrum of field-aligned plasma density irregularities. Numerous studies have shown that these irregularities can modify the local temperature, plasma density, composition, conductivity, and transport. Furthermore, there is evidence that these instabilities may affect the evolution of magnetospheric dynamics by changing the conductivity of the ionosphere.

It is generally accepted that modeling Farley-Buneman instabilities require resolving kinetic effects to reproduce experimentally observed nonlinear features. Particle-in-cell simulations have captured most of these at a computational cost that can severely affect their scalability. This limitation hinders the study of non-local phenomena that require three dimensions or coupling with larger-scale processes. In this talk, we show that a variation of the five-moment fluid system can recreate several aspects of Farley-Buneman dynamics. We describe these instabilities and the numerical methods chosen for reproducing them. Then, we show that this model produces good qualitative agreement with PIC simulations reported in the literature. We will outline some of the applications of this new approach for studying the coupling with larger-scale phenomena. Finally, we will explore how this simulation approach can improve remote sensing models and refine conductivity estimates of Global Circulation Models.

Thursday, October 13th
4:00-5:00 p.m.
CAS 502

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