BOSTON UNIVERSITY

Boston University College of Arts & Sciences Center for Space Physics

2022–2023 SPACE PHYSICS SEMINAR SERIES

Recent results from the MMS mission and their implications on strongly driven turbulence and particle acceleration

We will visit recent shock-related findings from the Magnetospheric Multiscale mission, and discuss how these findings open up new science possibilities. The findings represent strongly driven turbulence generated from star (solar) wind interaction with planetary magnetospheres. MMS observes intense magnetic field and density pulses generated just outside of the bow shock. These pulses have magnetic field strength similar to that of the interplanetary magnetic field (IMF) driving major geomagnetic storms, and the pulses have been shown to modulate the solar wind energy input at Earth. Similar pulses are observed by MAVEN at Mars. Comparing MAVEN observations with MMS four-spacecraft high-cadence measurements and fully kinetic simulations, we find that the pulses grow from electromagnetic ion cyclotron waves gyro-resonant with the solar wind ions, and that the pulses have the potential to drive mini-storms at the small induced

magnetosphere of Mars, opening dayside gateways for planetary ion escape. The much larger magnetosphere at Earth further provides a foreshock environment that is conducive to acceleration of ions to suprathermal energies. MMS observes magnetic field amplification by more than one order of magnitude, and ion acceleration to ~200 times of the solar wind energy. The terrestrial bow shock under quasi-radial IMF provides an in-situ laboratory to study the physics of particle acceleration at astrophysical shocks. We will envision future explorations out of the new possibilities.



Thursday, April 27th

4:00-5:00 p.m. 725 Commonwealth Ave | Room 502 Li-Jen Chen NASA GSFC