Title: Dissipation of Turbulence in Astrophysical Plasmas

Speaker: Ben Chandran, University of New Hampshire

Abstract:

Turbulent heating in astrophysical plasmas such as the solar wind has an important impact on the macrophysical evolution of these systems. Determining the mechanisms that dissipate the turbulence in these plasmas, many of which are effectively collisionless, is important for determining how the turbulent heating power is apportioned among different particle species and between perpendicular and parallel heating. In this review talk, I will provide a broad overview of the current state of the community's understanding of the turbulent-dissipation problem. To frame the discussion, I will begin by reviewing the different ways that energy cascades from large scales to small scales. I will consider the different types of energy cascades, including both perpendicular and parallel cascades of Alfven-wave-like fluctuations, fast-magnetosonic-like fluctuations, and slow-magnetosonic-like fluctuations. I will then draw upon this review of energy-cascade processes to describe the different types of plasma fluctuations and waves that can be excited at the small scales where much of the energy is ultimately dissipated, as well as the types of wave-vector anisotropies that are expected for each different fluctuation type. After setting the scene in this way, I will survey the different types of dissipation mechanisms that affect these different modes, including cyclotron heating, stochastic heating, current-sheet energization, shock heating, Landau damping, transit-time damping, and the entropy cascade. I will provide theoretical background on these various dissipation mechanisms and will describe where and under what circumstances each different mechanism is expected to be important. I will conclude by summarizing some of the most important open questions concerning the dissipation of turbulence in astrophysical plasmas.