Michigan Institute for Plasma Science and Engineering Seminar

Turbulent Plasmas in Astrophysics and Fusion

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Room 1200 EECS Building

Abstract

Gyrokinetics is a first principles theory for the dynamics and thermodynamics of magnetized, ionized gases. It has been developed over the last three decades, primarily in the magnetic confinement fusion community, where it is widely used to interpret observations and to design experimental devices and operational scenarios. Gyrokinetic simulations of instabilities and turbulence in hot, rarefied plasmas have been tested carefully in these laboratory settings. Recently, gyrokinetic ideas and codes have been successfully used to explain long-standing and otherwise puzzling observations of turbulent fluctuations in the solar wind. While magnetohydrodynamics remains the appropriate theory for dynamics in larger, truly astrophysical plasmas (such as galaxy cluster plasmas), the appropriate framework for the study of many interesting thermodynamic processes in astrophysics (such as turbulent heating and transport) is gyrokinetics. Example applications will be shown.

About the Speaker: **Bill Dorland is a physics professor at the Univ. of Maryland at College Park, Visiting Professor of Physics at the Univ. of Oxford, and the director of the Univ. of Maryland Honors College. He is a Fellow of the American Physical Society and the 2009 recipient of the Ernest O. Lawrence Award for Nuclear Technology. Prof. Dorland is best known for developing and applying comprehensive simulations of the instabilities and turbulence found in hot, magnetized plasma. Most of his 93 papers are in the area of magnetic confinement fusion research, where turbulence in the plasma fuel limits the performance of all existing laboratory devices. More recently, Dorland has been "exporting" knowledge about plasma turbulence gained from the laboratory, to study naturally turbulent plasmas such as the solar wind and in more distant astrophysical systems.**