



UNIVERSITÀ
DI TRENTO

Dipartimento di
Fisica

PHD PROGRAM IN SPACE SCIENCE AND TECHNOLOGY - SST

Heliospheric Turbulence: Recent Advances and an Overview of its Effects

General Seminar – Curriculum 2, November 4, 2026, 3.00 p.m.

Speaker:

William H. Matthaeus, PhD - Martin A. Pomerantz Professor of Physics and Astronomy, University of Delaware

Abstract:

Turbulence in general is an unsolved problem, and relative to ordinary fluids, it is even more complex in plasma or magnetofluids ("MHD"). In fluids, the usual scenario involves driving, cascade and dissipation. In plasma models, one also deals with interaction between nonlinearities and oscillatory wave modes, as well as anisotropy and the presence of multiple ideal conserved quantities. The solar wind is a major heliospheric ingredient that admits broadband MHD-like turbulence, having numerous far-reaching effects, ranging from heating of the corona and acceleration of the wind itself, to controlling the propagation of high energy solar energetic particles and galactic cosmic rays. This lecture will present an overview of turbulence effects in the heliosphere and in particular, the solar wind. Examples from observations are provided in this lecture, corresponding to theoretical aspects of turbulence, which themselves are often revealed and understood by use of numerical simulations. Topics covered include advances in understanding MHD and kinetic plasma cascade, issues in adaptation of classical turbulence theory to collisionless plasmas, small scale dissipative intermittency, heating, anisotropy of both variance and correlation types, space-time correlations, and the generation of very low frequency intermittency.

Bio:

William H. Matthaeus, PhD studies turbulence theory, plasma physics, fluid mechanics, and statistical mechanics, with applications to solar wind and coronal phenomena and transport and energization of charged particles in plasmas. He employs analytical, computational and observational methods to study turbulence cascade and transport, which, along with the associated complex kinetic plasma physics response, lead to dissipation and heating.

Online attendance:

Information on remote participation can be requested by sending an e-mail to dn_sst@unitn.it