

Course Outline

Physics 762 Plasma Physics II: Topics in Nonlinear Plasma Theory

1. **Overview of Nonlinear Plasma Physics**
2. **Nonlinear waves/structures**
 - (a) Nonlinear sound waves: KDV equation and solitons
 - (b) Shocks: Rankine Hugoniot Conditions
3. **Wave-particle interactions**
 - (a) Anisotropy driven whistler waves: quasilinear theory
 - (b) The standard map and quasilinear theory
4. **Wave-wave interactions**
 - (a) Raman and decay instabilities: parametric excitation of waves
 - (b) Plasmon-sound wave interactions: the Zakharov equations and wave collapse
5. **Navier-Stokes turbulence and dissipation processes**
 - (a) Kelvin Helmholtz instability
 - (b) Invariants, cascade processes and scaling laws
 - (c) Intermittancy
6. **MHD Turbulence and dissipation**
 - (a) Magnetic reconnection: linear, Sweet-Parker and Petschek theory
 - (b) Invariants, cascade processes and scaling laws
 - (c) Dynamo: stretch, twist, fold and the turbulent dynamo