Plasma Physics I

Aims

Teaching the principles of plasma physics:

Kinetic and fluid models for plasmas applications to the study of wave-plasma interaction.

Magnetohydrodynamic equations for the study of the stability of magnetized plasmas and magnetohydrodynamic (MHD) instability in linear and toroidal plasmas.

Introduction to models of the plasmas produced for applications (kinetics in gas phase and surface phase, sheaths and sources).

Contents

Fundamentals of plasma physics: kinetic and fluid plasma models, wave-plasma interaction by fluid model and kinetic model, magnetohydrodynamic equations, magneto-hydrodynamic stability and instabilities, magnetic reconnection, introduction to plasma applications.

Detailed program

Kinetic and fluid descriptions of plasma: the distribution function, the Vlasov equation, the momenta of the distribution function, the fluids equations, MHD and instabilities: space and time scales. Waves in Plasma: Introduction to the wave propagation in plasma, Linearization of the
Maxwell equations and fluids equations; Waves in non magnetised plasma; Langmuir oscillations;
Electromagnetic transverse waves; Pressure effects; Waves in a magnetised plasma: perpendicular and
parallel propagations; Wave polarisation in plasma; Waves in a drifting plasma: two stream instability.
Kinetics description of waves:Langau Damping. MHD and Instabilities: MHD stability; MHD instabilities:
Kink and sausage instabilities, Rayleigh-Taylor instability for plasma and fluids; Plasma Applications:
 Plasma Sources, Sheats and Applications.

Prerequisites
None

Teaching form
Lectures (6 CFU)

Textbook and teaching resource
Reference books:
R. J. Goldston, Introduction to Plasma Physics
M. A. Liebermann, Principles of plasma discharges and material processing, Wiley Interscience

Semester
First semester

Assessment method
Oral examination
Mark range: 18–30/30, examination

Office hours
MONDAY from 12,30 to 13,30
THURSDAY from 12,30 to 13,30

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