UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Plasma Physics I

2425-1-F1701Q090

Aims

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Teaching the principles of plasma physics: relevant thermonuclear fusion issues, astrophysics, ionosphere and plasma applications:

Kinetic and fluid models for plasmas applications to the study of wave-plasma interaction in natural and laboratory plasmas,

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

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

Contents

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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 (plasma sheaths and sources).

Detailed program

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 intability. Kinetics description of waves:Landau 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) held in the classroom on the blackboard and projection of movies and slides

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

Questions on the topics covered by the programme plus a subject of the student’s choice

Office hours

On appointment to be arranged by e-mail to claudia.riccardi@unimib.it

p/o

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Sustainable Development Goals

AFFORDABLE AND CLEAN ENERGY