



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Plasma Physics I

2425-1-F1701Q090

---

#### Aims

Aims

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

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 (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 instability. 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, Sheaths 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](mailto:claudia.riccardi@unimib.it)

p/o

Ed. U2 - Dipartimento di Fisica, Piazza della Scienza 3 - 3 floor, room 3014.

Phone: 0264482314

Email: [claudia.riccardi@unimib.it](mailto:claudia.riccardi@unimib.it)

## **Sustainable Development Goals**

AFFORDABLE AND CLEAN ENERGY

---