UNIVERSITÀ DEGLI STUDI DI TORINO

ID

VP12_DIP_FIS

Visiting Professor Program
Academic year 2020/2021

DEPARTMENT OF PHYSICS

TEACHING COMMITMENT: 12 hours

COURSE TITLE

Physics of the Matter in the Fluid and Plasma State

TEACHING PERIOD

1st term

SCIENTIFIC AREA

Physics of Matter

LANGUAGE USED TO TEACH

English

COURSE SUMMARY

The course introduces the theoretical foundation of fluid and plasma physics with applications to astrophysics and the recent developments in this research field.

Introduction. Fundamental properties of a fluid and plasma. Single particle motion in magnetic fields and principles of magnetic confinement in different geometries. Physics of binary and coulombian collisions and conservation laws. General formulation of the continuous media dynamics. Kinetic description of fluid and plasma dynamics Boltzmann and Vlasov equation. An application of the kinetic theory: Landau damping. Moments of Boltzmann equation and derivation of fluid equations. Dynamics of a two-fluids collisional plasma. MHD equations for a fluid of a single species. General stability criteria of MHD equilibrium configurations. MHD and interchange instabilities. Non-linear instabilities and saturation processe Dynamics of ideal fluids. Euler, continuity, energy, vorticity equations. Hydrostatic equilibrium conditions. Incompressibility conditions Irrotational flows. Dynamics of viscous fluids Navier Stokes equation. Hagen Poseuille regime. Reynolds number and similarity laws. Linear Dynamics of perfect gases. Acoustic waves. Solutions of non-linear dynamic equations. Supersonic flows. Waves propagations in fluids and non-collisional cold plasmas.

Acoustic, magneto-acoustic and EM waves in a magnetized plasma Cut-offs and resonant adsorption of cyclotron waves.

LEARNING OBJECTIVES

Understanding of: Fundamentals of Classical Statistical Mechanics. Kinetic theory of neutral and electrically charged fluids. Dynamics of compressible and uncompressible fluids. Fundamentals of Plasma Physics. Dynamics of high temperature plasma based on Magneto-hydrodynamic equations. Fluids and magneto-hydrodynamic instabilities.

TUTORSHIP ACTIVITIES (IF APPLICABLE)

LAB ACTIVITIES (IF APPLICABLE)

OTHER ACTIVITIES (IF APPLICABLE)

VISITING PROFESSOR PROFILE DESCRIPTION

We are looking for a person with excellent expertise in fluid dynamics and magnetohydrodynamics with a strong background in applied mathematics.

The candidate should also have track of record of teaching activities in fields related to the course subject.

CONTACT PERSON AT THE DEPARTMENT

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