PLASMA PHYSICS

Professor: Renato FEDELE **☎081 6 76259** **email: renato.fedele@unina.it**

SSD	FIS/03	Course Credit	8	Year (I, II)	I	Semester (I , II)	I

Insegnamenti propedeutici previsti: nessuno

CONTENTS

Basic notions on plasmas: plasma as fourth state of matter, fundamental parameters of plasma: from astrophysical and space plasmas to laboratory ones.
Classical and quantum electromagnetic processes associated with the motion of charged particles in plasmas: theory of orbits, Fermi acceleration, plasma-radiation interaction, wave-particle interactions and wave-wave interactions.
Kinetic theory of a neutral gas and of a plasma: Boltzmann transport equation for a system of neutral particles and its applications; Vlasov equation of a multi-component plasma (Vlasov-Maxwell system) and its applications (plasma oscillations and Landau damping).
Fluid theory of a multi-component plasma: oscillations and waves in plasmas in linear regime (oblique propagation, high and low frequency modes, hybrid modes of high and low frequency, birefringence of magneto-active plasmas).
Fluid theory of a single component plasma (magnetohydrodynamic theory): applications to astrophysics and to magnetic confinement fusion: diffusional and magnetohydrodynamic waves in convective regime.
Mechanisms for generating large amplitude electric and magnetic fields in plasmas. Applications to: inertial fusion, acceleration of charged particles and astrophysics and space physics.
Parametric instability processes in plasmas (applications in astrophysics and laboratory plasmas): three- and four-wave processes (modulational instability).

BIBLIOGRAPHY

- Booki: F.F.Chen, *Introduction to Plasma Physics*, Los Angeles; P. A. Sturrock, *Plasma Physics*, Cambridge Univ. Press; D.B. Melrose, *Instability in space e laboratory plasmas*, Cambridge Univ. Press, Huang K.*, Statistical Mechanics,* Wiley.
- Slides of course.
- Use of Mathematica