UNIVERSITÀ DI PISA

KINETIC THEORY OF PLASMAS / PLASMI TEORIA CINETICA

FRANCESCO PEGORARO

Academic year	2023/24
Course	FISICA
Code	355BB
Credits	6

Modules	Area	Type	Hours	Teacher(s)
PLASMI TEORIA CINETICA	FIS/03	LEZIONI	36	FRANCESCO PEGORARO

Obiettivi di apprendimento

Conoscenze
After completing the course the student will have a solid knowledge of the physics of high temperature dilute plasmas of interest for astrophysics, space physics, thermonuclear fusion studies and high-energy laser plasma interactions. The course is mostly theoretical. The course has an interdisciplinary perspective and is a needed prerequisite for all research activities in physical settings where plasmas are present from space to the laboratory.

Modalità di verifica delle conoscenze
The assessment aims to ascertain the basic knowledge of kinetic plasma physics and, most importantly, the understanding of, and the ability to use the methods that have been developed for the study of a complex system like a plasma.

Capacità
Being able at the end od the course to read and understand a research article in plasma physics

Modalità di verifica delle capacità
Seminar on a specific research article

Comportamenti

Modalità di verifica dei comportamenti

Prerequisiti (conoscenze iniziali)

Mechanics

Statistical mechanics
Electrmagnetism in vacuum and in media
Relativistic kinematics

Indicazioni metodologiche

Learning activities:

- attending lectures
- participation in seminar

Attendance: Advised

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Programma (contenuti dell'insegnamento)

Definition of high temperature dilute plasmas, derivation of Vlasov equation. Relationship with fluid plasma descriptions. Linear versus nonlinear plasma dynamics. Vlasov equilibria and plasma waves in a kinetic description; Landau damping. Waves in a magnetized plasma, the method of the characteristics. Low frequency, large scale limit of the kinetic plasma description. Plasma instabilities and anomalous transport properties of a plasma in regimes where thermodynamic equilibrium is absent even at a local level. Quasilinear theory and anomalous diffusion.

Bibliografia e materiale didattico

Krall and Trivelpiece Principles of Plasma Physics or any standard textbook on kinetic plasma theory
Notes on specific subjects distributed by e-mail or on
https://drive.google.com/drive/folders/1EZbGv5OpY6UnEpzzgv30nlpUn5mOZ1v2

Indicazioni per non frequentanti

Modalità d'esame

- Final oral exam

The oral exam consists in a seminar on an agreed subject (the seminar is based on reading and understanding a research article) with free questions related to the seminar subject and covering the material of the course.

Altri riferimenti web

https://drive.google.com/drive/folders/1EZbGv5OpY6UnEpzzgv30nlpUn5mOZ1v2

Note

Lecture schedule and examination dates decided together with participating students
Teacher freely available for clarifications and suggestions in his office

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