Summary
Following an introduction of the main plasma properties, the fundamental concepts of the fluid and kinetic theory of plasmas are introduced. Applications concerning laboratory, space, and astrophysical plasmas are discussed throughout the course.

Content
I Collisional and relaxation phenomena
- Inelastic collisions: ionization and recombination, degree of ionization
- Elastic collisions: Coulomb collisions
- Isotropisation and thermalisation
- Plasma resistivity and the runaway regime

II Transport in plasmas
- Random walk and diffusion
- Ambipolar and cross-field diffusion
- Energy and particle confinement

III Waves in cold magnetized plasma
- Dielectric tensor
- Resonances and cut-offs
- Parallel and perpendicular propagation

IV Wave-particle interaction and kinetic description of waves in hot un-magnetized plasmas
- The Vlasov-Maxwell model
- Resonant wave-particle interaction and Landau damping
- Stability criteria and streaming instabilities
- Langmuir and ion-acoustic waves and instabilities

V Waves in hot magnetized plasmas

VI Examples of nonlinear effects

Learning Prerequisites
Recommended courses
Electrodynamics, Plasma Physics I

Learning Outcomes
By the end of the course, the student must be able to:
- Manipulate the fundamental elements of the plasma fluid and kinetic theory

Teaching methods
Ex cathedra and exercises in class

Assessment methods
oral exam