FJD3300 Kinetic Plasma Theory 6.0 credits

Kinetisk plasmateori

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FJD3300 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

Master in Electrical Engineering or Engineering Physics or similar.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

When completing the course, the student should be able to

- Derive the basic plasma kinetic equation from first principles
- Discuss applications and validity of the Vlasov and Boltzmann equations
- Describe and explain Landau damping and the two-stream instability
- Describe basic kinetic properties of hot magnetised plasmas
- Derive and explain the Fokker-Planck equation
- Describe basic relaxation processes and collision times
- Distinguish between fully kinetic, drift kinetic, hybrid and gyrofluid models

Course contents

Liouvilles theorem. BBGKY hierarchy. Vlasov and Boltzmann equations. Plasma dispersion function. Landau damping. The bump-on-tail instability. Criteria of Nyquist and Penrose. Bernstein modes. The Fokker-Planck equation. Relaxation times. Resistivity. Chapman and Enskog expansions. Drift-kinetic model. Gyrokinetic model. Gyrofluid model. Vlasov-Fluid hybrid model. Two-stream instability. Inverse Landau damping. Collisionless drift waves. Electron and ion temperature gradient instabilities. Loss-cone instability.

Examination

- EXA1 - Examination, 6.0 credits, grading scale: P, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Participation in group discussions, completion of home assignments and oral exam.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.