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1. Course title

Plasmophysik
Plasmophysik
Plasma Physics

2. Course code

PAP304

Aikaisemmat leikkaavat opintojaksojat 53765 Plasmophysik, 5 op

3. Course status: compulsory

-Which degree programme is responsible for the course?
Master's Programme in Particle Physics and Astrophysical Sciences

-Which module does the course belong to?
PAP300 Advanced Studies in Particle Physics and Astrophysical Sciences (compulsory for Study Track in Astrophysical Sciences)

-Is the course available to students from other degree programmes?
Yes

4. Course level (first-, second-, third-cycle/EQF levels 6, 7 and 8)

Master's level, degree programmes in medicine, dentistry and veterinary medicine = second-cycle degree/EQF level 7
Doctoral level = third-cycle (doctoral) degree/EQF level 8

-Does the course belong to basic, intermediate or advanced studies (cf. Government Decree on University Degrees)?
Advanced studies

5. Recommended time/stage of studies for completion

-The recommended time for completion may be, e.g., after certain relevant courses have been completed.

6. Term/teaching period when the course will be offered
The course will be offered in the autumn term, in period I.

7. Scope of the course in credits
5 cr

8. Teacher coordinating the course
Minna Palmroth

9. Course learning outcomes
- You will obtain solid knowledge of basic concepts and phenomena of plasma physics, useful for further studies concerning laboratory, fusion, space and astrophysical plasmas.
- You will obtain skills to analytically solve basic problems related to plasma physics, such as particle drifts in simple magnetic field and electric field configurations.
- You will obtain skills to derive various basic plasma equations starting from basic set of fluid and Maxwell equations.
- You will obtain solid conceptual understanding and theory behind several key basic plasma phenomena, such as magnetic reconnection, magnetohydrodynamic stability and plasma instabilities.
- You will obtain a good understanding of different approaches in plasma physics (single particle, kinetic and fluid).

10. Course completion methods
- Contact teaching, but can be also taken as a distance learning course

11. Prerequisites
- Basic physics courses
- Solid calculation skills (e.g., Mathematics for Physicists I-II, Mathematical Methods of Physics I-II)
- Good knowledge on electrodynamics (e.g., Electrodynamics I and II)

12. Recommended optional studies
- Space Applications of Plasma Physics
- Advanced Plasma Physics
- Solar Physics
- Numerical Space Physics

13. Course content
After a brief introduction and a short review of electrodynamics needed in plasma physics, the following topics are discussed: motion of charged particles in electromagnetic fields, collisions and plasma conductivity, kinetic plasma description, macroscopic plasma quantities and equations, magnetohydrodynamics (MHD), magnetic reconnection, MHD waves, cold plasma waves, warm plasma, plasma physics and fusion research.

14. Recommended and required literature
- Introduction to Plasma Physics Pdf Book

Other recommended material
- Hannu Koskinen: Johdatus plasmafysiikkaan ja sen avaruussovellutuksiin, Limes ry., 2001
- Baumjohann, W., Treumann, R., Basic Space Plasma Physics, Imperial College Press, 1996.

15. Activities and teaching methods in support of learning
- Lectures
- Weekly exercises

16. Assessment practices and criteria, grading scale
Final grade is based on exercises (30%) and the final exam (70%)

17. Teaching language

English