

PHYS-424

**Plasma II**

Reimerdes Holger

Cursus	Sem.	Type
Energy minor	E	Opt.
Ing.-phys	MA2, MA4	Opt.
Physicien	MA2, MA4	Opt.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Oral
Workload	180h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	2 weekly
Exercises	2 weekly
<b>Number of positions</b>	

**Summary**

This course completes the knowledge in plasma physics that students have acquired in the previous two courses, with a discussion of different applications, in the fields of magnetic confinement and controlled fusion, astrophysical and space plasmas, and societal and industrial applications.

**Content****A. Fusion energy**

- Basics (nuclear reactions, the Lawson criterion)
- Magnetic Confinement: MHD model
- Magnetic Confinement: Tokamak equilibrium, instabilities and operational limits
- Magnetic Confinement: Transport - theoretical basis and phenomenology
- Magnetic Confinement: Heating, burning plasmas, ITER and route to a power plant

**B. Industrial applications**

- The basics of plasma discharges for industrial applications
- Examples of plasma applications in industry and medicine

**C. Plasmas in nature**

- Astrophysics and space plasmas
- Solar physics - radiation transport and dynamo
- Magnetic reconnection and particle acceleration

**D. Plasma diagnostics**

- Categories of plasma diagnostics
- Measurements of plasma properties, magnetic properties and processes at the plasma-material interface

**Learning Prerequisites****Recommended courses**

PHYS-324 Classical electrodynamics, PHYS-325 Introduction to plasma physics and PHYS-423 Plasma I.

**Learning Outcomes**

By the end of the course, the student must be able to:

- Describe various applications of plasma physics
- Identify the main components and physics issues of magnetic confinement fusion
- Describe the main scientific issues in astrophysical plasmas
- Describe the main advantages of plasmas in industrial applications
- Describe the physics basis of key plasma diagnostics
- Work out / Determine when plasma effects are important

**Teaching methods**

Ex cathedra and exercises in class

**Assessment methods**

oral exam

**Resources****Moodle Link**

- <https://go.epfl.ch/PHYS-424>