PHYS-731

Magnetic confinement

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Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	4
Session	
Exam	Oral
Workload	120h
Hours	**56**
Lecture	28
Exercises	28
Number of positions	

Frequency

Every 2 years

Remark

Next time: Fall 2024

Summary

To provide an overview of the fundamentals of magnetic confinement (MC) of plasmas for fusion.The different MC configurations are presented, with a description of their operating regimes.The basic elements of particle & energy transport, of plasma-wall interaction & of burning plasma are introduced.

Content

The plasma heating techniques are addressed. The course aims at providing both an experimental and a theoretical approach to the subjects.
The course will consist of three parts:

• an overview of the different magnetic confinement configurations (tokamaks, stellarator, RFPs, ...) and of the operating regimes, with an introduction to the plasma-wall interaction and to the burning plasma physics;

• introduction to particle and energy transport in magnetic confinement devices (classical, neoclassical, and turbulent transport);

• basic principles of plasma heating and current drive, including heating due to fusion-generated alpha particles.

Learning Prerequisites

Required courses

The introductory plasma physics courses are a pre-requisite.

Resources

Bibliography

- P. Helander and D.J. Sigmar, "Collisional Transport in Magnetised Plasmas", Cambridge University Press, 2002
- P.C. Stangeby, "The Plasma Boundary of Magnetic Fusion Devices", CRC Press, 2000
- J. P. (Hans) Goedbloed, "Advanced MHD", Cambridge University Press, 2010
- R. B. White, "The Theory of Toroidally Confined Plasmas", Imperial College Press, 2006

- J. P. Freidberg, "Ideal MHD", Cambridge University Press, 2014
- J. Wesson, "Tokamaks", Oxford University Press, 1987
- J. P. Freidberg, "Plasma Physcs and Fusion Energy", Cambridge University Press, 2007