

PHYS – E0463: Fusion Energy Technology

Preface and course layout

Course objectives

- **Introduction** into thermonuclear fusion, principle, and concepts, and technology
- **Introduction to plasma physics:** PHYS-E0461 (fall), ELEC-E4520 (spring)
- **Advanced plasma physics course with computational emphasis (PHYS-E0566) held in winter/spring:** due to low attendance, course may be individual assignment → contact course teacher
- **Advanced courses have been / will be given as special lecture series upon anticipated attendance, e.g.,**
 - Gyrokinetic theory (2017)
 - Scrape-off layer physics (2018, 2021)

Course schedule 2023:

<https://mycourses.aalto.fi/course/view.php?id=36107>

- **Duration:** Jan 9 – Apr 12, 2023
 - Note, week of Feb 20-24, 2023 is a midterm (evaluation week), no lectures nor exercise class
 - Note, week of Apr 17-21, 2023 is the exam week for this course
- **Scheduled lectures:** Mondays 12.15 - 2.00pm
 - Zoom: <https://aalto.zoom.us/j/65475330447>, Y309a
 - Computer and/or mobile device required for online quizzes
- **Scheduled exercises:** Wednesdays 10:15am - 12:00pm, Y309b

Course schedule 2023:

<https://mycourses.aalto.fi/course/view.php?id=36107>

- **Jan 9, 2023:** attendance of lectures is possible both in-person (Y309a) and Zoom. Exercise classes are only available in-person (Y309b):
 - Only in special cases email submission of exercises can be agreed
- **Staff:** Mathias Groth, Timo Kiviniemi, Ray Chandra, Roni Mäenpää
 - e-mail addresses: first.lastname@aalto.fi

Course schedule 2023:

<https://mycourses.aalto.fi/course/view.php?id=36107>

- **Course material (e.g., lecture notes) on MyCourses:**

<https://mycourses.aalto.fi/course/view.php?id=36107>

- **Aalto Fusion and Plasma Physics group:**

<https://www.aalto.fi/en/department-of-applied-physics/fusion-and-plasma-physics/>

Course schedule 2023:

<https://mycourses.aalto.fi/course/view.php?id=36107>

- **5 credits:**

- 25% for attending lectures AND participating into online quizzes
- 50% for attending the exercise classes and completing the exercises
- 25% for the (final) exams ⇒ **provisionally, oral exams during week of April 17 – 21, 2023: pairs of two students, Q&A for 30 mins**

Course curriculum

- **Fusion principles and concepts**
- **Tokamaks, stellarators and laser facilities**
- **Heating systems and diagnostics**
- **Plasma-wall interaction and fusion materials**
- **Fuel cycle**
- **Future fusion reactors: ITER and DEMO**
- **Long-term role of fusion in meeting future energy needs**

Course material

- **Kikuchi, Lackner, Tran: “Fusion Physics” (2012)**
www-pub.iaea.org/MTCD/Publications/PDF/Pub1562_web.pdf
- **Wesson: “Tokamaks” (4th edition 2011)**
- **Dolan: “Magnetic Fusion Technology” (2014)**
- **Stacey: “Introduction to the Physics and Technology of Magnetic Confinement Fusion” (2010)**
- **Stangeby: “The Plasma Boundary in magnetic fusion devices” (2000)**
- **Duderstadt, Moses: “Inertial confinement fusion” (1982)**
- **Material from plasma physics summer schools**
- **Various review papers on fusion**