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Fakultät für Naturwissenschaften, Fachbereich Physik

Announcement

Plasma Physics: Applications
Nuclear Fusion Research and Magnetic Confinement of Plasmas

Dr. Eich

Description

Nuclear fusion is one of the promising options for generating large amounts of carbon-free energy in the future. Fusion is the process that heats the Sun and all other stars, where atomic nuclei collide together and release energy. Fusion scientists and engineers are developing the technology to use this process in tomorrow's power stations. This course gives an introduction to the basics of nuclear fusion in general with particular focus on modern magnetic confinement experiments such as ASDEX Upgrade in Garching and Wendelstein-7X in Greifswald. During the course actual problems and challenges for the development of today's experiment to large scale machines like ITER and commercially viable reactors (DEMO) will be discussed.

Learning Outcomes

Basics of Nuclear Fusion processes in nature (stars) and as envisaged in magnetic confinement experiments. Van-Allen-Radiation Belt as an example of a natural magnetic cage. Basics of plasma motion for high temperature fusion plasmas in magnetic cages. Requirement of the magnetic confinement proper-ties to reach breakeven in fusion reactors. Detailed description of the physical goals of the European fusion program ('Roadmap to fusion') and physical goal of the international thermonuclear experimental reactor ITER.

Content

Magnetic confinement, tokamaks, stellarators, fusion plasma basics, motion of charges particles in magnetic fields, fluid description of plasmas, drifts in electro-magnetic fields, plasma heating, plasma boundary physics, plasma surface interaction, power balance of fusion reactors, requirement for commercial power plants, necessity for CO2 free base load, socio-economic aspects of nuclear fusion, actual topics for fusion research, Special devices: ASDEX Upgrade, JET, ITER, Wendelstein-7X.

During and between the individual courses we do exercises to get more familiar with the content.

Prerequisites

Basics in Experimental Physics, Electro dynamic of advantage, Plasma I not necessary though beneficial.

Literature

Will be discussed on first lecture course, scripts are available on selected topics.

Additional information

Lecture (3 hours per week) with seminar (2 hours per week)

Begin: Wednesday, 20.04.2016, 12.30, N24/252

The course is very suitable to be combined with the seminar on 'Diagnostics for plasma physics and application to Nuclear Fusion research'.

6 ECTS credits

Assessment

Oral examination

Lecturer

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