Universität Ulm

Master of Science Physics (PO 2017)

Future Energy Supply and Nuclear Fusion Research

Code	8812874340
ECTS credits	3
Attendance time	2
Language of instruction	English
Duration	1 Semester Semester
Cycle	each Winter Semester
Coordinator	Dean of Physics Studies
Instructor(s)	Dr. Thomas Eich
Allocation of study programmes	Physics M.Sc., elective module, 1st or 2nd semester Wirtschaftsphysik M.Sc., elective module, 1st - 3rd semester
Recommended prerequisites	Basics in experimental physics and electrodynamics is an advantage.
Learning objectives	The German government has announced a planned transformation in its energy supply, the so-called ‚Energiewende'. The frequent discussion of this new policy in the German media reflects the importance of energy in our everyday life. Energy heats our homes and moves our cars . It is crucial for industry. Catch-phrases like 'energy crisis' or 'climate change' are regularly appearing in the news. This lecture course introduces the basics of energy supply in Germany and reports in detail about conventional energy sources such as coal, oil and nuclear, as well as alternatives such as wind, biomass and solar. The flow of energy, starting from production in industrial power plants or small scale local facilities, towards its consumption for private households, transport and industry, will be discussed. Alternative energy is only rarely produced in the same region where it is consumed. It is also highly intermittent. Thus, a very large expansion of the German power grid and its international connectivity is necessary. This is one of the most difficult challenges within the foreseen turnaround of energy supply. Particular emphasis will be placed on the extent to which nuclear-fusion-based

	power plants can contribute to a future CO2-free energy supply in Germany and worldwide. Towards this end of the lecture, the physical and technical basics of a nuclear fusion power plant will be presented. One focus will be current nuclear fusion experiments at the Max -Planck -Institute for Plasma Physics in Munich. A further focus will be the large nuclear fusion experiment ITER in France, a major international science project under construction by China, Europe, India, Japan, Russia, South Korea and the U.S., designed to demonstrate the production of 100’s of megawatts of heat from the fusion process for periods up to one hour.
Syllabus	• Energy supply in Germany and worldwide • Individual energy consumption: Balance Sheet • Basics of climate change • Nuclear fusion reactor, discussion of nuclear energy • In the seminar: Alternative energies such as wind, photo voltaic, hydro#energy, geothermal, solar thermal, tidal power plant, smart heating, e#mobility etc.
Literature	http://www.weltderphysik.de/gebiete/technik/energie/ E. Rebhan, Energiehandbuch T. Buhrke, Renewable Energy: Sustainable Energy Concepts for the Future, Wiley Klimawandel (S. Rahmstorf) Kernfusions-Forschung: Physik (H. Zohm)
Teaching and learning methods	Lecture with Seminar, block course.
Workload	15 h Lecture+ Seminar 45 h Self study and exam preparation Total: 60 h
Assessment	The credit points will be awarded once the oral exam has been passed. No prerequisites are necessary for exam registration.
Grading procedure	The grade of the module will be the grade of the exam.
Basis for	Research in Plasma Physics