LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Atomfysik
Atomic Physics

FAFF55, 6 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED N
Date of Decision: 2023-04-17

General Information

Main field: Technology.
Compulsory for: F3
Language of instruction: The course will be given in Swedish

Aim

The course gives, based on quantum mechanics, the basis of fundamental atomic physics, as well as technical applications, e.g., laser technology. It gives a broad orientation about microcosm, while at the same time including detailed studies of selected topics. The aim of this is to simultaneously practice quantum mechanical problem solving, and to stimulate the interest for further studies in the subject. By highlighting important technical applications the course aims at illustrating the mutual dependence between technology and basic science.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe the structure of atoms
- be able to describe, and in simple cases quantitatively estimate, the energy structure of an atom, using quantum mechanical methods
- have received insight into how different phenomena in atomic physics may in principle have the same quantum mechanical background, but with different orders of magnitude, e.g., energy level structures and emission or absorption of radiation
- have received a deepened insight into the close and mutual interaction between technology and natural science, and to be aware of and be able to describe typical

technical applications of atomic physics.

Competences and skills
For a passing grade the student must

- be able to apply quantum mechanical methods for analysis and estimates in physical problems within the area
- have developed his/her ability to plan, perform and analyze experiments and to present scientific results in writing

Contents

Size and mass of atoms. Models for atoms. Electron spin and space quantisation. Atoms in external magnetic fields. Addition of angular momenta, configuration, term, level and sublevel. Many-electron atoms and the central field approximation. The periodic table. Spontaneous emission and selection rules. Stimulated emission and lasers
action. Spectroscopic methods.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exam, passed laboratory work and corresponding written reports.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0122. **Name:** Laboratory Work.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Approved written laboratory report after each laboratory exercise.
Contents: Experimental work as laboratory exercises in small groups. Preparation before and reporting after each exercise is mandatory.
Code: 0222. **Name:** Atomic Physics.
Credits: 4,5. **Grading scale:** TH. **Assessment:** Written examination.

Admission

Assumed prior knowledge: FAFA55 Concepts in Quantum Physics, FMAN55 Applied Mathematics, Quantum Mechanics (by the latest followed concurrently)
The number of participants is limited to: No
The course overlaps following course/s: FAF270, FAFF10

Reading list

- Fox, Mark: A Student's Guide to Atomic Physics. Cambridge University Press, 2018, ISBN: 978-1-108-44631-0.

Contact and other information

Course coordinator: Per Eng-Johnsson, per.eng-johnsson@fysik.lth.se
Further information: Some elements may be taught and assessed in English. This includes a maximum of 1.5 hp, in the form of laboratory sessions or written assignments.