LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Kvantmekanik, fortsättningskurs 1
Quantum Mechanics, Advanced Course 1

FMFN01, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED F/Pi
Date of Decision: 2023-04-18

General Information

Main field: Nanoscience.
Elective for: F4, F4-tf, F4-f, F4-nf, F4-axn, MFOT1, MNAV2, N4-nf
Language of instruction: The course will be given in English on demand

Aim

The overall aim of the course is to provide an in-depth knowledge of quantum mechanics, which all physicists should have regardless of whether they are engaged in theoretical or experimental physics, since quantum mechanics is the basis of all modern physics. The course covers both theory and applications. Furthermore, it includes a project that gives training in some application of different fields in physics.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to give an account of the formalism and mathematical methods of quantum mechanics and apply them to concrete problems.

Competences and skills
For a passing grade the student must

- be able to use the methods of quantum mechanics for analysis and calculation of relevant physical problems
- be able to apply quantum mechanical thinking on concrete problems
- be able to give an account of a quantum mechanical application based on scientific literature

- be able to work independently with literature on a quantum mechanical problem in current research.

Judgement and approach
For a passing grade the student must

- be able to provide arguments for the usefulness of quantum mechanical theory in some applications
- be able to identify a physics question and provide arguments for its quantum mechanical description based on scientific literature.

Contents

The course covers the formulation of quantum mechanics in terms of operators and state vectors. The course covers the Schrödinger equation, identical particles, continuous spectra, the Heisenberg picture, angular momentum and symmetries as well as approximation methods. Applications are made on simple systems e.g. two-level systems, quantum dots, atomic nuclei, Bose-Einstein condensates or system in external fields.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Assessment takes the form of a written exam at the end of the course as well as orally and in writing in the form of a project during the course.

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: 0110. **Name:** Examination.
Credits: 6. **Grading scale:** TH. **Assessment:** Written exam. **Contents:** According to the lectures
Code: 0210. **Name:** Project Work.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Written and oral presentation. **Contents:** Subject choosen according to student interest

Admission

Assumed prior knowledge: Quantum mechanics corresponding to FMFF40 Quantum Mechanics, General Course or FMFF15 Quantum Mechanics and Mathematical Methods.
The number of participants is limited to: No
The course overlaps following course/s: FMF032, FMF033

Reading list

- Andreas Wacker, Gunnar Ohlen, and Stephanie Reimann: Compendium Quantum Mechanics FYSN17/FMFN01. Mathematical Physics, 2013. Available from the course home page.

Contact and other information

Course coordinator: Stephanie Reimann, Stephanie.Reimann@matfys.lth.se

Course homepage: http://www.matfys.lth.se/education/FMFN01