Course syllabus

Kärnstrukturteori
Theory of Nuclear Structure

FMFN15, 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

Elective for: F4, F4-tf
Language of instruction: The course will be given in English on demand

Aim

The course aims at giving a basic understanding of theoretical models used in nuclear physics, specifically focusing on the structure of atomic nuclei.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to understand and explain some models used in nuclear structure physics
- be able to analyse possibilities and restrictions of different models

Competences and skills
For a passing grade the student must

- be able to determine which mathematical models are appropriate in different situations
- be able to carry through advanced calculations using some different models
- be able to write reports on computer exercises with high demands on disposition, use of language and layout
- be able to extract the main content in simple scientific papers

Contents

Basic properties of the atomic nucleus. Nuclear potentials, deformed nuclei. Coupling of angular momenta and Clebsch-Gordan coefficiants. Some topics of current interest like rapidly rotating nuclei and nuclei far from the beta-stability line are introduced. Creation and annihilation operators are discussed and the theory of superconductivity (BCS theory) applied to nuclei is presented.

The course includes some computer based exercises where realistic nuclear models are used to calculate some interesting properties of nuclei.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: The student must pass an oral exam, successfully complete some homework assignments and take active part in computer exercises, and have the written reports on these exercises approved. The grade is based mainly on the oral exam.

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.

Admission

Assumed prior knowledge: FMFN01 Quantum Mechanics, Advanced Course 1 (spin formalism, Dirac notation, operator formalism of harmonic oscillator).
The number of participants is limited to: No
The course overlaps following course/s: FMF121

Reading list

- Nilsson, S.G and Ragnarsson, I: Shapes and shells in nuclear structure, Cambridge University Press, 1995 and recent reference material.

Contact and other information

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