



# SH2011 Theoretical Nuclear Physics 6.0 credits

Teoretisk kärnfysik

This is a translation of the Swedish, legally binding, course syllabus.

## Establishment

Course syllabus for SH2011 valid from Autumn 2007

## Grading scale

A, B, C, D, E, FX, F

## Education cycle

Second cycle

## Main field of study

Physics

## Specific prerequisites

Recommended prerequisites: Quantum physics 5A1324 or corresponding.

## Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

## Intended learning outcomes

The course gives an introduction to different models of theoretical nuclear structure physics. The aim of the course is to provide understanding of the fundamental excitations in atomic nuclei from a microscopic point of view and give capability to perform simple calculations.

## Course contents

Central forces, spherical tensors and angular momentum coupling by means of  $3j$ ,  $6j$  and  $9j$  symbols. The one particle potential, one particle excitations and the effect of polarization (concept of effective charge). Two-body forces and excitations in two-body systems. Anisotropic harmonic oscillator and the Nilsson model. The cranking approximation, the Inglis formula and determination of the moment of inertia. Quasispin and derivation of the BCS-equation. Second quantization, Wick's theorem, the self consistent Hartree-Fock potential and Hartree-Fock-Bogolyubov approximation. The Tamm-Dancoff (TDA) and Random Phase Approximation (RPA). Broken symmetries and separation of spurious modes by means of the RPA. Restoration of broken symmetries and particle number projection.

## Course literature

Own material and/or Kris L.G. Heyde, The Nuclear Shell Model, Springer.

## Examination

- TEN1 - Examination, 6.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

## Other requirements for final grade

Home assignments (INL1; 6 cr).

## Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.

- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.