Nuclear and Particle Physics

Module No.: MN-P-SP-Nuc, MN-P-PN-Nuc, MN-P-WaMa Version: 12.02.2014 SG

Course: Theoretical Nuclear Physics I

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Category	Type	Language	Teaching Hours	CP	Semester
Specialized Course	Lecture	English	2	3	SuSe

Requirements for participation:

Basic Knowledge in Nuclear Physics and Quantum Mechanics

Type of module examinations:

One oral examination at the end of the module

Duration of the course:

1 semester

Aims of the course:

Introduction to the theoretical description of nuclear structure. In part I emphasis is laid on angular momentum algebra and the shell model.

Contents of the course:

Angular momentum in quantum mechanics, the nuclear shell model, two identical particles outside a closed shell: Residual interaction, effects of configuration space, more identical particles outside a closed shell (optional), neutrons and protons: the isospin formalism.

The interacting boson model, second quantisation, occupation number representation, second quantisation: Bosons, second quantisation: Fermions, properties of the creation and annihilation operators, operators in second quantisation and their evaluation, angular momentum coupling, the Interacting Boson Model-I, the interacting boson approximation, the construction of the IBM-1 hamiltonian, the multipole expansion of the IBM-1 hamiltonian, operators in the IBM-1, the dynamical symmetries of the IBM-1, searching for a basis: analytically solvable Hamiltonians, the algebraic approach: dynamical symmetries, lie groups and algebras, Casimir operators, dynamical symmetries and the labelling of states, application to the interacting boson model, the generators of the U(6) group, the U(5) limit, the SU(3) limit, the O(6) limit, transitional regions.

Recommended literature:

A script will be distributed during the course.