

From nuclei to stars

Theoretical course

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1. Many-body quantum mechanics

- (a) One-body quantum mechanics
- (b) Many-body quantum mechanics
- (c) Nucleon d.o.f. and one-nucleon states
- (d) Two-nucleon states

2. Nucleon-nucleon interaction

- (a) Symmetries
- (b) Experimental constraints
- (c) Operators and interaction models
- (d) Brief comment on effective field theories

3. Second quantisation formalism

- (a) Fock space
- (b) Creation and annihilation operators
- (c) Slater determinants
- (d) Operators in second quantisation

4. Wick theorem

- (a) Normal product
- (b) Contractions
- (c) Wick theorem
- (d) Application to the nuclear Hamiltonian

5. Mean-field methods

- (a) Reference state and partitioning of the Hamiltonian
- (b) Independent-particle approximation
- (c) Hartree-Fock theory

6. Beyond Hartree-Fock*

- (a) Correlation expansion methods
- (b) Symmetries and spontaneous symmetry breaking
- (c) Hartree-Fock-Bogolyubov theory

*If time allows.