

# Shell model calculations and the production of nuclear Hamiltonians

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CEA/Saclay

Opening Remarks, 13 May 2013

# Revised schedule

Mon. 13 May	Tues. 14 May	Wed. 15 May	Thurs. 16 May
	09h30 Lecture III	09h30 Lecture V	09h30 Lecture VIII
	10h45 <b>Break</b>	10h45 <b>Break</b>	10h45 <b>Break</b>
11h15 Welcome	11h15 Lecture IV	11h15 Lecture VI	11h15 <b>Tutorial IV</b>
12h30 <b>Lunch</b>	12h30 <b>Lunch</b>	12h30 <b>Lunch</b>	12h30 <b>Lunch</b>
14h30 Lecture I	14h30 Tutorial I	14h30 <b>Lecture VII</b>	14h30 Tutorial V
15h45 <b>Break</b>	15h45 <b>Break</b>	15h45 <b>Break</b>	15h45 <b>Break</b>
16h15 Lecture II	16h15 Tutorial II	16h15 Tutorial III	16h15 Team Project
17h30 <b>End</b>	17h30 <b>End</b>	17h30 <b>End</b>	17h30 <b>End</b>

# Revised schedule

Thurs. 16 May	Fri. 17 May
09h30 Lecture VIII	09h30 Team Project II
10h45 <b>Break</b>	10h45 <b>Break</b>
11h15 <b>Tutorial IV</b>	11h15 Team Project III
12h30 <b>Lunch</b>	12h30 <b>Lunch</b>
14h30 Tutorial V	14h30 Presentations
15h45 <b>Break</b>	15h45 <b>Break</b>
16h15 Team Project I	16h15 Wrap-up
17h30 <b>End</b>	17h30 <b>End</b>

# Expectations

- Background knowledge
  - Basic quantum mechanics
    - Second quantization, angular momentum coupling, solutions to 1-D Schrödinger Eq.
    - Any missing information can be found in standard textbooks
  - Introductory nuclear physics
  - **No familiarity with shell model calculations**
- Lectures presented for students, tutorials for beginners
- Perform calculations individually, even for group exercises
- Short presentation ( $\approx 15$  min) on results
- Most important point
  - Ask questions!!
  - Before, during, and after lectures/tutorials

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# Topics

## • Covered topics

- General introduction
- Motivation for shell model
- Procedure for configuration interaction calculations
- Practical aspects for implementation
- Nuclear forces
- Renormalization group methods
- Derivation of effective interactions from microscopic potentials
- Effect of three-body forces



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- Bypassed topics
  - Other nuclear structure techniques
    - ① Energy density functional methods
    - ② Ab initio techniques (coupled cluster, Green's function Monte Carlo, etc.)
  - Reaction methods (beyond decays)
  - Recent advances in shell model techniques
    - ① Coupling to the continuum
    - ② No core shell model
    - ③ ...

# Topics

## • Covered topics-tutorial sessions

- Selection of model space and interaction
- Production of interactions
- Calculation of level schemes and decays
- Calculation of spectroscopic factors and transitions
- Limitations within a model space
- Inclusion of three-body forces
- Practical problems with shell model codes

# Practical Details

- **Controlled access: if you are stopped**
  - Show your ID
  - State your participation in tutorial at ESNT
- **Transportation required for lunch each afternoon**
  - CEA bus departs around 12:40pm each day outside of Building 703
  - Find organizers at cashier station
- Obtain wireless access from Danielle Coret (Office 146)
- **Buses to and from Le Guichet (RER B station to Paris)**
  - CEA line from Le Guichet to Saclay: 8am to 9:45am (every 15 minutes)
  - CEA line from Building 703 to Le Guichet: 5:18pm to 7:18pm (every 30 minutes)
  - Public buses (line 9): station outside of Saclay
- **Tutorial website (for lectures and other materials)**
  - <http://esnt.cea.fr/Phocea/page/index.php?id=22>
- **In case NUSHELLX is not operational currently**
  - Meet with Angelo today to discuss/solve issues