Shell model calculations and the production of nuclear Hamiltonians

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CEA/Saclay

Opening Remarks, 23 April 2012

Revised schedule

Mon. 23 April	Tues. 24 April	Wed. 25 April	Thurs. 26 April
	09h30 Lecture III	09h30 Lecture V	09h30 Lecture VIII
	10h45 **Break**	10h45 **Break**	10h45 **Break**
11h15 Welcome	11h15 Lecture IV	11h00 Lecture VI	11h15 Tutorial IV
12h30 **Lunch**	12h30 **Lunch**	12h15 **Lunch**	12h30 **Lunch**
14h30 Lecture I	14h30 Tutorial I	14h30 Lecture VII	14h30 Tutorial V
15h45 **Break**	15h45 **Break**	15h45 **Break**	15h45 **Break**
16h15 Lecture II	16h15 Tutorial II	16h15 Tutorial III	16h15 Team Project
17h30 **End**	17h30 **End**	17h30 **End**	17h30 **End**

Revised schedule

	Thurs. 26 April	Fri. 27 April
	09h30 Lecture VIII	09h30 Team Project II
	10h45 **Break**	10h45 **Break**
	11h15 Tutorial IV	11h15 Team Project III
	12h30 **Lunch**	12h30 **Lunch**
	14h30 Tutorial V	14h30 Presentations
	15h45 **Break**	15h45 **Break**
	16h15 Team Project I	16h15 Wrap-up
	17h30 **End**	17h30 **End**

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
  - Bus will depart 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: 5:23pm to 7:23pm (every 30 minutes)
  - Public buses (line 9): station outside of Saclay
- Tutorial website (for lectures and other materials)
  - http://irfu.cea.fr/Sphn/Espace_Theorie/Apr2012/index.php
- In case NUSHELLX is not operational currently
  - Meet with Angelo today to discuss/solve issues

Workshop dinner - "Chez Fernand"

- **Wednesday at 20h00** (leave with 18h50 CEA bus)

  - 127 boulevard du Montparnasse, 75006 Paris (RER B - Port Royal)
  - http://www.restaurant-chezfernand.fr/