Program for Nuclear Talent course on *Many-body methods for nuclear physics, from Structure to Reactions* at Henan Normal University, P.R. China, July 16-August 5 2018

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Motivation and introduction

To understand why matter is stable, and thereby shed light on the limits of nuclear stability, is one of the overarching aims and intellectual challenges of basic research in nuclear physics. To relate the stability of matter to the underlying fundamental forces and particles of nature as manifested in nuclear matter, is central to present and planned rare isotope facilities.
Important properties of nuclear systems which can reveal information about these topics are for example masses, and thereby binding energies, and density distributions of nuclei. These are quantities which convey important information on the shell structure of nuclei, with their pertinent magic numbers and shell closures or the eventual disappearence of the latter away from the valley of stability.
During the last decade, the study of nuclear structure and the models used to describe atomic nuclei are experiencing a renaissance. This is driven by three technological revolutions: accelerators capable of producing and accelerating exotic nuclei far from stability; instrumentation capable of detecting the resulting

===== Aims and Learning Outcomes =====

This three-week TALENT course on nuclear theory will focus on the Many-body methods for nuclear structure and reactions, focusing on nuclear shell model and/or coupled cluster theory and in-medium SRG with applications to structure and reactions. Via hands-on projects and series of exercise, the participants will have been exposed to the necessary tools and theoretical models used in modern nuclear theory.
Format: We propose approximately forty-five hours of lectures over three weeks and a comparable amount of practical computer and exercise sessions, including the setting of individual problems and the organization of various individual projects. The course starts July 16 (with arrival on July 15) and ends (the course) on August 3. A three days workshop will be organized from August 4 to August 6. The mornings will consist of lectures and the afternoons will be devoted to exercises meant to shed light on the exposed theory, and the computational projects. These components will be coordinated to foster student engagement, maximize learning and create lasting value for the students. For the benefit of the TALENT series and of the community, material (courses, slides, problems and solutions

Course Content and detailed plan

Lectures are approximately 45 min each with a small break between each lecture. The morning sessions are scheduled to end around 1230pm.

Week 1.

Day		Lecture Topics and lecturer	Projects and exercises
Monday	9am-1230pm 1230pm-230pm 230pm-6pm	Lunch +own activities	
Tuesday	9am-1230pm 1230pm-230pm 230pm-6pm	Lunch +own activities	
Wednesday	9am-1230pm 1230pm-230pm 230pm-6pm	Lunch +own activities	
Thursday	9am-1230pm 1230pm-230pm 230pm-6pm	Lunch +own activities	
Friday	9am-1230pm 1230pm-230pm 230pm-6pm	Lunch +own activities	

Week 2.

Teaching and projects

The course will be taught as an intensive course of duration of three weeks, with a total time of 45 h of lectures, 45 h of exercises, with the possibility to complete a final assignment if credits are needed. The organization of a typical course day is as follows:

Time	Activity
9am-1230pm	Lectures, project relevant information and directed exercises
1230pm-230pm	Lunch
230pm-6pm	Computational projects, exercises and hands-on sessions
6pm-7pm	Wrap-up of the day and eventual student presentations

Teachers and organizers

The local organizers are

1. Chun-Wang Ma at Henan Normal University, Xinxiang, Henan 453007, P.R. China
2. Furong Xu at School of Physics, Peking University, Beijing 100871, P.R. China
3. Shan-Gui Zhou at the Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing 100864, P.R. China

Thomas Papenbrock and Morten Hjorth-Jensen will also function as student advisors and coordinators.
The teachers are

4. Heiko Hergert at National Superconducting Cyclotron Laboratory and Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA
5. Morten Hjorth-Jensen at National Superconducting Cyclotron Laboratory and Department of Physics and Astronomy, Michigan State University, East Lansing, MI 48824, USA

Audience and Prerequisites

You are expected to have operating programming skills in in compiled programming languages like Fortran or C++ or alternatively an interpreted language like Python and knowledge of quantum mechanics at an intermediate level. Preparatory modules on second quantization, Wick's theorem, representation of Hamiltonians and calculations of Hamiltonian matrix elements, independent particle models and Hartree-Fock theory are provided at the website of the course. Students who have not studied the above topics are expected to gain this knowledge prior to attendance. Additional modules for self-teaching on Fortran and/or C++ or Python are also provided.

Venue and how to apply

Here we should place info in how to arrivem where to stay and when to apply