Notre Dame Science
Department of Physics

UNIFICATION OF STRUCTURE AND REACTION MODELS FOR THE STUDY OF WEAKLY BOUND AND RESONANT SYSTEMS

Colloquium

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4:00 P.M. NSH 118
(Refreshments at 3:30 P.M. NSH 202)

The new possibilities offered by accelerators of last generation have allowed to experimentally study exotic nuclei, lying close to drip-lines, which can be weakly bound or resonant at ground state level. Contrary to the nuclei of the valley of stability, they exhibit unique phenomena, such as halos, cluster emission, and strong isospin-symmetry breaking. In order to describe exotic nuclei at theoretical level, it is necessary to include inter-nucleon correlations and continuum coupling in nuclear models, which demands bound, resonant and scattering states to be treated in a unified manner. For this, the real-energy Shell Model Embedded in the Continuum (SMEC) and the complex-energy Gamow Shell Model (GSM) have been developed for light nuclei. Indeed, continuum shell model is the tool of choice to describe loosely bound and unbound small systems. In order to describe heavy nuclei at drip-lines, to which shell model framework cannot be applied, the Gamow Hartree-Fock-Bogoliubov (GHFB) model has been introduced, where the HFB equations are solved using continuous bases of real or complex energies.

Applications pertaining to reactions involving weakly bound and resonant nuclei, as well as binding energies of neutron-rich nuclei will be presented within SMEC. Topics of importance for light nuclei far from the valley of stability, such as binding energies, overlap functions, neutron correlations and charge radii will be considered within the GSM formalism. In the context of GHFB, the densities of neutron-rich spherical and axially deformed nuclei will be depicted. Use of the developed methods to domains outside nuclear physics will be briefly discussed in the context of the physics of dipolar anions.

All interested persons are cordially invited to attend.