



PhD position in experimental physics

Investigating alpha-clustering in neutron-rich Oxygen isotopes

Description:

The presence of clusters of nucleons in the ground state of nuclei is the main evidence for the existence of correlations between nucleons. These correlations affect both the quantum structure of the nucleus and the equation of state describing nuclear matter. The goal of this internship is to study the evolution of the α -clustering probability in the ground state of neutron-rich oxygen isotopes and its influence on neutron skin thickness and the density dependence of the symmetry energy.

To achieve this, we propose to perform an experiment at GANIL to investigate direct alpha-transfer reactions using ^{16}O , ^{18}O , and ^{20}O beams at 7.5 MeV/nucleon on a deuterium target. The aim is to determine the transfer cross sections and extract the corresponding spectroscopic factors. Reaction products will be identified using the FAZIA and INDRA detector arrays. Thanks to their high efficiency, excellent energy resolution, granularity, and multi-hit capabilities, these detectors will enable not only complete isotopic identification of the reaction products but also the reconstruction of unbound states through invariant mass determination.

Additionally, these measurements will provide insights into α -clustering in the excited states of the studied oxygen isotopes through competing inelastic reaction channels.

The experimental proposal has been accepted by the GANIL PAC and the experiment will be performed in spring 2027. A Master 2 internship before the PhD is strongly recommended, as it would allow the student to participate in the experiment, data acquisition and first data analysis.

Provisional PhD timescale:

Year 1: Bibliography review, experimental data analysis, and first interpretation of the results.

Year 2: Further interpretation and theoretical calculations in collaboration with theorists (Relativist Mean Field (RMF) and Anti-symmetrized Molecular Dynamics (AMD)).

Year 3: Preparation of scientific publications and writing of the doctoral thesis.

Expected skills:

Nuclear Physics, Computing

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