M1 Internship in experimental nuclear physics

Investigating α-clustering in neutron-rich Oxygen isotopes

The goal of this internship is to study the evolution of the a-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 direct α-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 a-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 will be performed in spring 2026.

Internship objectives:

1- Simulate the ^{16,18,20}O + ^{2}H reactions using the HIPSE and GEMINI codes.

2- Apply the FAZIA+INDRA filter to the simulated events.

3- Use the simulated results to optimize the experimental setup for the upcoming measurements.

In parallel, the student will participate to the INDRA+FAZIA experimental campaign at GANIL, taking place from April to June 2025.

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