Internship in experimental nuclear structure

Exploring magicity and nuclear forces in ^{68}Ni

We propose to study the magicity of ^{68}Ni by means of neutron adding and neutron removal transfer reactions (d,p) and (p,d), respectively. This way, we get unique access to the occupancy of the normally occupied orbits and the vacancy of the valence ones. If a sharp transition in occupancy is found, the nucleus is considered as magic, otherwise rather superfluid. Furthermore, this study also allows to study the spin-orbit and tensor forces, essential to the modeling of atomic nuclei, in a unique manner.

^{68}Ni was produced by means of the LISE spectrometer at GANIL, protons and deuterons produced arising from transfer reactions are detected in the highly-segmented Si array MUST2, gamma-rays with EXOGAM2 and incoming/outgoing nuclei tracks, energy losses and time-of-flights with sets of gas-filled detectors. The experiment was a true success.

The student will analyse data on this experimental work (which is the subject of a PhD) and participate to other experiments from March-July 2024 using the same experimental setup. It is therefore planned for the student to learn about the methods for producing radioactive ion beams with the LISE spectrometer, calibrating detectors, handling digital electronics, and to be educated to data analysis of a transfer reaction. On the physics point of view, one experiment planned next year during the internship on ^{34}Si has very strong similarities as the one ^{68}Ni with a characterization of its magicity and study of the role of spin-orbit forces. The other experiment of this campaign will deal on a topic related on nuclear clustering, thus ensuring a good physics background and experimental skill for the student.

Expected skills
C++, root, detection, simulation

This work can be pursued by a PhD-thesis

Contact: SORLIN Olivier
GANIL, BP 55027, 14076 Caen France

Phone: +33 (0)2 31 45 45 25
mail: sorlin@ganil.fr