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PhD position in Nuclear Physics

TESTING THE NUCLEAR INTERACTION AT THE DRIPLINE

A PhD position is open in the nuclear structure group of the Nuclear Physics Department (Irfu/DPhN) of CEA Saclay (France). The scholarship is granted upon validation of the candidate file.

The study of exotic nuclei located in the vicinity of the boundary beyond which atomic nuclei decay by the emission of proton or neutron (called dripline) allowed to discover new phenomena unforeseen by theory. One of the most spectacular being the observation of a neutron halo in some neutron-rich nuclei such as ^{11}Li. In terms of shell structure, we also observe evolution of the magic numbers established for stable nuclei. Those magic numbers, emerging from the strong interaction between nucleons, can evolve and even disappear, while some others appear while moving away from the stable nuclei such as in the Oxygen isotopes for N=14 and N=16. Studying the structure of exotic nuclei produced at low intensity by means of fragmentation at an energy of a few hundreds of MeV/nucleons requires the use of a thick target to increase luminosity which traditionally results in the degradation of the energy resolution due to uncertainty on the reaction location. The MINOS device, a liquid hydrogen target coupled to a vertex tracker and developed recently at IRFU, allows to access, for the first time, to this information in this kind of measurements.
The proposed thesis will focus on the study of two exotic nuclei (even located beyond the dripline). The first is the unbound neutron-rich nucleus ^{28}F for which several new unbound states were recently observed with some located above the two-neutron emission threshold, making it an ideal case to study the neutron-neutron interaction. The second nucleus is the proton-rich nucleus ^{22}Si (N=8, Z=14), predicted to have the properties of a magic nucleus. This study, also motivated by the magicity of ^{22}O, mirror of ^{22}Si, will allow to investigate the effects of the Coulomb interaction as well as possible coupling to the continuum due to the fact that only unbound states are expected in ^{22}Si.
The successful candidate will lead the analysis of data taken during two experiments using the MINOS device coupled to the SAMURAI spectrometer at RIKEN, Japan. The first experiment was performed in 2015 and the second one is expected to be scheduled in 2021-22. In both cases, the analysis will be followed by the interpretation of the results in collaboration with theoreticians. Finally, the candidate will join other experiments at RIKEN and GSI.

Only candidates holding a Master (or equivalent) degree in physics will be considered. The candidate should have an interest in experimental and theoretical nuclear physics, programming skills and speak English.
Interested candidates should send a CV and a letter of motivation to acorsi@cea.fr and aldric.revel@cea.fr as soon as possible. The contract can start from October 2021.