



PhD position in experimental physics

Experimental Study of the ^4He 0_2^+ Resonance through Multichannel Decay Using the ACTAR TPC

Description:

The 0_2^+ excited state of ^4He provides a unique opportunity to investigate the structure and decay of a light nucleus in the continuum. This Ph.D. project will focus on the experimental study of this resonance through the $^4\text{He}(n,n')$ reaction at the NFS neutron facility at GANIL. The experiment will employ the ACTAR TPC filled with pure ^4He gas to produce, detect and reconstruct the charged decay products with high efficiency. Particular attention will be devoted to identifying the three main decay channels, $^3\text{H}+p$, $^3\text{He}+n$, and $^2\text{H}+^2\text{H}$, and to studying their evolution as a function of excitation energy. A key objective will be to determine the relative contributions, and in particular the branching ratios, of these three decay channels. These experimental observables will provide stringent constraints on the predicted channel couplings and decay properties of the ^4He 0_2^+ resonance within the No-Core Gamow Shell Model. Detailed simulations, detector calibration, event reconstruction, and data analysis will be performed to extract the excitation function and decay-channel contributions with controlled uncertainties. The results will provide an important experimental test of the description of ^4He as an open quantum system and offer new insight into the structure and decay of its 0_2^+ resonance. The experiment proposal has been accepted by the GANIL PAC and will be performed in second half of 2027.

Provisional PhD timescale:

Year 1: Review the literature, contribute to experimental preparation and data acquisition, and begin detector calibration, event reconstruction, and data analysis.

Year 2: Complete the analysis and interpret the experimental results through No-Core Gamow Shell Model calculations in collaboration with GANIL theorists, with the aim of establishing quantitative experimental constraints on the model.

Year 3: Finalize the interpretation of the results, prepare scientific publications, and write the doctoral thesis.

Expected skills:

Nuclear Physics, Computing

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