STUDY OF CALCIUM ISOTOPES VIA COLD NEUTRON CAPTURE REACTIONS

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Nuclei around doubly closed shells play a crucial role in determining both the nucleonic single-particle energy levels and the two-body matrix elements of the effective nuclear interactions. Of particular importance is the comparison of experimental data with calculations either based on a shell-model approach or taking into account couplings between basic core excitations (such as vibrations) and single particles [1].

In this work we present a detailed γ-spectroscopy study of Ca isotopes, produced by a neutron capture reaction on a ^{48}Ca target. The experiment was performed at the PF1B cold-neutron facility at ILL (Grenoble, France), delivering, after collimation, a halo-free pencil beam with a capture flux on target of 10^8 s^{-1} cm^{-2}. The experimental set-up consisted of 46 HPGe crystals: 8 EXOGAM clover detectors, 6 GASP detectors, as well as two clovers from the ILL LOHENGRIN Instrument, ensuring a total photopeak efficiency of 6% [2]. The cold neutron capture reaction populated excited states of ^{49}Ca within a few units of spin, from the ground state up to the neutron binding energy in this nucleus. The same type of information is also obtained for ^{41}Ca and ^{45}Ca, owing to target contaminants of ^{40}Ca and ^{44}Ca. A key aspect of the analysis is the accurate measurement of angular correlations, which allow to establish spins and parities of several excited states. The experimental information on ^{41}Ca and ^{49}Ca, in particular, will be compared to preliminary calculations with a newly developed "hybrid" model [3], aiming at describing the entire excitation spectrum of one-valence-particle nuclei, including complex excitations arising from the coupling of the valence nucleon with excitations of the doubly-magic core.

REFERENCES

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