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Evolution of the N=50 shell gap: new insights from spectroscopic data on 82Ge

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The evolution of the N = 50 single-particle gap size from β stability towards the exotic 78Ni, at the origin of the magic nature of the N = 50 isotones, is still poorly understood. Experimental data indicate that the size of the effective N = 50 gap continuously decreases from stability down to Z = 32 [1]. This reduction must certainly be followed by a stabilization around Z = 30, a phenomenon that has still not received any theoretical explanation.

In 2018, the ν-Ball campaign took place at the ALTO facility of Orsay [2]. The γ-spectrometer was made of 34 HPGe detectors to perform high resolution γ-spectroscopy, coupled to 20 LaBr3 scintillators enabling the realization of fast-timing measurements. During this campaign, medium-spin yrast and near-yrast states of neutron-rich nuclei were successfully populated in the fission of a 232Th target exposed to the quasi-mono-energetic fast-neutron flux generated by LICORNE. Among all the reaction products, the N = 50 nucleus 82Ge have been identified. In this presentation, I will show results focusing on the new spectroscopic data obtained for the nucleus 82Ge [3]. Indeed, using double and triple γ coincidences in the HPGe of ν-Ball, we were able to add two new transitions and one excited state in its level scheme. The latter is interpreted as the 7+ state originating from the N = 50 core-breaking configuration $\nu(1g_{9/2})^{-1}\nu(2d_{5/2})^{1}$, and we discuss the relationship between its observed excitation energy and the effective N = 50 shell gap amplitude at Z = 32. This new information is used to quantify the evolution of the N = 50 gap from Z = 38 down to Z = 32. According to our analysis, the gap slope is almost three times as high as the one obtained in Ref. [1]. We propose for the first time to explain this
evolution by the effect of the isospin asymmetry of the pseudo-spin symmetry in this region [4].

In the future, at GANIL, there will be the opportunity to study N = 50 isotones on the neutron deficient side at the DESIR facility. The possibility to study nuclei close the N = Z line, near the doubly magic 100Sn nucleus, will allow to further study the role of the isospin asymmetry of the pseudo-spin symmetry in the evolution of the nuclear orbitals.

Références

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