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Nuclear structure of neutron-rich Ge isotopes

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Abstract

The region near ^{78}Ni is crucial for nuclear structure studies, as it lies around a doubly-magic shell closure ($Z = 28$, $N = 50$), making it an ideal testing ground for shell evolution and the interplay between single-particle and collective effects. Currently, many experimental and theoretical efforts are dedicated to investigating this region of the nuclear chart [1-3], aiming to understand the robustness of nuclear shells far from stability and the emergence of collective effects as nucleons are added. The interaction among valence nucleons may be capable of attenuating the magic nature of a nucleus very close to shell closures [4]. From this perspective, isotopes of Ge ($Z = 32$), could be of significant interest to understand the evolution of the $N = 50$ gap.

In the recent IS771 experimental campaign, neutron-rich Ge isotopes were investigated via decay spectroscopy at the ISOLDE Decay Station (ISOLDE, CERN) using very neutron-rich Ga beams, produced using the PSB protons impinging on a proton-to-neutron converter to fission a thick UC_x target. High production yields were achieved for isotopes such as $^{83-85}$Ga [5], populating $^{83-85}$Ge through β-decay and β-delayed neutron emission. The calculated yields for the different decays of this experiment were consistent with previous measurements.

The high yields together with the spectroscopic capabilities of the ISOLDE Decay Station, equipped with 10 HPGe detector clovers in a compact geometry, enabled a significant expansion of previous knowledge, including the identification of new transitions and levels, as well as the ability to carry out angular correlations measurements for spin-parity assignments. In addition, two $LaBr_3$ and three beta detectors were used to perform lifetime measurements of excited states in the subnanosecond range via fast-timing techniques.

In this contribution, the current status of the analysis of the experiment will be presented, focusing on the obtained yields, the extended level schemes extracted through high-resolution γ-ray spectroscopy and the preliminary results for lifetime measurements.

References

[1] R. Yokoyama et al., β-delayed neutron emissions from $N > 50$ gallium isotopes, Physical Review C **108** (2023) 064307.

[2] K. Sieja et al., Laboratory versus intrinsic description of nonaxial nuclei above doubly magic ^{78}Ni, Physical Review C **88** (2013) 034327.

[3] C. Delafosse et al., Pseudospin Symmetry and Microscopic Origin of Shape Coexistence in the ^{78}Ni Region: A Hint from Lifetime Measurements, Physical Review Letters **121** (2018) 192502.

[4] A. Huck et al., Beta decay of the new isotopes ^{52}K, ^{52}Ca, and ^{52}Sc; a test of the shell model far from stability, Physical Review C **31** (1985) 2226.

[5] ISOLDE yield database (development version), https://isoyields2.web.cern.ch/YieldDetail.aspx?Z=31.

Abstract

The region near 78Ni is crucial for nuclear structure studies, as it lies around a doubly-magic shell closure (Z = 28, N = 50), making it an ideal testing ground for shell evolution and the interplay between single-particle and collective effects. Currently, many experimental and theoretical efforts are dedicated to investigating this region of the nuclear chart [1-3], aiming to understand the robustness of nuclear shells far from stability and the emergence of collective effects as nucleons are added. The interaction among valence nucleons may be

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