Contribution ID: **82** Type: **Oral presentation**

Direct Observation of the competing M1 and isospin-forbidden M3 transitions from the decay of the IAS in ^{10}B

Friday, October 10, 2025 11:40 AM (20 minutes)

Structural effects in the lightest stable nuclei were the first to be studied experimentally. Early research focused on isospin mixing, properties of isospin multiplets, and α clustering. Recently, the existing experimental data for the γ decay of the stable N = Z doubly odd nuclei and the β decay of the corresponding isospin multiplets were reviewed [1]. Nowadays, with the advances in ab initio many-body theories, there is renewed interest in the structure of these nuclei. The reason is that most of the data were obtained in the second half of the last century and, in some cases, lacked the needed precision to meet these advances. Thus, many subtle structural effects remained unexplored.
A unique worldwide experimental setup created with a hybrid array of large-volume ELI-NP $LaBr_3:Ce$ and $CeBr_3$ and ROSPHERE HPGe detectors placed in BGO anti-Compton shields, which provides unprecedented γ-ray efficiency for high-energy γ-rays at IFIN 9 MV Tandem [2]. Excited states in ^{10}B were populated with the ^{10}B(p, p′γ)^{10}B reaction at 8.5 MeV, and their γ decay was investigated via the method of coincidence γ-ray spectroscopy. The state-of-art spectrometer allowed the observation of weak γ-ray transitions, such as the M3 transition between the $J_\pi, T = 0_1^+, 1$ isobaric analog state (IAS) and the $J_\pi, T = 3_1^+, 0$ ground state which competes with an M1 transition to the first excited $J_\pi, T = 1_1^+, 0$ state and the E2 transition between the $J_\pi, T = 2_1^+, 0$ state and the IAS, i.e., performing measurements of branching ratios at the level of 10^{-5} [3-6]. For the first time in ^{10}B, the competing M1 and isospin-forbidden M3 transitions from the decay of the IAS have been observed in an γ spectroscopy experiment. As a result, clustering effects in both the $3_1^+, 0$ gs, and the $0_1^+, 1$ IAS are suggested to enhance the M3 transition.

References:

[1] A. Kuşoğlu, D.L. Balabanski, Quantum Beam Sci., 7(3), 28 (2023)
[2] S. Aogaki, et al., Nucl. Instrum. Methods Phys. Res. A, 1056, 168628 (2023)
[3] A. Kuşoğlu, et al., Phys. Rev. Lett. 133, 072502 (2024)
[4] A. Kuşoğlu, Sci. Bull. 69 (21), 3303 (2024)
[5] A. Kuşoğlu, et al., Nuovo Cim. C, 47, 47 (2024)
[6] A. Kuşoğlu, et al., EPJ Web of Conferences 00020, 4 (2024)

Acknowledgment: This work was supported by the Romanian Ministry of Research and Innovation under research contract PN 23 21 01 06, the ELI-RO program funded by the Institute of Atomic Physics, Măgurele, Romania, contract number ELI-RO/RDI/2024-002 CHIPHERS and ELI-RO/RDI/2024-007 ELITE. FRX acknowledges support from the National Natural Science Foundation of China under Grants No. 12335007, 12035001, and 11921006, and the High-Performance Computing Platform of Peking University.

Primary author: KUŞOĞLU, Aslı (Extreme Light Infrastructure-Nuclear Physics (ELI-NP), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), 30 Reactorului Str., 077125 Bucharest-Măgurele, Romania)

Co-authors: BALABANSKI, Dimiter (Extreme Light Infrastructure-Nuclear Physics (ELI-NP), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), 30 Reactorului Str., 077125 Bucharest-Măgurele, Romania); FAN, Siqin (School of Physics, and State Key Laboratory of Nuclear Physics and Technology, Peking

University, Beijing 100871, China); HU, Rongzhe (School of Physics, and State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing 100871, China); XU, Furong (School of Physics, and State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing 100871, China); CONSTANTIN, Paul (Extreme Light Infrastructure-Nuclear Physics (ELI-NP), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), 30 Reactorului Str., 077125 Bucharest-Măgurele, Romania); SÖDERSTRÖM, Pär-Anders (Extreme Light Infrastructure-Nuclear Physics (ELI-NP), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), 30 Reactorului Str., 077125 Bucharest-Măgurele, Romania)

Presenter: KUŞOĞLU, Aslı (Extreme Light Infrastructure-Nuclear Physics (ELI-NP), Horia Hulubei National Institute for R&D in Physics and Nuclear Engineering (IFIN-HH), 30 Reactorului Str., 077125 Bucharest-Măgurele, Romania)

Session Classification: Session II