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Recent experimental results from the JYFL-ACCLAB along the proton dripline

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Since the previous edition of the Nuclear Structure conference in 2022, the experimental results of the Nuclear Structure Group of University of Jyväskylä, Finland, have focused in the proton dripline nuclei through in-beam recoil-decay tagging (RDT), and decay-spectroscopy techniques employing both major research installations hosted by the group, namely the vacuum-mode recoil separator MARA and the gas-filled recoil separator RITU. Some prime examples of the decay-spectroscopy results are the discoveries of many new isotopes. For example, using the MARA vacuum-mode recoil separator we have identified a new proton-emitting isotope 149Lu [1]. The decay Q-value of 1920(20) keV is the highest measured for a ground-state proton decay, and it naturally leads to the shortest directly measured half-life of 450+170 −100 ns for a ground-state proton emitter. Through non-adiabatic quasiparticle calculations we were able to conclude that 149Lu is the most oblate deformed proton emitter observed to date. Additionally, within the same beam time we collected a good number of RDT γ rays feeding the also proton-decaying 147Tm (πh11/2) and 147mTm (πd5/2) states, which we found both to be triaxial [2]. A few more examples of new isotopes discovered in JYFL would be the α-decaying isotopes 190At, discovered by Kokkonen et al [3] using the RITU separator, and 160Os, discovered by Briscoe et al with MARA [4]. In addition to the already mentioned 147Tm, in-beam γ-ray spectroscopy techniques has been used to study the heavy nuclei 211,213Ac by Louko et al [5], who found that the negative-parity low-lying excited states in Ac nuclei tend to follow the 2 +, 4 +, and 6 + states of the even-even Ra core. In other studies at the lead region Ojala et al [6] and Papadakis et al [7] combined two prompt in-beam spectroscopy techniques, namely γ-ray- and conversion-electron spectroscopy, in a RDT study of the triple-shape coexistence nucleus 186Pb and in recoil-tagging study of 188Pb, respectively. In the former the feeding of the 0 + 2 state, the interband 2 + 2 ⟶ 2 + 1 transition, and the energies of the electric monopole transitions from the excited 0 + states to the 0 + ground state were observed in 186Pb, based on which the shapes of the excited 0 + states were reassigned. In this talk I will summarize the experimental details, results, and interpretations of some selected results of the work carried out by the Nuclear Spectroscopy Group in JYFL-ACCLAB, together with the future prospects at the MARA-LEB radioactive-beam installation presently under construction in the laboratory.

[1] K. Auranen et al., PRL 128, 112501 (2022)
[2] K. Auranen et al., PRC 108, L011303 (2023)
[3] H. Kokkonen et al., PRC 107, 064312 (2023)
[4] A. Briscoe et al., PLB 847, 138310 (2023)
[5] J. Louko et al., PRC submitted (2024)
[6] J. Ojala et al., Comm. Phys. 5, 213 (2022)
[7] P. Papadakis et al., PLB. submitted (2024)

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