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New perspectives for studying nuclear collective states and exotic shapes with the EAGLE gamma spectrometer and the upgraded Recoil Filter Detector at HIL UW

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In this presentation, we will discuss the scientific objectives and prospects of the upcoming experimental campaign at the Heavy Ion Laboratory (HIL) in Warsaw. The integration of the modernized Recoil Filter Detector (RFD) with the EAGLE gamma-ray spectrometer [1] offers new opportunities to advance spectroscopic studies of deformed medium-mass nuclei at high spins. This setup is designed to improve sensitivity to gamma rays with high energies, which are typically subject to significant Doppler broadening due to the high recoil velocities of the emitting nuclei. Additionally, the upgraded system will enable the investigation of shape transitions in octupole-deformed thorium nuclei, where gamma-ray spectra are dominated by a large background from competing processes, such as particle evaporation and prompt fission.

The presentation will highlight selected results previously obtained with the RFD detector [2-6], with a particular emphasis on recent technical advancements in the experimental setup, i.e. modernization of its active elements and implementation of a digital signal readout system, which will significantly boost the efficiency of the device, enhance its performance, improve measurement precision, and broaden the scope of future experiments. It will make feasible gamma-ray spectroscopic studies of fast recoiling nuclei in light and medium mass regions as well as very heavy nuclei produced in fusion-evaporation reactions with very low cross-section. The combined use of the RFD and the particle detector DIAMANT [7-8] will improve the EAGLE setup's sensitivity, especially in experiments aimed at high spin studies in exotic nuclei.

References

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