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Nuclear fission studies in inverse kinematics with the R3B setup at GSI

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Despite the recent experimental and theoretical progress in the investigation of the nuclear fission process, a complete description still represents a challenge in nuclear physics because it is a very complex dynamical process, whose description involves the coupling between intrinsic and collective degrees of freedom as well as different quantum-mechanical phenomena. Due to this complexity and the use of different reaction mechanisms to induce the fission process, as well as the definition of different fission observables which were often biased by the experimental conditions, many contradictory results and conclusions exist in literature. In the last decade, unprecedented fission experiments have been carried out at the GSI facility using the inverse kinematics technique in combination with state-of-the-art detectors especially designed to measure the fission products with high detection efficiency and acceptance. For the first time in the long-standing history of fission, it was possible to simultaneously measure and identify both fission fragments in mass and atomic numbers and obtain many correlations among them sensitive to the fission process dynamics and the nuclear structure at the scission point. Recently, these measurements have been improved by combining the previous experimental setup with the calorimeter CALIFA (CALorimeter for In-Flight detection of gamma-rays and high energy charged pArticles) and the neutron detector NeuLAND (New LArge Neutron Detector) developed by the R3B collaboration, which allow us to measure the gamma rays and light particles in coincidence with the fission fragments. In this talk I will show the results obtained in all these experiments, summarizing as well the new ideas for the future fission experiments at FAIR.

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