Contribution ID: **195** Type: **Oral Contribution**

Nuclear fission at storage rings

Thursday 27 October 2022 09:40 (35 minutes)

Nuclear fission is a rich laboratory for studying structural, dynamical and statistical properties of nuclei. It is also highly relevant for understanding the origin of heavy elements in stars. In addition, fission is a powerful source of energy and therefore also very important for industry and society.

One of the most important fission quantities is the fission barrier as it defines the fission probability. The most direct way (and often the only way) to obtain fission barriers is to measure the fission probability as a function of the excitation energy of nuclei formed by transfer and inelastic scattering reactions. In [1] we have shown that the measurement of the fission probability together with the probabilities for the de-excitation channels that compete with fission (i.e. gamma or neutron emission) sets strong constraints to the description of the de-excitation process and can lead to a significant reduction of the uncertainty of the fission barrier parameters. However, the measurement of gamma- or neutron-emission probabilities in standard experiments is very difficult due to the very low detection efficiencies for gamma rays and low-energy neutrons. Moreover, so far decay probabilities have only been measured for nuclei close to the valley of stability due to the difficulty to produce and handle radioactive targets.

The NECTAR (NuclEar reaCTions At storage Rings) project aims to circumvent these problems by performing measurements in inverse kinematics at storage rings. The inversion of the kinematics makes possible the study of short-lived nuclei and the detection of the beam-like residues produced after neutron and gamma-ray emission with high efficiencies. The long-standing issues related to the interaction of a heavy ion beam and a thick target can be solved by using a storage ring. Indeed, in a storage ring, heavy, radioactive ions revolve at high frequency passing repeatedly through an electron cooler, which will greatly improve the beam quality and restore it after each passage of the beam through the internal gas-jet serving as ultra-thin, windowless target. This way, excitation energy and decay probabilities can be measured with unrivaled accuracy.

In this contribution, I will present the NECTAR project whose aim is to measure for the first time simultaneously fission, neutron and gamma-ray emission probabilities at the storage rings of the GSI/FAIR facility. I will also present the first results of the proof of principle experiment, which we have performed in June 2022 at the ESR storage ring of GSI/FAIR. Finally, I will discuss the short- and long-term perspectives for the study of fission at storage rings.

[1] R. Pérez Sánchez, B. Jurado et al., Phys. Rev. Lett. 125 (2020) 122502

Acknowledgment: This work has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (ERC-Advanced grant NECTAR, grant agreement No 884715).

Primary author: JURADO APRUZZESE, Beatriz (LP2I Bordeaux)

Presenter: JURADO APRUZZESE, Beatriz (LP2I Bordeaux)

Session Classification: Plenary Talks

Track Classification: Plenary Talks