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Surrogate reactions at ion storage rings

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The surrogate-reaction method is a powerful method to indirectly infer neutron-induced cross sections of very short-lived nuclei. When the surrogate method is used in inverse kinematics, the nucleus formed in the neutron-induced reaction of interest is produced by a reaction (typically a transfer or an inelastic-scattering reaction) involving a radioactive heavy-ion beam and a stable, light target nucleus. The decay probabilities (for fission, neutron and gamma-ray emission) as a function of excitation energy of the nucleus produced by the surrogate reaction provide precious information to constrain models and enable much more accurate predictions of the desired neutron-induced cross sections [1].

Yet, the full development of the surrogate method is hampered by the numerous long-standing target issues. The objective of our project is to solve these issues by combining surrogate reactions in inverse kinematics with the unique and largely unexplored possibilities at heavy-ion storage rings. In this contribution, I will present the conceptual idea of the setup, which will be developed to measure for the first time simultaneously the fission, neutron and gamma-ray emission probabilities at the storage rings of the GSI/FAIR facility. I will also discuss the technical developments that are being carried out towards these measurements.

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

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