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Surrogate reactions in inverse kinematics at heavy-ion storage rings

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In this contribution, I will present the NECTAR project, which uses for the first time surrogate reactions in inverse kinematics at a heavy-ion storage ring. This allows one to measure all the de-excitation probabilities as a function of the excitation energy of the nuclei formed through the surrogate reaction with unrivaled efficiency and precision, and to indirectly determine neutron-induced cross sections of short-lived nuclei, which are currently not measurable.

I will describe our new methodology and the results of the first two surrogate-reaction experiments, which we have successfully performed at the ESR storage ring of the GSI/FAIR facility in Darmstadt, Germany. In these experiments we have investigated the (p,p'), (d,p) and (d,d') surrogate reactions and have achieved a significant breakthrough by measuring for the first time the fission, gamma-ray, neutron and even two- and three-neutron emission probabilities simultaneously. The measurement of all competing decay channels makes it possible to determine fundamental quantities, including fission barriers, particle transmission coefficients, gamma-ray strength functions, and nuclear level densities, and to employ them to infer (n,f), (n,gamma), (n,n'), (n,2n), and (n,3n) cross sections.

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