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MNT reactions with slowed-down relativistic beams –on a pathway to heavy-ion Coulomb barrier reactions with secondary beams

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The properties of heavy neutron-rich nuclei are critical to explain the formation and existence of heavy elements in the universe. However, it is well known that certain regions on the nuclear chart, particularly those heavier and more neutron-rich than the heaviest stable primary beams, i.e., ^{238}U, cannot be accessed using conventional production methods. Among the alternative approaches, multinucleon transfer (MNT) reactions have emerged as the most promising mechanism for reaching these challenging regions. MNT reactions also offer an efficient route for producing exotic isotopes along the line □=126, which are relevant to the origin of the third abundance peak in the rapid neutron-capture process (r-process). Realizing the full potential of this method will require the use of neutron-rich secondary beams.
To explore this potential, the Super-FRS experiment collaboration has started a program to conduct MNT experiments at GSI/FAIR. These experiments will utilize both stable and, eventually, secondary beams at the FRS and the Super-FRS. The reaction targets are located inside the cryogenic stopping cell, and the identification of the reaction products is performed using the high-resolution and broadband MR-TOF-MS. Tests at the FRS Ion Catcher have confirmed the feasibility of this experimental design [1]. The future Super-FRS Ion Catcher, equipped with a larger stopping cell, will enable MNT studies with highly intense beams.
This contribution will present preliminary results obtained using 238U stable beams, as well as further tests and plans involving secondary beams.
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