Probing the Production of Neutron-Rich Nuclei Towards the r-Process Path via Multinucleon Transfer Reactions

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The production and study of nuclides at the extremes of nuclear stability toward the neutron dripline have become a central focus in the nuclear physics community to understand various astrophysical processes, most notably the rapid neutron capture process (r-process), which plays a significant role in the production of half of the abundance of nuclides heavier than iron [1]. Along the lines of these studies, we investigated medium-mass heavy-ion reactions at energies of 15–25 MeV/nucleon to access nuclides with high neutron excess [2,3].

In this contribution, we present experimental data from two representative reactions analyzed using different spectrometers. Specifically, we studied the reaction of ^{70}Zn (15 MeV/nucleon) + ^{64}Ni with the use of the MAGNEX large-acceptance spectrometer at the INFN-LNS in Catania, Italy, as well as the reaction of ^{86}Kr (15 MeV/nucleon) + ^{64}Ni by employing the MARS spectrometer at Texas A&M University, USA. The experimental data were compared with theoretical model calculations.

Through this parallel contrast of the results from both reaction systems, we aim to gain insights into the optimum experimental conditions that may enhance our understanding of exotic nuclei production, ultimately contributing to a deeper exploration of nucleosynthesis processes, particularly those associated with the rapid neutron capture (r-process) pathway.

References:

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