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Advances in Heavy-Ion Transfer Reactions: Insights from Recent Experiments at LNL-INFN

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Transfer reactions play a crucial role in studies of nuclear structure and reaction mechanism. In heavy-ion transfer reactions, multiple nucleons can be transferred along with significant energy and angular momenta from the relative motion to the intrinsic degrees of freedom in a single collision [1,2]. This makes multinucleon transfer reactions a valuable tool for investigating various topics, ranging from nucleon-nucleon correlations to reaction dynamics [3].

Recent experiments conducted at the Legnaro National Laboratories (LNL, INFN) have focused on studying nucleon-nucleon correlations using heavy-ion beams on medium-mass targets in inverse kinematics [4,5]. Reaction products were detected at forward angles using the large solid angle magnetic spectrometer PRISMA. Transfer cross sections were measured across a wide range of energies, from near to far below the Coulomb barrier. The results were interpreted through excitation functions, extending down to very low energies corresponding to large distances of closest approach, where nuclear absorption is minimal.

Additionally, experiments were conducted to investigate the production mechanism of neutron-rich nuclei [6-8]. Transfer processes between heavy ions at energies near the Coulomb barrier have emerged as a competitive method for producing exotic species, particularly heavy neutron-rich nuclei.

This presentation will provide an overview of these experiments, with a particular emphasis on the main results and challenges encountered. New achievements will also be discussed, especially in connection with the AGATA array currently coupled to PRISMA.

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Author: MIJATOVIĆ, Tea (Ruder Boskovic Institute, Zagreb, Croatia)

Orateur: MIJATOVIĆ, Tea (Ruder Boskovic Institute, Zagreb, Croatia)

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