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Recent studies of heavy ion transfer reactions using large solid angle magnetic spectrometers

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Transfer reactions produce a wealth of nuclei in a wide energy and angular range and with cross sections spanning several orders of magnitude. Total angle and energy integrated cross sections for transfer channels have been investigated with spectrometers in various systems close to the Coulomb barrier. Such ingredients allow one to understand how nucleons are exchanged between projectile and target and how energy and angular momentum are transferred from the relative motion to the intrinsic excitation. The recent results of the multinucleon transfer reaction studies with neutron-rich projectile emphasized that these reactions provide a suitable mechanism to populate neutron-rich heavy nuclei [1,2].
The transfer reactions are among the most important tools to probe nucleon-nucleon correlations in nuclear systems. The pairing interaction induces correlations that are essential in defining the properties of finite quantum many body systems in their ground and neighboring states. These structure properties may influence in a significant way the evolution of the collision. Recently, pair correlations were probed in heavy ion collisions by performing studies far below the Coulomb barrier with the PRISMA spectrometer for several systems. The microscopic calculations that incorporate nucleon-nucleon correlations well reproduce the experimental data in the whole energy range, in particular, the transfer probability for two neutrons is very well reproduced, in magnitude and slope [3].
The talk will focus on the main outcome of these recent studies, critically addressing the new achievements, the present problems and new challenges, especially in view of forthcoming experiments to be performed with exotic beams at the radioactive beam facilities.

[1] T. Mijatovic et al., Phys. Rev. C 94 (2016) 064616.
[2] F. Galtarossa et al., Phys. Rev. C 97 (2018) 054606.
[3] D. Montanari et al., Phys. Rev. Lett. 113 (2014) 052601.

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