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Sub-barrier transfer reactions and the nuclear Josephson effect

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A series of sub-barrier transfer experiments have been recently carried out at LNL, with reaction products detected in inverse kinematic and at forward angles with the large solid angle magnetic spectrometer PRISMA. We measured transfer cross sections far below the Coulomb barrier, making excitation functions down to very low energies. At these low energies, corresponding to very large distances of closest approach, the nuclear absorption is small [1,2,3] and one can probe nucleon-nucleon correlation properties. For the (well Q-value matched) one and two neutron transfer channels in the system 60Ni+116Sn the microscopic calculations very well reproduce the experimental data in the whole energy range, both in magnitude and slope [2]. The fact that most of the cross section of the two neutron transfer channel is in the ground to ground state transition has been further confirmed by a second experiment [4]. Proton transfer channels have been also analyzed [5], showing a large yield in the population of two proton transfer channels, indicating the presence of strong proton-proton correlations.
These kind of studies, where we followed the behaviour of the transfer probabilities by varying the in ternuclear distance, turned out to be fundamental to probe nucleon-nucleon correlation effects, where the interaction between the nuclear surfaces plays a fundamental role. In this context, the coupling of the AGATA gamma array to PRISMA offered a unique opportunity to study a nuclear (alternating current (AC)) Josephson-like effect [6], with Cooper-pair tunnelling between superfluid nuclei, whose manifestation has been recently proposed [7] using the data of Refs. [2,4] as a stepping stone. Predictions have been made of a specific gamma strength function associated with the dipole oscillations generated by the, mainly successive, two neutron transfer process. In a very recent experiment carried out at LNL with PRISMA+AGATA we directly tested for the
first time the possible manifestation of this important effect of Cooper pair behaviour, observed to date only in condensed matter physics.
After a general overview on the subject, the talk will focus on new results, addressing the new achievements and the critical issues.

[1] L. Corradi et al., Phys. Rev. C 84, 034603 (2011).
[2] D. Montanari et al., Phys. Rev. Lett. 113, 052601 (2014).
[3] L. Corradi, G. Pollarolo, and S. Szilner, J. Phys. G: Nucl. Part. Phys. 36, 113101 (2009).
[4] D. Montanari et al., Phys. Rev. C 834, 137477 (2022).
[5] L. Corradi et al., Phys. Lett. B 93, 054623 (2016).
[6] B.D. Josephson, Phys. Lett. 1, 251 (1962).
[7] G. Potel, F. Barranco, E. Vigezzi, and R. A. Broglia, Phys. Rev. C 103, L021601 (2021).

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