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# Searching for the nuclear Cooper pairs

The pairing interaction induces nucleon-nucleon correlations that are essential in defining the properties of finite quantum many-body systems close to their ground states. A very specific probe of this pairing component in the nuclear interactions, which ties up nucleons in a highly correlated state, the nuclear Cooper pairs, is the two-nucleon transfer reactions. How paring correlations can be probed in heavy-ion collisions, is still an open question. Several experiments have been performed in the past, searching for signatures mainly via extraction of the enhancement coefficients, defined as the ratio of the actual transfer cross section and the prediction of the model using uncorrelated states. Unfortunately, experimental evidence of these factors is marred by the fact that all existing studies involve reactions at energies higher than the Coulomb barrier, where the reaction mechanism is the result of the interplay between nuclear and Coulomb interactions.

With the development of the new instrumentation, it nowadays became possible to measure the heavy-ion transfer reaction with high efficiency and good ion identification even at very low bombing energies where nuclei interact at large distances [1]. Multinucleon transfer reactions were measured in the $^{206}$Pb + $^{118}$Sn system at the INFN-LNL accelerator complex. The measurement has been performed in the inverse kinematic, by using the heavy $^{206}$Pb beam, and by detecting the lighter reaction fragments in the magnetic spectrometer PRISMA. The total cross sections of different transfer channels will be extracted in an energy range from above to well below the Coulomb barrier. By direct comparison of one- and two-nucleon transfer probabilities (one expects that the probability for the two-nucleon channel is proportional to the square of the single-particle one) we will extract the enhancement factors at the large distances. In the second stage, the experimental results will be compared with the state-of-the-art microscopical calculations which include correlations [2].

[1] Corradi, L., et al., J. Phys. G, 36 (2009) 113101.
[2] Montanari, D., et al., Phys.Rew.Lett., 113 (2014) 052501.

**Primary author(s) :** DIKLIĆ, Josipa (Ruđer Bošković Institute)

**Co-author(s) :** SZILNER, Suzana (Ruder Boskovic Institute, Zagreb)

**Presenter(s) :** DIKLIĆ, Josipa (Ruđer Bošković Institute)