DESCRIPTION OF MULTI-NUCLEON TRANSFER AND FUSION REACTIONS WITH THE COUPLED CHANNEL METHOD

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Heavy-ion transfer reactions are an ideal tool to study the pair correlations. New experimental data show that the probability to transfer a pair of neutrons is enhanced compared to the expected value in the uncorrelated limit or pure sequential transfer. In order to understand this enhancement, we first use a semiclassical model approximation and show that a direct coupling between the entrance and the pair transfer channels improves the description of the experimental one- and two-neutron transfer cross sections for the 40Ca+96Zr and 60Ni+116Sn systems.

In this model, we discuss the validity of the perturbative approach and highlight the effect of high-order terms. We show that a pure sequential transfer can not reproduce the enhancement of the pair transfer. The effect of absorption due to the capture process is also investigated for energies around the Coulomb barrier. We find that the absorption plays an important role at energies close to the barrier.

Finally, we use a quantal coupled-channels approach to achieve a simultaneous description of the fusion cross sections and the transfer probabilities for the 40Ca+96Zr reaction. We find a significant effect of the couplings to the collective excited states on the transfer probabilities around the Coulomb barrier. We succeed in reproducing simultaneously the fusion cross sections, the fusion barrier distribution, and the transfer probabilities up to the three-neutron transfer channel, by including both the collective excitations and the transfer channels in the coupled-channels calculations.