QUASIELASTIC KNOCKOUT OF CLUSTERS BY ELECTRONS AND NUCLEAR RESTRUCTURING EFFECTS

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Up to now, our understanding of cluster formation in nuclei and cluster decay is far from complete. There is very little information on the amplitudes of various cluster components in nuclear wave functions and on the dynamics of cluster restructuring ("off-diagonal" cluster transitions) in reactions. Cluster knockout processes can serve as an useful tool for identifying corresponding dynamics. Earlier we studied this problem for proton induced reactions [Phys. Rev. **C55** (1997) 302] and predicted certain signatures of the presence of virtually excited clusters in the initial state. Here we formulate a general microscopic formalism for the description of quasielastic knockout of α - clusters by ultrarelativistic electrons from p-shell nuclei. Our major interest is focused on the influence of nuclear structure on the experimentally observed differential cross sections and angular distributions.

Although all necessary formulas, including those accounting for the final state interaction between the knocked out cluster and the residual nucleus were derived, our numerical calculations for the particular ^{12}C(e,e$'\alpha$)^{8}Be reaction were carried out mainly in the simplest PWIA approximation. The DWIA results bear only qualitative character. The reasons for this are (i) the desire to avoid overloading the formalism by technically complicated details which are of minor importance from the viewpoint of nuclear structure; (ii) the absence of well defined optical potentials for the α - ^{8}Be system. Nevertheless, even at this stage the calculated cross sections and angular distributions allow us to make a number of useful conclusions.

In the energy sharing experiments, the difference between the transitions which are diagonal and nondiagonal with respect to the internal state of the knocked out α - cluster and, therefore, the difference between the cross sections, is relatively small. The influence of virtually excited clusters is quantitative rather than qualitative, at least in the considered electron energy range, and it is further suppressed by the distortion effects. The effects due to the final state interaction are in general comparable to the effects caused by the nuclear restructuring. The most appreciably the signatures of the nondiagonal processes become visible in the quasielastic peak, in particular for the transitions into excited states of the residual nucleus. For the transitions into 2^+ and 4^+ states of ^{8}Be we have obtained a clear enhancement of the nuclear restructuring effects.