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Study of fusion, transfer, and breakup reactions with weakly bound nuclei 6,8He

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Fusion cross sections $\sigma_{\rm fus}$ for the strongly bound nucleus ^{4}He and the weakly bound nuclei ^{6,8}He have differences in the width of the main maximum of the barrier distribution function $D(E) = d^2\left(E\sigma_{\rm fus}\right)/dE^2$ [1] near the Coulomb barrier (see Fig. 1). It indicates the differences in the mechanisms of interaction of these projectiles with target nuclei. These differences are the result of correlation between the relative motion of nuclei and their internal degrees of freedom. For simplicity, we use the model of discretization of barrier distributions and multi-dimensional potential barriers. We assume that the cross sections for fusion and transfer channels may be represented as combinations of the cross sections for the finite numbers of one-dimensional radial Coulomb barriers $V_i(r)$ with weights w_i determined by fitting of experimental barrier distribution functions and fusion cross sections. Numerical solution of the time-dependent Schrödinger equation [2] and the coupled channel method [3] are used to investigate the dynamics of transfer and breakup reactions of ^{6,8}He nuclei in the interaction with ^{197}Au, ^{208}Pb nuclei at energies near and above the Coulomb barrier and to calculate the cross sections of these reactions.

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