Decoherence in nuclear collisions: the role of the exit doorway

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Abstract- We discuss the influence of breakup coupling on tunneling and fusion using the concept of exit doorway. We consider the doorway as a resonance with only an escape width which simulates the continuum [1]. The tunneling probability is calculated assuming a model of two coupled channels; the elastic channel and the "excited" channel with complex energy $E_d = \varepsilon_d - i\Gamma_d/2$, [2, 3]. It is found that the presence of the width reduces the tunneling/fusion at sub-barrier energies. This is a consequence of the intrinsically irreversible nature of the coupling. Such treatment of coupling to the continuum is manifestly decoherent, as the flux lost to the breakup is never recovered, quite reminiscent of deep inelastic reactions. Application of our model to the fusion of halo nuclei along the line of [4] seem to indicate that fusion is hindered owing to the coupling to the exit doorway. At much lower energies, however, the coupling becomes virtual and static effects related to the halo becomes more relevant leading to an enhanced tunneling/fusion when compared to non-halo nuclei [5].

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