

Abstract Submitted  
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**The role of internal degrees of freedom in reactions with composite systems**<sup>1</sup> NAUREEN AHSAN, ALEXANDER VOLYA, Florida State University — The effects of the intrinsic structure of composite objects in quantum-mechanical processes, such as tunneling or scattering, are important components of nuclear fusion, fission, particle emission, and reaction physics in general. These processes are governed by non-perturbative physics with exponential sensitivity to various conditions. While a number of approximate methods to treat these problems are available, these techniques have their limitations and include approximations which, given the exponential sensitivity and non-perturbative nature of underlying physics, may lead to significant deviations from the exact results; furthermore, these deviations are often unexpected and counterintuitive. In this presentation we discuss the scattering and tunneling processes for a two-body system coupled by the harmonic oscillator or the infinite square well potentials. Assuming a deuteron-like behavior where only one of the particles interacts with the scattering potential (Coulomb force) we find the exact solution to this problem. This study reveals that while the problem is well defined, the mathematics and physics behind the solution are complicated. The virtual excitations into closed channels grow exponentially in the interaction region; even in the low-energy limit, the behavior of the solution shows strong sensitivity to the mass ratio of bound constituents and exhibits a resonant behavior.

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