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Tunneling probability: an evaluation of different approximations[1]

MING LI, CONSTANTINOS MAKRIDES, BO GAO, University of Toledo — Before the recent developments in the quantum-defect theory[2] and the related analytic solutions for $1/r^n$ type of long-range potentials, there were virtually no exact result of tunneling for physically realistic systems, which made the evaluation of different approximations, such as the ubiquitous semiclassical approximation, difficult. By comparing with the exact analytic results of tunneling for $-1/r^6$ and $-1/r^4$ types of potentials, we carefully evaluate the validity of the semiclassical and the top-of-barrier[3] approximations for tunneling through the angular momentum barrier in atom-atom, ion-atom, and electron-atom interactions.

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[2]B. Gao, Phys. Rev. A **78**, 012702 (2008).
[3]S. J. Ward and J. H. Macek, Phys. Rev. A **62**, 052715 (2000).

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