Dynamically assisted tunneling in the impulse regime

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We present our study on the enhancement of quantum tunneling rates through a potential barrier V(x) employing pulse-shaped vector potentials. In this regard, we discuss our findings regarding a novel enhancement effect where a pulse $A(t)=A_0/\cosh^2(\omega t)$ "pushes" parts of the quantum wave function out of the rear end of the barrier. This effect persists for Coulomb potentials thus opening up the possibility for applications in controlled fusion experiments [1].

Special emphasis is put on obtaining the enhancement effects in time-dependent tunneling rates for deuterium-tritium as well as proton-boron fusion [2]. Furthermore, we perform a scaling analysis comparing the relevant energies and field parameters within the different types of nuclear fusion reactions. In this regard, we discuss two characteristic dimension-less parameters that distinguish the different regimes of quantum tunneling.

Further possible applications include condensed matter, atomic physics, Coulomb ratchets, electron-positron pair production [3] as well as muon-assisted fusion and assisted nuclear alpha-decay [4].

References

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