Dynamically Assisted Tunneling in the Impulse Regime

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We study the enhancement of tunneling through a potential barrier $V(x)$ by a time-dependent electric field with special emphasis on pulse-shaped vector potentials such as $A_x(t) = A_0/\cosh^2(\omega t)$. In addition to the known effects of pre-acceleration and potential deformation already present in the adiabatic regime, as well as energy mixing in analogy to the Franz-Keldysh effect in the non-adiabatic (impulse) regime, the pulse $A_x(t)$ can enhance tunneling by "pushing" part of the wave-function out of the rear end of the barrier. Besides the natural applications in condensed matter and atomic physics, these findings could be relevant for nuclear fusion, where pulses $A_x(t)$ with $\omega = 1$ keV and peak field strengths of 10^{16} V/m might enhance tunneling rates significantly.