Superluminal Tunneling Confronts Special Relativity

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Abstract

Experiments with evanescent modes and tunneling particles have revealed several non classical properties. The most important ones will be introduced:

i) their signal velocity may be faster than light (i.e. superluminal),

ii) they are described by virtual particles,

iii) they are nonlocal and act at a distance,

iv) the tunneling time is due to scattering time at the barrier front, there is zero time spent inside the barrier,

v) this strange behavior is a universal field independent property. Actually, experimental tunneling data of phonons, photons, and electrons display a universal scattering time at the tunneling barrier front. The scattering time equals approximately the wave packet's oscillation time. Scattering time data from 10^{-3}s to 10^{-18}s have been measured and predicted.

vi) the properties of evanescent, i.e. of tunneling modes are not compatible with the special theory of relativity.

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