History and Discussion of Group-Velocity-Based FTL Research

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In 1992 Günter Nimtz demonstrated an experiment, in which microwaves with a frequency of approximately 9.2 GHz were sent through an undersized waveguide. Although in this setup the waveguide represents an impenetrable barrier, it was observed that microwaves of significantly damped amplitude appeared at the other end of the conductor. Günter Nimtz considered this as a quantum mechanical effect termed “superluminal tunneling''. In this process it has been observed that inside the barrier the tunneling time always equals zero as if the pulse had not covered any distance. In that context pulses with velocities of multiples of the speed of light could be measured depending on the length of the barrier. The figure below shows the general principle: As expected, a barrier in the signal path results in a reflection R with almost full signal intensity. However, the signal – although significantly damped in its amplitude – is also transmitted through the barrier. The time delay for the transmitted component as well as for the reflected one was shown as a scattering time at the potential barrier front, while the time within the barrier equals zero.

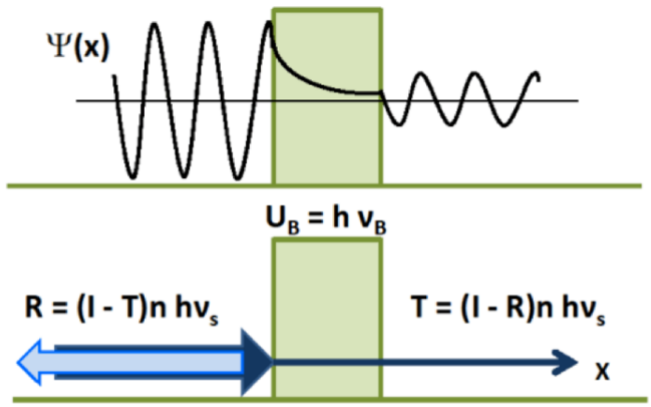

Figure 1: Concept of the tunneling process: The top shows the wave function Ψ as a function of barrier length x. The squared function represents the probability of finding a tunneling wave packet at a barrier length x. A wave quantum is either reflected at the barrier front or transmitted through the barrier. This behavior is illustrated in the bottom part of the figure. R and T represent the amplitude of the reflected and the transmitted signal.

Numerous researchers have reproduced this or a similar result in different setups and in different media but only a minority of them considers the interpretation of superluminal signal velocities correct. Nevertheless, this topic lead and still leads to controversial and often even emotional discussions. The author will present these approaches, the criticism and potential ways to revisit and continue research in the domain of superluminal signal velocities.