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A unified view to Cologne and Florence experiments on superluminal photon propagation

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Abstract

We show that two of the first performed experiments on superluminal photon propagation, namely, the 1992 Cologne experiment on the tunneling of evanescent waves in an undersized waveguide, and the 1993 Florence experiment on the microwave propagation in vacuum between two horn antennas, do admit a common interpretation. Precisely, both experimental devices behave as a high-pass filter. We get this result by two different methods, one based on the Friis law (which yields the efficiency of a transmitting device), and the other on the deformation of the Minkowski space–time. This allows us to set intriguing connections between these two (a priori different) classes of experiments. In particular, in either case the superluminal propagation can be described as a tunneling and is related to evanescent waves.

1. Introduction

The subject of faster-than-light propagation of electromagnetic waves received in the last years a great deal of attention, both from the experimental [1–10] and the theoretical side (see Refs. [11–13] for reviews). Propagation at a group velocity greater than the light velocity has been experimentally demonstrated not only for evanescent (tunneling) waves [1–8], but also for non-evanescent ones (like X-shaped waves) [9,10].

One of the main problems for a theoretical treatment of the superluminal photon propagation is due to the fact that it was observed in *different* kinds of experiments [11–13], which are not easily comparable. It is so quite impossible to state if the results of different experiments are compatible with each other.

In this Letter, we want to show that two of the first performed experiments, namely, the 1992 Cologne experiment [1,2] on the tunneling of evanescent waves in an undersized waveguide, and the 1993 Florence experiment [3] on the microwave propagation in air between two horn antennas, do admit a common interpretation. This will allow us to set intriguing connections between these two (a priori different) classes of experiments.

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