

Stepan Vintskevich

Title: Effect of slowing down light pulses in vacuum and its Lorentz-invariant mass

Abstract:

We show that the concept of the Lorentz-invariant mass of groups of particles can be applied to light pulses consisting of very large but finite numbers of noncollinear photons. Explicit expressions are found for the invariant mass of this manifold of photons for the case of diverging Gaussian light pulses propagating in a vacuum. As the found invariant mass is finite, the light pulses propagate in a vacuum with speed somewhat smaller than the light speed. A small difference between the light speed and the beam-propagation velocity is found to be directly related to the invariant mass of a pulse.

From another hand effect of slowing down of a light pulse can be described from the purely geometrical point of view. The mean velocity of a finite-size short light pulse in a far zone is defined as the vectorial sum of velocities of all rays forming the pulse. Schemes for measuring these effects are suggested and discussed.