

# **Quantum-entangled superluminal double-helix photon produces a relativistic superluminal quantum-vortex zitterbewegung electron and positron, Part 2: Crossing lightspeed**

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**Abstract.** This article continues the development of the relativistic quantum-vortex electron and positron models composed of a helically-circulating electrically-charged superluminal energy quantum (SEQ). Parametric equations similar to that of a coiled slinky toy are proposed and analyzed for the relativistic electron and positron models, which can each have either spin-up or spin-down. The point-like electric charge of the SEQ moves along a positively or negatively-turning helical trajectory, depending on the sign of the electric charge, to form the quantum-vortex electron/positron model. At low electron-model speeds, the SEQ moves along the surface of a mathematical horn torus that moves forward at the electron/positron model's speed. At highly relativistic electron-positron speeds this horn-torus surface, along which the SEQ moves, transforms into a spherical surface whose radius decreases with increasing electron/positron speed. There is a range of speeds of the superluminal energy quantum composing the relativistic electron/positron model. The maximum and minimum speeds range from superluminal to subluminal, passing easily through the speed of light. These speed ranges depend on the electron/positron speed and the combination of the sign of the electric charge and spin direction of the electron/positron model.