

Helmut Günther

Tachyons and Relativity

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22 Figures

Portrait Ole Christensen Rømer p.2, Portrait Sir Isaac Newton p.5, Portrait Albert Einstein p.13 according to the originals of Christina Günther

Berichte aus der Physik

Helmut Günther

Tachyons and Relativity

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Phone: 0049/2421/99011-0 • Telefax: 0049/2421/99011-9

Internet: www.shaker.de • e-mail: info@shaker.de

Preface

G. Feinberg launched the concept of tachyons¹ in early 1967 in his paper "Possibility of Faster-Than-Light Particles" in Physical Review, where he also presented a quantum theory of these hypothetical particles. In 2005², D.-E. Liebscher compiled peculiar properties of tachyons.

We first show that tachyons are compatible with the formalism of special relativity. But do these particles really exist? That is, can we prove them experimentally? We take up the explanations of G. Eilenberger (1981), namely that there are solutions of the so-called sine-Gordon equation on a lattice structure, which we can call "quasitachyons", just as we are talking about localized solutions of this equation of quasiparticles in a lattice, chapter 7.

We ask whether tachyons can transmit signals, and what this would mean for causality. We consider the total inelastic collision of two tachyons.

And we ask the hypothetical question of a connection between tachyons and particle creation as well as dark energy.

We investigate the difference between the terms correlation and interaction. We establish a relation between Zeilinger's teleportation to explain the famous "Einstein-Podolsky-Rosen paradox" and the instantaneous correlation by zero-energy tachyons.

Something quite different is the story with "Schrödinger's cat", the paradox burdened with the most of emotions, which was originated with the aim of disproving quantum theory. In addition to our actual topic, we give a presentation in which the alleged paradox does not arise at all.

I would like to thank E. Liebscher from the Leibniz-Institut für Astrophysik in Potsdam for helpful discussions on the tachyon question.

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This booklet is the complete English reworking of "Tachyonen - Partikel mit Überlichtgeschwindigkeit in Einsteins Relativitätstheorie", Günther (2021).

Berlin, March 2023

Helmut Günther

¹ancient Greek: $\tau\alpha\chi\upsilon\varsigma$ = rapid.

²The years given also refer to the literature references at the end of the book.

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