Dynamic Mass of Photons and Its Implications for Nonlocality

Johann Pascher

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Abstract

This work explores the consequences of a dynamic, frequency-dependent mass for photons within various time models in quantum mechanics. By assigning $m_\gamma = \omega$ in natural units, an energy-dependent time is introduced, impacting nonlocality and causality. The theory is supported by experimental predictions.

Contents

1 Introduction

This work examines the implications of a dynamic, frequency-dependent mass for photons within different quantum mechanical time models [1].

2 Natural Units as a Foundation

2.1 Definition of Natural Units

Theorem 2.1 (Natural Units)**.** *With* $\hbar = c = G = 1$*:*

$$[L] = [E^{-1}] \tag{1}$$
$$[T] = [E^{-1}] \tag{2}$$
$$[M] = [E] \tag{3}$$

2.2 Significance for Mass-Energy Equivalence

$$m_\gamma = \omega \tag{4}$$

3 Time Models in Quantum Mechanics

3.1 Limitations of the Standard Model

$$i\hbar\frac{\partial\psi}{\partial t} = H\psi \tag{5}$$

3.2 The T0 Model with Absolute Time

$$E = \frac{\hbar}{T_0} \tag{6}$$

3.3 The Intrinsic Time Model

$$T(x) = \frac{\hbar}{mc^2} \tag{7}$$

3.4 Extension for Photons

$$T(x) = \frac{1}{E} \tag{8}$$

4 Unification of Models

$$T(x) = \frac{1}{\max(m, E)} \tag{9}$$

5 Implications for Nonlocality and Entanglement

5.1 Energy-Dependent Correlations

- Delay: $\left|\frac{1}{E_1} - \frac{1}{E_2}\right|$

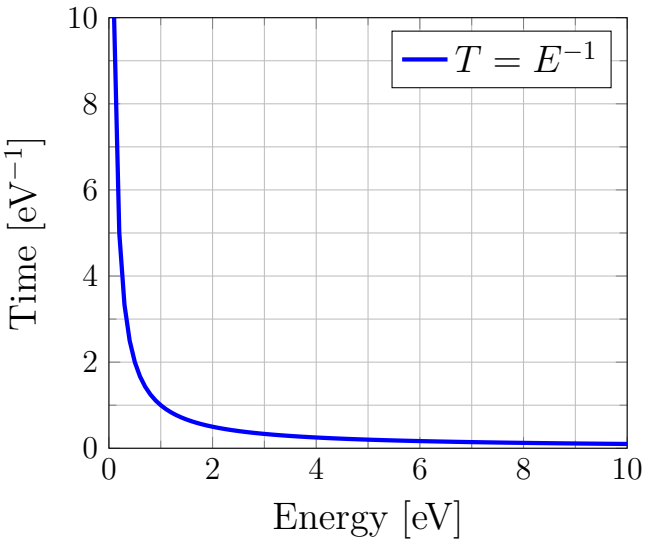

Figure 1: Energy-dependent time for photons.

6 Experimental Verification

- Frequency-dependent Bell tests.

7 Physics Beyond the Speed of Light

$$E^2 = (mc^2)^2 + (pc)^2 + \alpha_c p^4 c^2 / E_P^2 \tag{10}$$

8 Conclusion

The dynamic mass of photons provides a novel view of nonlocality as an emergent phenomenon.

References

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