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Do We Need a Fifth Dimension in Quantum Mechanics?

Spiros Koutandos*

PhD in Superconductivity

***Corresponding author:** Spiros Koutandos, PhD in Superconductivity.

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Abstract

We come to the conclusion in this article that we need an extra imaginary coordinate to describe the curvature induced by mass in three-dimensional volume and to solve the dilemma of whether the electron does occupy some volume before it collapses to a point after the measurement. We also give a new metric for the five-dimensional case. We are in agreement with Kaluza-Klein theory and modern string theories that a loop should be formed in the higher dimensions.

Introduction

Quantum mechanics has revolutionized our understanding of the physical universe, providing profound insights into the behavior of particles at the microscopic level. Despite its successes, several fundamental questions remain unresolved, particularly concerning the nature of wavefunction collapse and the true dimensionality of spacetime. Traditional interpretations of quantum mechanics often rely on four-dimensional spacetime, but emerging theories suggest that additional dimensions may be necessary to fully explain quantum phenomena.

In this paper, we explore the need for a fifth dimension in quantum mechanics. Building upon the Kaluza-Klein theory and modern string theories, we propose an extra imaginary coordinate to describe the curvature induced by mass in three-dimensional volume. This additional dimension aims to address the longstanding dilemma of whether an electron occupies some volume before collapsing to a point upon measurement. Furthermore, we introduce a new metric for the five-dimensional case, which aligns with the theoretical frameworks suggesting that higher dimensions form closed loops.

Our research delves into the implications of this fifth dimension, offering a fresh perspective on the behavior of quantum systems and the nature of spacetime. By examining the hypersurfaces of present time and their interactions with energy disturbances, we provide a comprehensive analysis of how these additional dimensions can influence our understanding of reality. Through this study, we aim to contribute to the ongoing discourse on hidden variables in quantum mechanics and pave the way for future investigations into the higher-dimensional structure of the universe.

Main Part

As we have discovered from our research the hypersurfaces of present time in four dimensions are the volume in three dimensions which vibrates when the system is disturbed by the addition of energy, and the vibrations are longitudinal waves, something like phonons [1, 2]. The hypersurface in five dimensions is a ring, a closed loop [3-5]. This ring is the worldline in five dimensions, a result which agrees with Kaluza-Klein theory and string theories.

Before the measurement, the time of the system is frozen because circular procedures are being performed. Once we make an observation, a discontinuity in ordinary spacetime occurs, which we call the point particle, and we are entitled to say that a magnetic monopole appears, and a new zero for the real component of the time axis is chosen. The collapse of the wavefunction is the collapse of the present situation and reality as we know it [6, 7].

The new metric in the presence of mass, which alters the speed of light, is:

$$ds^2 = d\vec{r}^2 - \frac{c^2}{\chi}dt^2 = d\vec{r}^2 - c^2dt^2 + (d\rho)^2 = d\tau^2 + (d\rho)^2 \quad (1)$$

In equation (1), χ\chiχ stands for the dielectric susceptibility. Obviously, the spacetime interval τ\tauτ may obtain imaginary solu-

tions as well, so the fifth dimension is an imaginary one describing this phenomenon. However, by adding this extra dimension of ρ\rhoρ, the interval ds2ds^2ds2 may become positive indeed.

The curvature of spacetime caused by mass depends on the fine structure constant and the Compton wavelength: $K = \frac{\alpha}{\lambda_C}$ (2)

We believe that: $\rho = \frac{|\psi|}{K}$ (3)

We shall put forth a formula which we have proved in our work [1]: $\Omega = K\tau$ (4)

Combining formulas (3) and (4) into equation (1), we arrive at the following equation for the new metric: $K^2 ds^2 = d\Omega^2 + d|\psi|^2$ (5)

Conclusion

We have found out a new five-dimensional metric, and the fifth coordinate is the absolute value of the wavefunction. We have not given a definite answer as to what is the loop formed in five dimensions, but we shall leave this for future work. We hope we have contributed to the field of hidden variables in quantum mechanics.

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