EDITORIAL

Spacetime and the observer in quantum mechanics

Spiros Koutandos

Koutandos S. Space-time and the observer in quantum mechanics. J Mod Appl Phys. 2023; 6(1):1-2.

ABSTRACT

We claim that associated with a curvature in spacetime caused by the presence of mass is an alteration of spacetime. The dipolic nature of the charge plays an important role in this. In this article we give specific formulas for the events taking place and find out about the role of the wave function in measuring time.

Key Words: *Quantum thermodynamics; Hidden variables of quantum mechanics; Quantum mechanics; Free energy*

INTRODUCTION

There is a long story behind the search for hidden variables in quantum mechanics. One of the branches of this field of research comes from De Broglie's hypothesis of the electron clock. The reader may refer to some recent work on this [1,2].

We support in this paper that apart from new volume created by the electron mass there is also a local spacetime depending on the observer just like around the globe there is a local time.

What is used in special relativity for separating spacelike and timelike events are cones. These cones become solid angles for the observer in order for him to observe an event.

We have all heard the philosophy that everything in life is a cycle. We believe that since we have preservation of the entropy for the whole system when it is closed there happen some elementary thermodynamic cycles. We shall begin with the current knowledge gained from previous work [3]:

$$E\frac{|\psi|^2}{N}=\frac{TdS}{dV} \quad (1)$$

$$P=\frac{|\psi|^2}{N}(E-U)=\frac{K_B dT}{dV} \quad (2)$$

Therefore what comes out from equations (1) and (2) is that the coefficient of efficiency of this cycle is:

$$\frac{TdS}{PdV}=\frac{E}{E-U} \quad (3)$$

To continue our line of arguments we put forth the Lagrangian density as it is found in numerous works of different authors[4]:

$$\frac{dL}{dV}=|\psi|^2(E-U)-\frac{\hbar^2}{2m}|\nabla\psi|^2=\frac{\hbar^2}{2m}\Delta|\psi|^2 \quad (4)$$

Further we know from relativity that:

$$S=\int mc^2 d\tau \quad (5)$$

Therefore:

$$\frac{dS}{dVd\tau}=\frac{\hbar^2}{2mN}\Delta|\psi|^2 \quad (6)$$

We have assumed from previous work that the action is connected to the variation of mass and volume:

$$dS=\frac{\hbar}{mN}dmdV=\frac{dm}{dV}dV^2=dPdV=dTdS \quad (7)$$

On combining equations (6) and (7) and complementing from previous work we finally have [3]:

$$\frac{\hbar^2}{2mN}\Delta|\psi|^2=\frac{VdP}{dV}=\frac{|\psi|^2}{N\chi}mc^2=\frac{|\psi|^2}{N^2}m_e c^2 V=\frac{\hbar}{m_e N}\frac{dm}{d\tau} \quad (8)$$

If we attempt to solve the last two parts of the equation (8) we find:

$$\frac{V}{N}\frac{dm}{dV}=\frac{dm}{dt}\frac{\hbar}{m_e c^2}\rightarrow V=e^{\frac{m_e c^2}{\hbar}\tau} \quad (9)$$

Comparing equation (9) with a previously gained result [3] the conclusion is the following

$$\chi=\frac{N}{V}=e^{-\frac{E}{KT}}=e^{-\frac{m_e c^2}{\hbar}\tau} \quad (10)$$

The result of equation (10) is in agreement in general lines with the result of another author [5]:

$$\tau=\frac{\hbar^2\omega}{mc^2 KT} \quad (11)$$

The solid angles have the following dependence on spacetime interval:

Phd In Superconductivity Maniakiou 17 Agia Paraskevi Attica Pc 15343, Greece

Correspondence: Spiros Koutandos, Phd In Superconductivity Maniakiou 17 Agia Paraskevi Attica Pc 15343, Greece, e-mail skoutandos1@gmail.com

Received: 04-Jan-2023, Manuscript No. PULJMAP-23-6056; Editor assigned: 5-Jan-2023, Pre QC No. PULJMAP-23-6056 (PQ); Reviewed: 6-Jan 2023, Qc No. PULJMAP-23-6056; Revised: 16-Jan-2023, Manuscript No. PULJMAP-23-6056 (R); Published: 19-Jan-2023, DOI: No 10.37532/ puljmap.2022 .6(1); 01-02.

$$\Omega = \frac{mc^2\tau}{\hbar} \tag{12}$$

There is one last formula we need to expose in order for the reader to comprehend the following calculations:

$$\Delta|\psi|^2 = |\psi|^2 (\nabla\phi)^2 + (\nabla|\psi|)^2 \tag{13}$$

The metric of spacetime with the altered speed of light is the following:

$$d\tau^2 = d\vec{r}^{\,2} - \frac{c^2}{\chi} dt^2 \tag{14}$$

We also are aware that the following identity is valid (for simplicity in the absence of magnetic field):

$$\frac{d\vec{r}}{dt} = \frac{\hbar}{m} \nabla\phi \tag{15}$$

On using equations (13-15) and (8) we derive the following basic formula:

$$(\nabla|\psi|)^2 = |\psi|^2 \frac{d\tau}{dt} \tag{16}$$

CONCLUSION

The final conclusion which is equation (16) is in order with our definition of force density and the arguments used in our precious article about the dipole nature of the electron which splits spacetime:

$$\left|\frac{d\vec{F}}{dV}\right| = \frac{\hbar^2}{2mN} \left|\nabla|\psi|^2\right| = \frac{d\tau}{dt} \tag{17}$$

We have not proved about the cyclic nature of time completely and we hope that other investigators will complete this work.

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