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Original Research Paper

Physics

ASSIGNING PHYSICAL QUANTITIES TO THE HIDDEN VARIABLES OF QUANTUM MECHANICS

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ABSTRACT In this article we describe the research of many years which has lead to a relativistic-thermodynamic explanation of the electron and the wave function of particle. The spacetime acquires a curvature K depending on the mass and new volume is created. What is new here is that we give the final equations leading to the stability of our system and its thermodynamic description.

KEYWORDS :

INTRODUCTION

As a result of our research [1,2,3,4,5] we put forth the following set of equations:

$$-\frac{\hbar^2}{2mN}\Delta|\psi|^2 = B = V\frac{dP}{dV} = \frac{mc^2|\psi|^2}{N\chi} = \frac{dS}{dVdt} = \hbar I = \hbar\frac{dm}{dt} \quad (1)$$

$$\frac{\hbar^2}{2m}|\psi|\Delta|\psi| = \sigma K = \frac{|\psi|^2}{N}Q \quad (2)$$

$$\Omega = -PV, \sigma = surface\ tension, S = action, \chi = dielectric\ susceptibility$$

K=constant curvature of spacetime created by the presence of mass

It should also be stated that the various quantities behave according to the transformations of a fluid spacetime:

$$\frac{df}{dt} = \nabla f \cdot \frac{d\vec{r}}{dt} + \frac{\partial f}{\partial t} \quad (3)$$

$$\frac{d\vec{A}}{dt} = \left(\frac{d\vec{r}}{dt} \cdot \nabla\right)\vec{A} + \frac{\partial \vec{A}}{\partial t} \quad (4)$$

$$\frac{d\vec{r}}{dt} = \frac{\hbar}{m}\nabla\phi + \frac{e}{mc}\vec{A} \quad (5)$$

By making use of the set of equations (3),(4) and (5) and by defining the vorticity as the rotation of the current density we were able to prove London equations [6]

Spacetime curvature is the inverse of the relativistic radius of the particle:

$$\frac{e^2}{4\pi\varepsilon_0 R} = mc^2 \rightarrow K = \frac{1}{R} = \frac{1}{\alpha\lambda_C} \quad (6)$$

In equation (6) alpha is the fine structure constant and lambda is the Compton wave length.

Our model is described by swirling droplet for the particle. One proof of equation (2) comes from somewhat lengthy calculations performed in previous work[7,8]. If we consider hollow droplets with the mass distributed spherically then Marangoni flow should give us that the gradient of surface tension is force density:

$$\sigma = c^2\frac{dm}{dS} \quad (7)$$

$$\psi^*\frac{d\vec{v}}{dt} = i\vec{J}|\psi|\Delta|\psi| + \nabla(|\psi|\Delta|\psi|) = i\vec{J}\sigma K + \frac{d\vec{F}}{dV} \quad (8)$$

MAIN PART

Momentum or else velocity(times mass) in quantum mechanics is associated with a mystery regarding its extraction and its definition. We managed to find a formula for momentum by recognizing the fact that new volume is created by the presence of mass which creates a curvature in spacetime. This solves the ambiguity of the elctron having a point volume (it does not actually) and yet possessing properties of an elementary particle. The formula is the following:

$$\vec{p} = -i\hbar\nabla\psi = \psi\left(\frac{d\vec{r}}{dt} + i\nabla S/K_B\right) \quad (9)$$

In equation (3) S stands for the entropy of the system

We expose some formulas necessary downward:

$$\Delta|\psi|^2 = \nabla\cdot(\psi^*\nabla\psi + \psi\nabla\psi^*) = 2\psi^*\Delta\psi + 2|\nabla\psi|^2 \quad (10)$$

$$-\frac{\hbar^2}{2m}\Delta\psi = (E-U)\psi \quad (11)$$

Combining formulas (9),(10),(11) and (1) we arrive at the following conclusion:

$$\left(E - U - \frac{mc^2}{\chi}\right) = \left(\frac{d\vec{r}}{dt}\right)^2 + \nabla S^2/{K_B}^2 \quad (12)$$

According to our investigations the phase phi of the wavefunction was assigned to a point flux. As for the value of the probability we find:

$$P = \frac{|\psi|^2}{N} = \chi\frac{d\Omega}{dV} \quad (13)$$

In equation (13) Omega stands for the solid angles. Substituting equation (10) into equation (1) we finally have:

$$VdP = mc^2 d\Omega \quad (14)$$

From equation (14) we deduce that the silent work of VdP part of free energy is proportional to the change in solid angles.

We need to give some proof for equation (1) and it comes from Ginzburg -Landau expansion of free energy density. We are told that free energy density in superconductors is the order parameter squared, which in the specific case is the probability, times the difference between local temperature and critical one, plus the gradient of the order parameter. From equations (9),(10),(11) the form it takes is:

$$\frac{dF}{dV} = f = |\psi|^2(T - T_C) + \frac{VdP}{dV} \quad (15)$$

We believe that a coefficient of efficiency comes into play for the first part of the right member of equation (15) and the whole free energy is recovered.

Next we are going to explore some more the proposition put ahead by equation (6).

The time derivative of the radius vector has been given the known value. As for the second part of the momentum it is extracted form the assumption that psi, the wave function represents some form of entropy wave:

$$d|\psi|^2 = |\psi|^2 dS/K_B \quad (16)$$

In the aforementioned series of papers [1,2,3,4,5] we had discovered that the definition of pressure in the quantum mechanics formalism should be:

$$P = \frac{|\psi|^2}{N}(E-U) = K_B \frac{dT}{dV} \quad (17)$$

The mass is the carrier of the thermal charge as expected and this way we attribute to the mass density times energy the thermal charge:

$$E\frac{|\psi|^2}{N} = \frac{dQ}{dV} \quad (18)$$

Taking in mind equations (17),(18) the following thermodynamic identity is brought to light:

$$\int PdV = K_B \delta T = \int TdS - \langle U \rangle \quad (19)$$

In equation (19) <U> stands for the mean potential energy calculated the quantum way, that is probability times potential energy integrated over the volume.

This being the case we are going to estimate B, the bulk modulus through estimating the volume density of pressure by exploiting equations (16) and (17):

$$\frac{dP}{dV} = |\psi|^2 \frac{(E-U)}{K_B}\frac{dS}{dV} = \frac{dTdS}{dVdV} \quad (20)$$

From equation (14) the following conclusion is extracted leading towards a stability type for our system:

$$dG = VdP - SdT \rightarrow d^2G = dVdP - dSdT = 0 \quad (21)$$

To this equation should be added the following one:

$$\frac{d|\psi|^2}{dt} = 0 \quad (22)$$

One more task we need to accomplish is to give value to the unknown chi, which is the dielectric susceptibility:

$$\chi = \frac{N}{V} \quad (23)$$

Right away equation (13) takes the symbolic form:

$$PV = \frac{d\Omega}{dV} \quad (24)$$

Only in this case P is the probability and omega is the solid angle. To prove that this makes sense we are going to estimate the fluctuation of pressure. By using equations (1) and (23) we arrive at the following definition of probability as density of pressure:

$$\frac{dP}{dV} = mc^2\frac{|\psi|^2}{N^2} \rightarrow \delta P = c^2\frac{\delta m}{N} \quad (25)$$

With the use of equation (1) , equation (25) gives:

$$dPdV = mc^2|\psi|^2\frac{dV^2}{N^2} = c^2 dmdV = dS \quad (26)$$

In equation (26) S is the action.

CONCLUSION

Through a long investigation the author has come to some definite conclusions. The reason for writing this article is to correct some mistakes found in the previous papers, give more clarity and make a short report of this research. The reader should definitely refer to the bibliography given in the reference section for more details in the calculations. There are also more articles referred to and more work to further prove our point in trying to assign hidden variables behind the Copenhagen interpretation of quantum mechanics. We hope we have conttributed to this field.

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