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A Newly Proposed Model for the Electron

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Abstract: *This article is mainly a revision of an article called "Is Schrodinger equation describing a turbulent flow?" and we add some new evidence regarding the possibility of describing the electron as a point vortex.*

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I. Introduction- A Revision

In a recently published article [1] we claim that Schrodinger equation describes a two dimensional turbulent flow with vorticity. This two dimensional turbulent flow takes place on the surfaces of constant value for the wave function psi at least in the steady time independent circumstances. The vorticity is found to be:

$$\hbar\vec{\Omega} = i(\vec{v}^* \times \vec{v}) \Rightarrow \quad (1)$$

$$i\hbar\nabla \times \vec{\Omega} = \nabla \times (\vec{v}^* \times \vec{v}) = (\nabla \cdot \vec{v})\vec{v}^* - (\nabla \cdot \vec{v}^*)\vec{v} + (\vec{v} \cdot \nabla)\vec{v}^* - (\vec{v}^* \cdot \nabla)\vec{v} \quad (2)$$

Equation (2) is easily transformed to:

$$i\hbar\nabla \times \vec{\Omega} = (\nabla \cdot \vec{v})\vec{v}^* - (\nabla \cdot \vec{v}^*)\vec{v} + -2(\vec{v}^* \cdot \nabla)\vec{v} + \nabla|\vec{v}|^2 \quad (3)$$

Now, Schrodinger equation informs us that:

$$\nabla \cdot \vec{v} = -i\hbar\nabla \cdot \nabla\psi = -i\hbar\Delta\psi = i\hbar \cdot \frac{2m}{\hbar^2}(E-U)\psi \quad (4)$$

Overall we have:

$$(\nabla \cdot \vec{v})\vec{v}^* = i \cdot \frac{2m}{\hbar}(E-U)\psi(+i)\hbar\nabla\psi^* = -2m(E-U)\psi\nabla\psi^* \quad (5)$$

In taking a look back at equation (3) we find out that :

$$(\nabla \cdot \vec{v})\vec{v}^* - (\nabla \cdot \vec{v}^*)\vec{v} = -2m(E-U)i \cdot \mathrm{Im}(\psi\nabla\psi^*) \quad (6)$$

We are going to exploit the fact that we are talking about a Navier-Stokes like equation so we expand the viscous term:

$$\psi^*\Delta\vec{v} = -i\hbar\psi^*\nabla^2\nabla\psi = -i\hbar\psi^*\nabla(\Delta\psi) = i\hbar \cdot \frac{2m}{\hbar^2}\psi^*\nabla((E-U)\psi) \quad (7)$$

In proceeding with the transformation of equation (5) obviously we need to find the right side of equation (6) as a term:

$$\psi^*\Delta\vec{v} = -\frac{2m}{\hbar}(E-U)\,\mathrm{Im}(\psi^*\nabla\psi) + i \cdot \frac{2m}{\hbar}(E-U)\,\mathrm{Re}(\psi^*\nabla\psi) - i \cdot \frac{2m}{\hbar}|\psi|^2\nabla U \quad (8)$$

Equation (8) is transformed to:

$$\psi^*\Delta\vec{v} = -\frac{2m}{\hbar}(E-U)\,\mathrm{Im}(\psi^*\nabla\psi) + i \cdot \frac{2m}{\hbar}(E-U)\nabla\frac{|\psi|^2}{2} - i \cdot \frac{2m}{\hbar}|\psi|^2\nabla U \quad (9)$$

Finally we have:

$$\psi^*\Delta\vec{v} = -\frac{2m}{\hbar}(\left(E-U)\,\mathrm{Im}(\psi^*\nabla\psi) + i\nabla\left(\frac{|\psi|^2}{2}(E-U)\right) - i\frac{|\psi|^2}{2}\nabla U\right) \quad (10)$$

In combining equations (10),(6),(3) we get the master equation:

$$i\hbar\nabla\times\vec{\Omega} = i\cdot\hbar\psi^*\Delta\vec{v} + -\frac{m}{\hbar}\nabla\left(|\psi|^2(E-U)\right) + \frac{m}{\hbar}|\psi|^2\nabla U - $$
$$-2(\vec{v}^*\cdot\nabla)\vec{v} + \nabla|\vec{v}|^2 \quad (11)$$

Equation (11) leads to:

$$i\frac{\hbar^2}{2m}\nabla\times\vec{\Omega} + \frac{|\psi|^2}{2}\nabla U = i\frac{\hbar^2}{2m}\psi^*\Delta\vec{v} + (\vec{v}^*\cdot\nabla)\vec{v} + \nabla(\Delta P) \quad (12)$$

In equation (12) we assigned what would naturally appear as a pressure a difference of pressure and we will explain for that.

II. Main part

In equation (12) we set for the pressure difference:

$$\Delta P = |\psi|^2\frac{(E-U)}{2N} - m\frac{|\vec{v}|^2}{2} \quad (13)$$

In the recently published article [1] we describe the left part of equation (12) as the total time differential of the velocity for two dimensional flow. The main argument is that:

$$\nabla\frac{P}{\rho} = \nabla\left(\frac{|\psi|^2(E-U)}{|\psi|^2}\right) = -\nabla U \quad (14)$$

Thus we conclude that the pressure of this two dimensional flow is the one ascribed inside the parenthesis. But in equation (13) we can see that the first member of the right side of the equation is exactly this pressure.

It would be tempting to assign equation (13) to the Bernoulli function , that is density of free energy plus kinetic energy but there is a minus sign.

In another article [2] we claim that there is close resemblance between Schrodinger equation and what happens in a thin layer between the gas and the liquid in evaporation or boiling. After all it was Van der Waals who studied this phenomenon and used a gradient of the density squared for the free energy in that region. This should most possibly account for the second part of the right side of equation (13).

Now if we assume that the fathers of quantum mechanics knew something about all that we can discover another reason for why the used the letter P for probability although it is not really the probability but the probability per unit volume:

$$\Delta P = \nabla\cdot\nabla\left(\frac{|\psi|^2}{N}\right) = \frac{1}{N}\nabla\cdot\left(\psi^*\nabla\psi + \psi\nabla\psi^*\right) \quad (15)$$

Equation (15) naturally leads to:

$$\Delta P = \frac{2}{N}\left(\psi^*\Delta\psi + |\nabla\psi|^2\right) \quad (16)$$

Equation (16) apart from the units is equation (13).

The view of the author is that as the Laplacian accounts for the mean value in a matter of speaking around a sphere it was chosen to represent the difference of pressure between the inner parts of the swirling droplets which appear as electrons . This is described in the article of reference [2]

III. Conclusion

It is widely believed among those who search for the hidden variables that the electron could be described as a point vortex. This belief comes from the early years of the theory of ether. We have given some mathematical proof to support this view but it is not conclusive yet. We believe that there should be an explanation for why the velocity squared accounts for a kind of pressure. Perhaps this is related to a centrifugal potential and the fact that the central unit of quantum mechanics has dimensions of angular momentum. We hope that in the future there will be answers

References

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