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On The Existence of a Thermal Current

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Abstract We find a thermal current and explain the London equations

The reader may refer to some previous work of the author. In the article published in this journal called "Solving the alpha omega equation" we had found an equation transforming the coordinates to a rotating system of reference. A straightforward expansion of the total time derivative of the velocity may convince the reader that there actually exists a Coriolis force. Also we should give the correct equation since we had forgotten a psi term:

$$\psi^* \frac{d\vec{v}}{dt} = |\psi|^2 \frac{d^2\vec{r}}{dt^2} + \vec{\Omega} \times \frac{d\vec{r}}{dt} + 2\psi^* \nabla\left(\psi(E-U)\right) \quad (1)$$

On multiplying equation (1) by the complex conjugate of the wavefunction we find:

$$\psi^* \frac{d\vec{v}}{dt} = |\psi|^2 \frac{d^2\vec{r}}{dt^2} + \vec{\Omega} \times \frac{d\vec{r}}{dt} + \psi^* \Delta\vec{v} \quad (2)$$

Equation (2) leads to:

$$\psi^* \frac{d\vec{v}}{dt} = \frac{d\vec{J}}{dt} + \vec{\Omega} \times \frac{d\vec{r}}{dt} + \psi^* \Delta\vec{v} \quad (3)$$

Next we shall reproduce a formula found in the paper "Regarding the total time derivative of the radius"

$$\nabla\left(\left|i\hbar\left(\nabla - \vec{A}\right)\psi\right|^2\right) = \frac{d\vec{J}}{dt} + \vec{\Omega} \times \frac{d\vec{r}}{dt} + \nabla\left(\left(\nabla|\psi|\right)^2\right) \quad (4)$$

A step further ahead is to analyze the following term:

$$\left(\vec{v}^* \cdot \nabla\right)\vec{v} = \left(\nabla|\psi| \cdot \nabla\right)\nabla|\psi| + \left(|\psi|\nabla\phi \cdot \nabla\right)\nabla|\psi| - \left(\nabla|\psi| \cdot \nabla\right)\nabla\phi \quad (5)$$

This leads to the following:

$$\left(\vec{v}^* \cdot \nabla\right)\vec{v} = \nabla\left(\left(\nabla|\psi|\right)^2\right) + \frac{\partial}{\partial t}\nabla|\psi|^2 \quad (5)$$

IN the paper "A newly proposed model for the electron" we had found a formula called the alpha omega equation. If we combine the terms of formulas (3), (4) and (5) in this equation we see that most terms cancel. First we reproduce the equation:

$$i\frac{\hbar}{2m}\nabla \times \vec{\Omega} + |\psi|^2 \nabla U = i\frac{\hbar}{2m}\psi^* \Delta\vec{v} + \left(\vec{v}^* \cdot \nabla\right)\vec{v} + \nabla(\Delta P) \quad (6)$$

In the aforementioned paper it was also found that:

$$\Delta P = |\psi|^2 (E-U) - |\nabla\psi|^2 \quad (7)$$

On combining equations (4), (5), (6) , (7) we finally arrive at:

$$i\frac{\hbar}{2m}\nabla \times \vec{\Omega} + |\psi|^2 \nabla U = \psi^* \frac{d\vec{v}}{dt} + \frac{\partial}{\partial t}\nabla|\psi|^2 + \nabla\left(|\psi|^2 (E-U)\right) \quad (8)$$

The last step is to combine result (8) with a formula found in the paper "Rewriting the master equation" reproduced in the following:

$$\psi^* \frac{d\vec{v}}{dt} = 2iPQ\frac{d\vec{r}}{dt} + \frac{\hbar^2}{2m}\nabla(PQ) \quad (9)$$

In the previous Q is the quantum potential. Combining equations (8) and (9) we deduce that:

$$i\frac{\hbar}{2m}\nabla \times \vec{\Omega} + |\psi|^2 \nabla U = i\vec{J}Q + \frac{\hbar^2}{2m}\nabla\left(|\psi|^2 \left(\frac{d\vec{r}}{dt}\right)^2\right) \quad (10)$$

For more clarity concerning the calculations we show again the quantum potential:

$$Q = \left(E - U - \left(\frac{d\vec{r}}{dt} \right)^2 \right) \quad (11)$$

In superconductors the potential energy is purely magnetic so:

$$PQ = |\psi|^2 \left(E - U + \left(\nabla\phi - \vec{A} \right)^2 \right) \approx |\psi|^2 (E - U) + \bar{J} \cdot \vec{A} = E|\psi|^2 \quad (12)$$

It can also be found right away that the energy terms cancel so in the case of superconductors we have the well known equation:

$$\nabla \times \vec{\Omega} = \nabla \times \nabla \times \bar{J} = E\vec{J} \quad (13)$$

I. Conclusion

The thermal current which is to be studied in next research is JPQ. Many previous attempts have been made to associate the quantum potential with a thermal charge. We believe we have found an answer. It is tempting to believe that the shells have been named from K to O for the missing letters

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