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The Quantization of Flux

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Abstract: *In this paper we start from basic postulates of quantum mechanics such as that the volume integral of the probability is conserved. The consequence of this is that the total time derivatives of the probability, the value of the radius and the solid angle are zero. Next we conclude that there is quantization of magnetic flux which for big values of the magnetic induction is not observed in the macro world.*

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I. Main part

We have so far created a system explaining quantum mechanics by assuming that there is total time derivative of the radius associated with the current density. As the current density has no radial part it is easy to understand that only the unit radius is changing. That way the volume is preserved. Another assumption which we will use in this paper is that the solid angle is changing. We will see that as expected the volume and therefore the volume integrals are preserved and that is the case in bound states of course. In overall we describe a system where orientation is important and this is the value of the observer in quantum mechanics. We have also talked about a vorticity being created as a result of all this. The discussion can be found in a more encrypted form in the results of the Berry phase.

The value of the magnetic field in quantum mechanics as we know is defined as the product of some constant times the current that goes through the loop that creates it times the gradient of the solid angle at which we look at the magnetic loop. On the other hand the enrgy of the photon comes in quanta and thus we should expect that the magnetic flux is quantized some way. So we define:

$$\vec{A} = \frac{\hbar c}{e} \nabla \Omega \quad (1)$$

In equation 1 omega stands for the solid angle. We then find the magnetic flux:

$$\Phi_B = \oint \vec{A} d\vec{l} = n \cdot 4\pi \cdot \frac{\hbar c}{e} \quad (2)$$

Anyone accustomed with the cgs and gauss system in electrodynamics will recognize the 4 pi times the velocity of light constant. So the flux is quantized within matter. But how does it change? To answer that we make the necessary demand that the total solid angle is constant in time:

$$|\psi|^2 \frac{d\Omega}{dt} = \vec{A} \cdot \vec{J} + |\psi|^2 \frac{\partial \Omega}{\partial t} = (\vec{r} \times \vec{B}) \cdot \vec{J} + |\psi|^2 \frac{\partial \Omega}{\partial t} = \vec{M} \cdot \vec{B} + |\psi|^2 \frac{\partial \Omega}{\partial t} = 0 \quad (3)$$

We are also going to need:

$$\vec{E} = \frac{\partial \vec{A}}{\partial t} = \frac{\hbar c}{e} \nabla \frac{\partial \Omega}{\partial t} \quad (4)$$

In order to make use of equation (4) we apply the operator of gradient on equation 3. Then we take the rotation of it (the operator curl) and we finally get:

$$\nabla |\psi|^2 \times \frac{\partial \vec{A}}{\partial t} + \frac{\partial \vec{A}}{\partial t} \times \nabla |\psi|^2 + |\psi|^2 \nabla \times \frac{\partial \vec{A}}{\partial t} = |\psi|^2 \frac{\partial \vec{B}}{\partial t} = 0 \quad (5)$$

Therefore the change of magnetic induction occurs at the surfaces of zero value for the probability. We present here a result that has been given in the paper of reference:

$$|\psi|^2 \nabla \times \nabla \phi = 0 \quad (6)$$

Obviously there must be a relation.

Next we note that in the gauge used the deviation of the vector potential is zero:

$$\nabla \cdot \vec{A} = 0 \Rightarrow \Delta\Omega = 0 \quad (7)$$

Also it is known that the vector potential is not single valued as it is to be expected for a function of angles.
It is the author ‘s opinion that these are the solid angles with which we can look at and measure the droplets of mateer.

References

[1]. Regarding the total time derivative of the radius, SpirosKoutandos, IOSR, Journal of Applied Physics, vol.10, issue 6, ver. 1
[2]. A newly proposed model for the electron, SpirosKoutandos, IOSR, Journal of applied physics, vol.10, issue 4, ver II

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