A Mapping and Connection between Heisenberg's Equations and Maxwell's Equations

The purpose of this physicist's paper is to continue the idea of a transformation or mapping of the Heisenberg's equations of motion, or simply the transformation of the derivative with respect to time. We will start again with the magnetic monopole, however the transformation of Heisenberg's equations of motion do not need that connection exclusively. We can consider just the transformation of Heisenberg's equations of motion by themselves. However, the connections between Maxwell's equations with the magnetic monopole term included and the Heisenberg's equations of motion is a very interesting connection. It makes one wonder if there is a more natural connection between quantum mechanics and classical electromagnetism.

For the magnetic monopole we have:

$$\mathbf{\nabla} \cdot \mathbf{B} = \mu_0 \rho_m$$

And in integral form,

$$\iint_{\sigma} \mathbf{B} \cdot d\mathbf{S} \neq 0$$

However, $\mathbf{B} \neq \mathbf{\nabla} \times \mathbf{A}$ any longer if used like this!

Let $\mathbf{A} \Rightarrow \mathbf{A} + \Phi_f$

$$\iint_{\sigma} \{\mathbf{\nabla} \times \mathbf{A} + \mathbf{\nabla} \times \Phi_f\} \cdot d\mathbf{S} \neq 0$$

Then $\iint_{\sigma} \mathbf{\nabla} \times \mathbf{A} \cdot d\mathbf{S} = 0$ and by Stoke's theorem

$$\int_{\sigma} \Phi_f \cdot d\mathbf{S} \neq 0$$

Proposition we want to make is: There exists another transformation of Heisenberg's equations of motion,

$$\Lambda_T[H, \Phi_f] = [H, \Phi_f] + \eta_T$$

However, it is not a Lorentz transformation. I think someone has said, “There’s something missing!” J. D. Jackson said it was the covariant derivative in his Classical Electromagnetism textbook when he was discussing the magnetic monopole. So let us follow him and write down the following.

$$\mathbf{F} = \frac{d\mathbf{P}}{dt} = e(\mathbf{E} + \mathbf{\nabla} \times \mathbf{B}) + \eta_1 \frac{\partial \mathbf{\nabla} \cdot \mathbf{E}}{\partial x} + \eta_2 \frac{\partial \mathbf{\nabla} \cdot \mathbf{E}}{\partial t}$$

We do not yet know the first term, the derivative with respect to $x$, so we will deal with the second term, the derivative with respect to time.

We have by the Lorentz transform the following for the Lorentz force.

$$\mathcal{S}e\mathbf{E} = e(\mathbf{E} + \mathbf{\nabla} \times \mathbf{B})$$

And by Heisenberg’s equations of motion we have.
\[ \frac{-i}{\hbar} [H, \Phi_f] = \frac{\partial \Phi_f}{\partial t} \]

We calculate and conclude:

\[ \frac{-i}{\hbar} \Lambda_T [H, \Phi_f] = \frac{-i}{\hbar} [H, \Phi_f] + \alpha \mu_f e \bar{E} = \frac{-i}{\hbar} [H, \Phi_f] + \mu_f e (\bar{E} + \bar{v} \times \bar{B}) \]

\[ \frac{-i}{\hbar} \Lambda_T [H, \Phi_f] + \frac{i}{\hbar} [H, \Phi_f] = \alpha \mu_f e \bar{E} \]

\[ \mu_f \frac{d \bar{p}}{dt} = \frac{-i}{\hbar} \{ \Lambda_T - 1 \} [H, \Phi_f] = \alpha \mu_f e \bar{E} \]

\[ \frac{-i}{\hbar} \{ \Lambda_T - 1 \}^{-1} \{ \Lambda_T - 1 \} [H, \Phi_f] = \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f e \bar{E} \]

\[ \frac{\partial \Phi_f}{\partial t} = \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f e \bar{E} \quad \text{Or} \quad [H, \Phi_f] = i\hbar \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f e \bar{E} \]

\[ i\hbar \frac{\partial \Phi_f}{\partial t} = [H, \Phi_f] = i\hbar \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f e \bar{E} \]

\[ i\hbar \partial \Phi_f = i\hbar \{ \Lambda_T - 1 \}^{-1} \mu_f e (\bar{E} + \bar{v} \times \bar{B}) \]

\[ i\hbar \partial \Phi_f = i\hbar \{ \Lambda_T - 1 \}^{-1} \mu_f e (\bar{E} + \bar{v} \times \bar{B}) dt = i\hbar \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f e \bar{E} dt = i\hbar \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f \Delta \bar{p} \]

\[ i\hbar \Delta \Phi_f = i\hbar \{ \Lambda_T - 1 \}^{-1} \alpha \mu_f \Delta \bar{p} = [H, \Phi_f] \Delta t \]

Where we put \( \Delta \Phi_f \) as:

\[ \Delta \Phi_f = \frac{\partial \Phi_f}{\partial x} \Delta x + \frac{\partial \Phi_f}{\partial y} \Delta y + \frac{\partial \Phi_f}{\partial z} \Delta z + \frac{\partial \Phi_f}{\partial t} \Delta t \]

Of course the Lorentz transformation of the momentum is very well-known. Questions remain, of course, but what is your opinion so far? Do you hope there is a new mapping or transformation for Heisenberg’s equations and Maxwell’s equations? Therefore, what is \( \Lambda_T \)? Or what is \( [\Lambda_T - 1]^{-1} \)? Or again what is \( [\Lambda_T - 1]^{-1} \)? Is it a novel transformation from a commutator space to a new commutator space? Is it closely connected to the Lorentz transformation and a further mechanical transformation? Is it a connection between the \( \bar{E} \) and \( \bar{B} \) fields and the quantum evolution of operators? And is it at the same time, connected to the Lorentz transformations? At this point I am in need of a clear, explicit form for the first point we made, the magnetic monopole does not need to be included at all. This connection still exists without including it in the Maxwell’s equations and the time derivative associated with them and the Heisenberg’s equations of motion. That brings in an amazing connection between them. Can we accept this connection?
During the first introduction in quantum history of the Schrödinger equation there was a funny poem written:

Schrödinger with his $\psi$ can do,  
Calculations quite a few.  
But what is $\psi$?

So what is $\Lambda_r$ here in this theory?

There is no intention here of removing the uncertainty principle of Werner Heisenberg, nor questioning the Copenhagen interpretation of Niels Bohr, nor making a conflicting claim contrary to Max Born’s probabilistic interpretation of the wave functions. I think the foundations of quantum mechanics are correct.

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