317(5): Development of the Ampère Law

If it is assumed that:

$$\underline{\nabla} \cdot \underline{B} = 0 \quad -(1)$$

and

$$\underline{\nabla} \times \underline{E} + \frac{\partial \underline{B}}{\partial t} = \underline{0} \quad -(2)$$

and define:

$$\underline{\kappa} = \frac{\underline{q}}{r^{(0)}} - \underline{\omega} \quad -(3)$$

it follows that:

$$\underline{\kappa} \cdot \underline{B} \quad -(4)$$

and

$$\underline{\kappa} \times \underline{E} = \underline{0}. \quad -(5)$$

The Ampère Law then takes the format:

$$\underline{\nabla} \times \underline{B} = \underline{\kappa} \times \underline{B} \quad -(6)$$

Using the quantum condition:

$$\underline{p} = \hbar \underline{\kappa} = -i\hbar \underline{\nabla} \quad -(7)$$

it follows that:

$$\underline{\nabla} \phi = i \underline{\kappa} \phi \quad -(8)$$

By definition:

$$\underline{A}^a = A^{(0)} \underline{q}^a \quad -(9)$$

and

$$\underline{W}^a{}_b = W^{(0)} \underline{\omega}^a{}_b \quad -(10)$$

2)

Removing indices:

$$\underline{\kappa} = \frac{\underline{q}}{r^{(0)}} - \underline{\omega} = \frac{1}{W^{(0)}}\left(\underline{A} - \underline{W}\right) \quad -(11)$$

and from previous work:

$$\underline{\nabla} \cdot \underline{q} \times \underline{\omega} = \underline{\nabla} \cdot \underline{A} \times \underline{W} \quad -(12)$$
$$= 0$$

A possible solution of eq. (12) is:

$$\underline{q} \parallel \underline{\omega} \quad -(13)$$

and

$$\underline{A} \parallel \underline{W} \quad -(14)$$

Using the minimal prescription:

$$\underline{p} = \hbar \underline{\kappa} = e\left(\underline{A} - \underline{W}\right) \quad -(15)$$

So

$$\underline{\kappa} = \frac{e}{\hbar}\left(\underline{A} - \underline{W}\right) \quad -(16)$$

and comparing eq. (11) and (16):

$$W^{(0)} = \frac{\hbar}{e} \quad -(17)$$

<u>Units check</u>

$$W^{(0)} = \text{weber} = \text{Tesla}\ m^2 = J C^{-1} s$$
$$\hbar / e = J s C^{-1}$$

3) As discussed in the Enigmatic Photon, eq. (17) is the elementary unit of magnetic flux. In ECE2, the minimal prescription (15) is defined, so the effective vector potential is $\underline{A} - \underline{W}$.

Conclusion

The Ampère Law of magnetism in ECE2 is

$$\boxed{\underline{\nabla} \times \underline{B} = \underline{\kappa} \times \underline{B}} \quad -(18)$$

The Ampère Maxwell law of electromagnetism is

$$\boxed{\underline{\nabla} \times \underline{B} - \frac{1}{c^2} \frac{\partial \underline{E}}{\partial t} = \underline{\kappa} \times \underline{B}} \quad -(19)$$

Eqs. (18) and (19) assume eqs (1) and (2).
