1)

Notes 56(3)

Field Equations of the Class of Electromagnetic AB Effects

These effects are defined as follows. In regions where there are no fields present:

$$F = 0 \quad -(1)$$

$$D \wedge A = 0. \quad -(2)$$

In the absence of gravitation, eq (2) means:

$$d \wedge A^1 = g A^2 \wedge A^3 \quad -(3)$$

$$d \wedge A^2 = g A^3 \wedge A^1 \quad -(4)$$

$$d \wedge A^3 = g A^1 \wedge A^2 \quad -(5)$$

$$d \wedge A^0 = -d \wedge A^3 = -g A^1 \wedge A^2. \quad -(6)$$

Eqs (3) to (6) define the electromagnetic AB potentials in regions where there are no fields.

In regions where there are fields present:

$$F = D \wedge A \neq 0 \quad -(7)$$

and

$$F^1 = d \wedge A^1 - g A^2 \wedge A^3 \quad -(8)$$

$$F^2 = d \wedge A^2 - g A^3 \wedge A^1 \quad -(9)$$

$$F^3 = d \wedge A^3 - g A^1 \wedge A^2. \quad -(10)$$

Standard Model

In the standard model there is no explanation for the AB effects because:

$$F = d \wedge A \quad -(11)$$

so if A is zero F is zero and if F is zero A is zero. A potential cannot exist in the absence of a field in the standard model.

Gauge Theory

The usual attempts to rectify this anomaly of the standard model are based on the gauge transformation:

$$A \rightarrow A + d\chi \quad -(12)$$

and the Poincaré Lemma:

$$d \wedge d\chi = 0. \quad -(13)$$

The Stokes Theorem is then used to claim that

$$\int_S d \wedge d\chi \neq 0 \; ? \quad -(14)$$

As shown in Vol. 1 of "Generally Covariant Unified Field Theory" (Abramis 2005), this claim is mathematically incorrect.

4) The generally covariant Stokes theorem must be used in ECE theory (vol 1 and paper 29 of vol 2):

$$\int_S F = \oint A \quad -(15)$$

Therefore if $F = 0$,

$$\int_S D \wedge A = 0 \quad -(16)$$

i.e.

$$\int_S d \wedge A^1 = \int_S g A^2 \wedge A^3 \neq 0 \quad -(17)$$

$$\int_S d \wedge A^2 = \int_S g A^3 \wedge A^1 \neq 0 \quad -(18)$$

$$\int_S d \wedge A^0 = -\int_S d \wedge A^3 = -\int_S g A^1 \wedge A^2 \neq 0. \quad -(19)$$

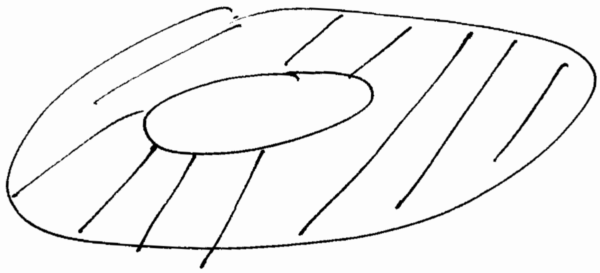
The Chambers effect is due to surface integrals such as those in eqs. (17) to (19). The area is defined by the path of the electron beams as is well known.

5) Inside the shaded area of Fig (1):

$$\int_S F = 0. \qquad -(20)$$

AB experiments can be understood by defining one area inside another:

<u>Fig (1)</u>



The surface integral in eq. (20) refers to the shaded area in Fig (1) and excludes the inner area, representing the iron whisker and $F \neq 0$ in the Chambers experiment. The surface integrals in eqs. (17) to (19) also refer to the shaded area in Fig (1), <u>i.e. the area where $F = 0$</u>. In this area the surface integrals in eqs. (17) to (19) are <u>non-zero</u>.

In the standard model, the AB effect is <u>incorrectly</u> attributed to:

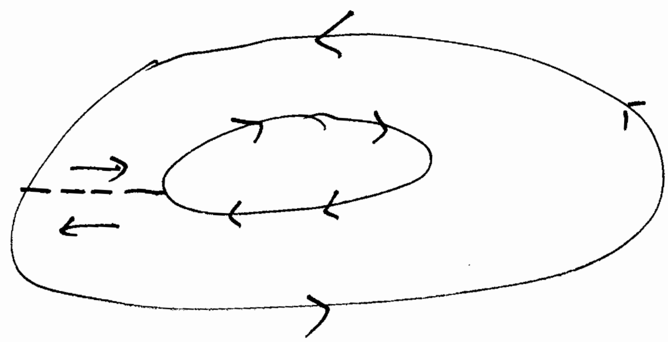
$$\int_S d \wedge d\chi \neq 0 \; (?) \qquad -(21)$$

) is the shaded area of Fig (1). This is incorrect because by Stokes' theorem:

$$\int_S d \wedge d\chi = 0 \quad -(22)$$

for all χ. The correct contour integral to be used is:

Fig (2)



and produces the result that there is NO AB effect

$$\boxed{\int_S d \wedge d\chi = \oint d\chi = 0 \quad -(23)}$$

for ANY function χ.

This serious error in the standard model has been accepted uncritically for years. The correct explanation of any AB effect always requires a generally covariant unified field theory (i.e. ECE theory).

8) The Chambers effect is observed experimentally to be the integral over the magnetic flux density of the iron whisker over the total area enclosed in Fig (1). In the shaded area there is no magnetic flux density, but there is a non zero potential A_1.

So the Chambers effect is:

$$\int_S F = \int_S D \wedge A = \oint A \quad \text{— (24)}$$

with:

$$\int_S D \wedge A_1 \ (\text{shaded area}) = 0, \quad \text{— (25)}$$

$$\int_S D \wedge A \ (\text{inner area}) \neq 0. \quad \text{— (26)}$$

The A_1 in the shaded area is different from the A in the inner area. The effect is due to the A_1 of the shaded area adding momentum to a test electron via eq. (11).