FUNDAMENTAL FIELDS AND PHASE INFORMATION

Modern science has generally restricted itself to the study of topics acceptable to mainstream science. Such topics as dowsing, radionics, psychotronics, UFO's, absent healing, psychic surgery, plant communication, ESP, PK (psychokinesis), pyramidology, Kirlian photography, tachyons (faster than light objects), biofeedback and biomagnetics are generally treated with suspicion.

It is not without reason that mainstream science demands proof of the existence of para-normal events, but unfortunately, the borderline sciences have been deficient in providing material evidence. One reason behind this predicament may be that most para-normal events operate at a subtler level than at a gross material level. For example, a healer's hands may feel hot to the patient, but no significant rise in temperature can be observed with a thermometer. In another example, dowsers often claim success in locating underground streams. Here again no significant fields, whether electric or magnetic, can be observed.

For lack of a better term, these subtle fields will be called psi fields. A link between psi fields and electromagnetic fields was hinted at when an acupuncturist friend told the author that he could light fluorescent bulbs with his hands. Another link was provided by a paper written in 1959 by **Y. Aharonov** and **David Bohm.**(1) In this paper, the authors described a subtle effect arising from potential fields rather than from electric or magnetic fields. A short account of the Aharonov-Bohm effect will follow.

The Aharonov-Bohm Effect

In a region with electric and magnetic fields $\vec{E}$ and $\vec{B}$, classical physics predicts that a particle of charge q will experience a force (Lorentz force)

$$\vec{F} = q\vec{E} + q/c\ (\vec{V} \times \vec{B}) \qquad (1)$$

where c is the speed of light, $\vec{v}$ the particle velocity. If the $\vec{E}$ and $\vec{B}$ fields are radiation fields (time varying) then the energy flow (Poynting's vector) is

$$\vec{S} = \frac{c}{4\pi}\ \vec{E} \times \vec{B} \qquad (2)$$

If both the electric and magnetic fields are zero, then it is seen that all forces are zero and all energy flows are zero. Thus no physical consequences can be observed if the $\vec{E}$ and $\vec{B}$ fields are zero.

Quantum mechanics requires the use of potential fields rather than the $\vec{E}$ and $\vec{B}$ force fields. The vector potential, $\vec{A}$, and the scaler potential, ϕ, are related to the $\vec{E}$ and $\vec{B}$ fields by

$$\vec{E} = -\nabla\phi - \frac{1}{c}\frac{\delta\vec{A}}{\delta t} \qquad (3)$$

$$\vec{B} = \nabla \times \vec{A} \qquad (4)$$

It has been assumed that the use of ϕ and $\vec{A}$ are equivalent to the use of $\vec{E}$ and $\vec{B}$. However, Aharonov and Bohm, in their paper, showed that the potential fields, ϕ and $\vec{A}$, can result in physical consequences when both $\vec{E}$ and $\vec{B}$ are zero.

The quantum mechanical Schrodinger's equation in an electromagnetic field is

$$\frac{1}{2m}\left[\frac{\hbar}{i}\nabla - \frac{q}{c}\vec{A}\right]^2\psi + q\phi\psi = E\psi \qquad (5)$$

where ψ is the electron wave function. Aharonov and Bohm suggested an experiment whose set-up is shown below.

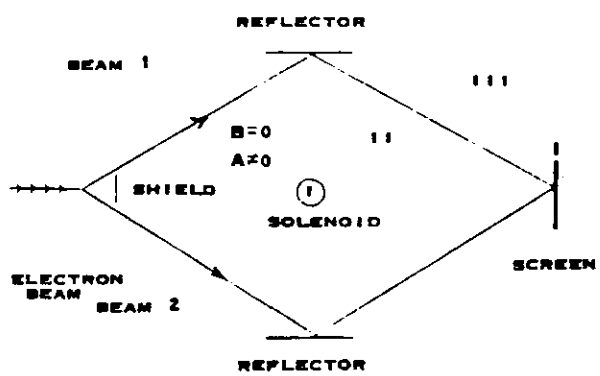

Fig. 1 Set-Up for Aharonov-Bohm Interference Experiment

An electron beam is split into 2 beams which encloses a tightly wound long solenoid. The beams are recombined at a screen and their interference pattern observed. If there are no fields present (neither $\vec{B}$ nor $\vec{A}$) and the path lengths are the same, then the electrons will interfere constructively because their phases were the same in the initial beam. Now the solenoid is turned on and a magnetic flux exists inside the solenoid. However since it is a long and highly wound solenoid, no magnetic fluxes exist in region II. At the same time, a vector potential field

$$\vec{A} = (A_\tau, A_\sigma, A_\zeta) = (0, 2N_i \pi a^2 / cr, 0) \quad (6)$$

exists in region II. Here i is the current, N the number of turns per unit length, a the radius of the solenoid, r the distance from solenoid axis. it is seen that indeed $\vec{B}$ = O by using equation (4).

$$\vec{B} = \nabla \times \vec{A} = 0 \quad (7)$$

Thus we have the situation where $\vec{B}$ = O but $\vec{A} \neq$ O. Does this have any physical consequences? The solution to Schrodinger's equation for an electron traversing path 1 is

$$\psi = \psi_0 \exp [{}^{iq}/_{hc} \int_{x_1} \vec{A} \cdot d\vec{l}] \quad (8)$$

Where ψ_0 is the free particle solution and the integral measures the summation of $\vec{A}$ along the path of travel. The combined solution for an electron along path 1 and another electron along path 2 is thus

$$\psi = \psi_1 + \psi_2 = \psi_0 \exp [{}^{iq}/_{hc} \int_{x^1} \vec{A} . d\vec{l}] + \psi_0 \exp [{}^{iq}/_{hc} \int_{x^2} \vec{A} . d\vec{l}] \quad (9)$$

What is observable is the probability density.

$$\psi^* \psi = 2 |\psi_0|^2 + 2 |\psi_0|^2 \exp [iq/hc \oint \vec{A} . d\vec{l}] \quad (10)$$

Where the integral denotes the summation of $\vec{A}$ along the closed loop, path 1 plus path 2. The remarkable property is that the observable $\psi^* \psi$ varies with $\vec{A}$ even though no $\vec{B}$ field interacts with the electrons! Thus Aharonov and Bohm theoretically predicted electron phase shifts when no force fields are present. A number of experiments have been performed which confirmed the existence of this effect.[2, 3, 4]

The Existence of Potential and Scalar Fields and Waves

Aharonov and Bohm did not have psi fields in mind when they were writing their paper. As a consequence, the above described experimental set-up used locally generated potential fields and the electron beams enclosed a magnetic flux. In fact, the phase integral is equal to the enclosed magnetic flux,

$$\oint \vec{A} . d\vec{l} = \Phi_B \quad (11)$$

These are severe limitations. If potential fields have any correspondence to psi fields, then they should exist independently of enclosed fluxes and can originate from non-local sources.

In fact, electromagnetic theory does predict the existence of potential waves traveling at the speed of light. If we substitute equation (1) and (2) into the 4 Maxwell equations

$$\begin{aligned} \nabla . \vec{E} &= 4\pi\rho \\ \nabla . \vec{B} &= 0 \\ \nabla \times \vec{B} &= \frac{4\pi}{c} \vec{J} + \frac{1}{c} \frac{\partial \vec{E}}{\partial t} \\ \nabla \times \vec{E} &= - \frac{1}{c} \frac{\partial B}{\partial t} \end{aligned} \quad (12)$$

and use the Lorentz gauge condition

$$\nabla . \vec{A} + \frac{1}{c} \frac{\partial \phi}{\partial t} = 0 \quad (13)$$

and assuming we are far away from sources, then we arrive with two potential wave equations.

$$\nabla^2 \phi - \frac{1}{c^2} \frac{\partial^2 \phi}{\partial t^2} = 0 \quad (14)$$

$$\nabla^2 \vec{A} - \frac{1}{c^2} \frac{\partial^2 \vec{A}}{\partial t^2} = 0 \quad (15)$$

The important question is whether the $\vec{A}$ and ϕ waves need always to be in association with $\vec{B}$ and $\vec{E}$ wave. For the static or quasistatic case (the Aharonov-Bohm effect) we see that $\vec{A}$ can decouple from $\vec{B}$. For the time varying case, it is more complicated because if we initially have

$$\vec{B} = \nabla \times \vec{A}(t) = 0 \quad (16)$$

then

$$\vec{E} = - \nabla \phi - \frac{1}{c} \frac{\partial \vec{A}(t)}{\partial t} \quad (17)$$

E is not necessarily zero. $\vec{E}$ not equal to zero automatically generates a $\vec{B}$ and thus $\vec{A}$ will be forced to couple with $\vec{B}$.

However, if our generating source forces $\vec{B}$ to be zero at all times, then we automatically insure that $\vec{E} = 0$ for all times because

$$E_0 = cB_0 \tag{18}$$

where B_0 and E_0 are the magnitudes of the $\vec{B}$ and $\vec{E}$ fields. $\vec{E} = 0$ means that from equation (17)

$$-\nabla\phi - \frac{1}{c}\frac{\partial \vec{A}}{\partial t} = 0 \tag{19}$$

Equation (19) can always be satisfied if a scalar field, χ, exists such that

$$\vec{A} = \nabla\chi \tag{20}$$

and

$$\phi = -\frac{1}{c}\frac{\delta\chi}{\delta t} \tag{21}$$

If equation (20) and (21) are substituted into equation (13) we obtain

$$\nabla^2\chi - \frac{1}{c^2}\frac{\delta^2\chi}{\delta t^2} = 0 \tag{22}$$

which is a wave equation for χ.

Thus we have predicted the existence of scalar waves. The scalar waves replace the potential waves when the physical $\vec{E}$ and $\vec{B}$ field are zero. The scalar fields are more primitive than the potential fields in that the latter are derived from the former. Equation (20) substituted into equation (8) results in

$$\psi = \psi_0 \; exp\left[\frac{iq}{\hbar c}\;\chi\right] \tag{23}$$

Equation (23) shows that χ is just a phase parameter. It has no physical consequence on a single electron because

$$\psi^*\psi = |\psi_0|^2 \tag{24}$$

However, for two interfering electrons

$$\psi^*\psi = |\psi_1|^2 + |\psi_2|^2 + 2|\psi_1||\psi_2| \, exp\left[\frac{iq}{\hbar c}(\chi_1 - \chi_2)\right] \tag{25}$$

and the exponential phase factor may be directly observed.

Consider the radiation from an oscillating dipole. The vector potential field is

$$A \propto \frac{sin(\omega(t-r/c))}{r} \tag{26}$$

In the radiation zone ($r \ll \lambda$)

$$E \propto \frac{cos(\omega(t-r/c))}{r} \tag{27}$$

and

$$B \propto \frac{cos(\omega(t-r/c))}{r} \tag{28}$$

The energy received at the receiving antenna

$$S \propto E.B \propto \frac{1}{r^2} \tag{29}$$

The scalar phase parameter, χ, also appears to have a $\frac{1}{r}$ dependence.

$$\chi \propto \frac{cos(\omega(t-r/c))}{r} \tag{30}$$

Thus we see that in detecting χ fields a 1/r drop in intensity will be observed, while in detecting radio waves a $1/r^2$ drop in intensity will be observed. It is also interesting that $\vec{A}$ fields, when decoupled from $\vec{E}$ and $\vec{B}$, become χ fields which penetrate all objects because there will be no energy transfer to objects when E and B are zero. However, if $\vec{A}$ interacts slightly with highly non-linear media or a weak coupling with B and E exists, then it is possible that A can be rotated enough such that

$$\vec{B} = \nabla \times \vec{A} \neq 0 \tag{31}$$

The gas mixture in a fluorescent tube is a highly non-linear media. It is perhaps due to the above explanation that the acupuncturist was able to light the fluorescent tube with his hands.

Scalar Field Generators

A simple $\vec{A}$ field generator consists of a toroid coil.

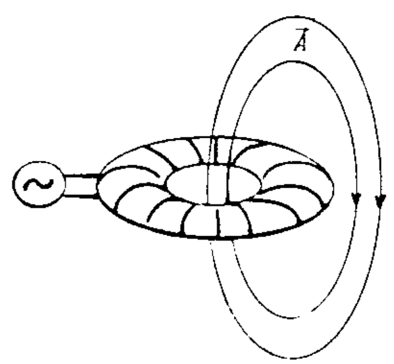

Fig. 2 Toroid $\vec{A}$ Field Generator

The $\vec{B}$ flux are enclosed inside the coil and only $\vec{A}$ fields exist outside. At ELF frequencies, this set-up can generate strong $\vec{A}$ fields. However, at radio frequencies, $\vec{E}$ and $\vec{B}$ fields will be generated outside as well.

A true scalar generator is shown below

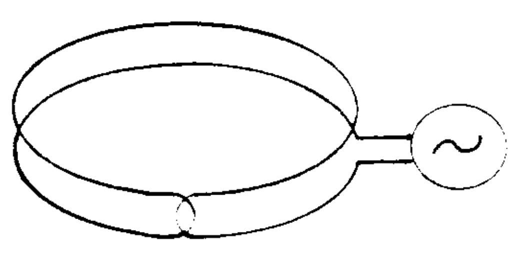

Fig. 3 Möbius Scalar Generator

It merely consists of a loop in a figure 8 configuration with a double twist at the neck and fold over itself. This configuration insures that nearly all electromagnetic fields and potential fields are cancelled. However, the scalar field need not be zero. The scalar field measures the phase of the current and an electron at the beginning of the loop will have a different phase than at the end of the loop due to lattice scattering. Thus there should be an average phase difference between the top loop and the bottom loop. The scalar fields will reflect this average phase difference.

The author has been informed that such a device has been developed and certain properties of scalar fields have been qualitatively confirmed.+ The generated fields appear to penetrate everything and seemed to have a 1/r dependence. Another feature of this device operating near the earth's Schumann resonance frequencies (7 - 10 Hz) was that it has a calming effect on humans and animals.

The Detection of Scalar Fields

Biological organisms and gas tubes serve as highly non-linear media, and for this reason they can serve as scalar field detectors. However, the efficiency may be rather low. For high efficiency detection, an electron interference device should be used. The set-up can be as shown in Figure 1. It is the contention of this author that this set-up can measure fields from region III, as well as from region II. For a local source closer to beam 1, beam 1 will be phase shifted more than beam 2. Hence interference effects will be observed on the screen if the source intensity changes.

Conclusion

This paper has attempted to link persistent reports of subtle fields known to science. In the process, the existence of scalar fields and scalar waves were predicted. These are fields with long range and great penetrating power. It is gratifying that in this period of research other researchers reported the observation of fields which behaved qualitatively similar to the predicted scalar fields. The scalar fields are mathematically the same as the gauge fields used in unified field theory. They belong to the mathematical group U(1) which is a subset of a large group SU(3) X SU(2) X U(1) which include tensor fields, as well as scalar fields and relate the electromagnetic, weak and nuclear forces to each other. If the scalar fields have reality, then it is also possible that the abstract tensor fields have reality, and new vast areas will be opened for research.

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