AN EXAMINATION OF THE MAGNETIC FIELD

By the nature of this title, the reader may be wondering what aspects of quantum electrodynamics will be examined in this paper. No aspects of QED will be addressed in this paper. Instead, an alternative model *which explains the known experimental facts* will be proposed to QED. At this last sentence, the reader is already experiencing vehement opposition (to say the least) to this paper. The reader's perspective is as follows. Can I (the theorist) provide even an incremental reason as to why an alternative to QED should be given even remote consideration? QED is the most rigorously tested theory in all of physics (or all of science for that matter). It has been successfully tested to thirteen decimal places with resounding success. As Feynman himself once said, it's comparable to measuring the distance between Los Angeles and New York and coming to an accuracy within the width of a human hair. What possible motivation is there for developing an alternative to QED? Although the idea of developing an alternative model to QED seems positively ludicrous, there are reasons for considering the possibility.

Firstly, in the paper on the Heisenberg uncertainty principle at this web site, substantial doubt should have been cast on the validity of the Heisenberg uncertainty principle. Quantum field theory *relies* on the uncertainty principle in various respects. If the uncertainty principle is accepted as invalid, then we have no alternative in the matter. We *must* develop an alternative model to quantum field theory that explains the known facts.

Secondly, although QED is the most rigorously tested theory in all of physics, there is a "fly in the ointment". What is specifically being referred to, is renormalization. It is my understanding that there are some physicists (albeit an exceedingly small number) who are reluctant to accept quantum field theory (despite its outstanding experimental verification) because of renormalization. They would prefer to see another model which does not rely on renormalization. Furthermore, there are some physicists who are uncomfortable with renormalization even though they accept the fundamental validity of QED. For example, in Steven Weinberg's book *Dreams of a Final Theory*, on page 115 he states the following. "Dirac in particular always referred to renormalization as sweeping the infinities under the rug." The model outlined in this paper, will not rely on renormalization.

Thirdly, I myself have expressed a degree of opposition to certain aspects of contemporary theoretical physics. (My opinion may not "count" in the reader's eyes since, as of this writing, I do not have a "name" for myself. Notwithstanding this fact, I feel that my position is of a legitimate nature, and I will offer my own "two cents" on the subject.) In part V of my paper on the Heisenberg uncertainty principle, one of my objections to $\Delta E \Delta t \geq \frac{1}{2}\hbar$ was that I do not believe that a fundamental law like the conservation of energy can be broken even if we're dealing with "special circumstances" such as time scales being kept infinitesimally small. (If the reader has not read this paper, objections to $\Delta E \Delta t \geq \frac{1}{2}\hbar$ have been dealt with in much greater detail in part V of that paper.) Therefore, if *any* theory in physics relies on this equation, I would prefer to see another model to explain the known facts.

Although the reader may be reluctant to agree with the third objection outlined, presumably the reader is somewhat receptive to the first two objections. Therefore, despite the phenomenal experimental rigour with which QED has been verified, there are grounds for (at the very least) giving consideration to the possibility of an alternative model.

In order to explain this new model, we shall first proceed with some very rudimentary precepts. If we place a bar magnet under a piece of paper and put iron filings on top of the paper, what pattern do we see emerge? We see certain closed, circular loops form around the magnet. (See diagram).

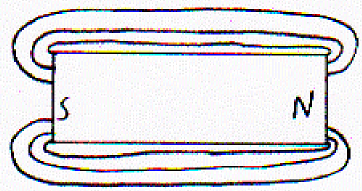

Fig.1

These closed, circular loops will be referred to as lines of force. Instead of saying that these lines of force "appear" in the presence of a magnetic/electromagnetic field, can a more precise explanation of their "emergence" be provided? Although a more precise explanation can be provided, a lucid explanation is of a rather difficult nature. Regrettably, diagrams would not facilitate a more comprehensible explanation. The reader should keep this in mind when reading the “mechanism” of how these lines of force emerge. To begin, we will confine our analysis to the lines of force which are closest to the *edges* of the magnet before proceeding to analyze the other lines of force. (Although this analysis is being made with respect to a bar magnet, the analysis can be extrapolated to any other type of a magnet, such as a U-magnet.) When a line of force emerges at the outer edge, it cannot propagate any further outwards in a linear motion. This line of force *will* curl back on itself to form a closed loop (with the magnet) for the following reason. The very corner of the magnet will exert an attractive force on the line of force and induce a slight curling motion. The line of force will then propagate in a linear motion in a the opposite direction from where it emerged. When the line of force reaches the *other end* of the magnet the reverse of what transpired at the first end will now take effect. Namely, instead of the line of force propagating linearly forward, this second corner of the magnet will exert an attractive force and cause the line of force to curl inwards towards the magnet thereby establishing a closed loop. (My apologies if the explanation was "murky".)

We will now analyze the other lines of force that are further from the edges of the magnet. It is the first line of force which will have the same effect on the second line of force that the edge of the magnet had on the first line of force. Specifically, the second line of force will not propagate linearly outwards but will loops back on itself *as a result* of the attractive force of the first line. Once this "initial loop" (from the second line of force) has been established, the second line will propagate linearly. However, it will not propagate indefinitely in a linear fashion as the first line will exert an attractive force on the second line and cause it to curl inwards thereby establishing the second loop around the magnet. The singular tense has been used in these explanations. However, since there are loops around both horizontal sides of the magnet, the same thing is transpiring on *both* sides of the magnet. Namely, lines of force emerge from *one* vertical end, curl back on themselves and propagate on *both* horizontal sides, and re-enter the *one* vertical side at the other end.

If the reader was able to follow the above, then this is an explanation of how these lines of force "appear" in the presence of an electromagnet. (This “appearance” of the lines of force wouldn't apply to a static magnetic field such as is found in a bar magnet as the lines of force are already there. However, the lines of force would establish closed loops in the same way they are established with an electromagnet.) In regards to this explanation, a few things must be emphasized. The most important aspect to emphasize is the speed with which all of this transpires. The following sentence will become critical in a subsequent part of this paper.

These lines of force propagate at light speed. They are relativistic.

In the explanation, the individual lines were analyzed separately. However, this was only done for explanatory purposes. Since the lines propagate relativistically, the lines of force "appear" almost instantaneously.

The reader may have noticed an unanswered question in the analysis. How does one line of force (or even the edge of the magnet when we are dealing with the *first* line of force) exert an influence on another line of force to cause it to curl in and form a loop? In the paper on heat, it was stated that there are questions which need to be answered but were not answered at that time. They were questions which I would have to analyze in the future. The same can be said about this analysis. I don't know the answer to the question posed. However, merely because a scientific theory does not contain certain answers, that doesn't *automatically* render the theory incorrect. It may be that this question will require a more intense level of theorizing before an effective answer is provided. I am reasonably certain that in the future I will be able to provide the answer being sought.

From this analysis, new theoretical physics can be developed. If these lines of force are propagating at light speed, then they must be a concentrated form of energy. The energy content of a magnetic field would be derived from the following equation.

$$E=BH(\text{CONSTANT}) \qquad (1)$$

The energy of a magnetic field is directly proportional to the magnetic induction of that field (B) times the magnitude of the field itself (H) times a constant (whose value, at this time, is unknown in the same way that the value of "G" was unknown when Newton formulated the theory of gravity). The reader's reluctance to accept anything that has been stated thus far may stem from the fact that I have yet to show how these lines of force can even begin to explain repulsion and attraction. How can I possibly show that this model of the electromagnetic field could replace the exchange of virtual photons?

An important principle in explaining attraction and repulsion via this model lies with the stated position that these lines of force are relativistic. Working within these parameters, it is critical to realize the following principle when dealing with anything that is relativistic. *If something which is relativistic is capable of an interaction, then some type of pressure will be induced*. To (briefly) clarify this statement, the relativistic photon does induce pressure since it interacts with matter. However, the neutrino does not induce pressure as it can go through several light years of matter without interacting with anything. Electromagnetic repulsion and attraction can be explained by stating that these lines of force *interact with each other*. Specifically, the lines of force from one magnet interact with the lines of force from another magnet.

In order to facilitate the explanation of attraction and repulsion, we will utilize a model that is sporadically utilized in first year physics text books to explain QED. This model entails children on roller skates with pillows. When one child throws a pillow at the other, he recoils. When the other child catches the pillow, he also recoils. That is how repulsion is explained in QED. To explain attraction, the children hold on to the pillows but refuse to let go of them. When they try to pull the pillows out of each other's hands, there is an attraction. In order to establish how relativistic lines of force are responsible for attraction and repulsion, we will still utilize the model of children on roller skates. However, we will eliminate the pillows (virtual photons). Instead, their arms will represent the lines of force.

When lines of force from separate magnets interact with each other, whether there will be an attraction or repulsion depends on whether the lines of force are moving in the same direction, or in opposite directions. Since we are dealing with closed loops, the directions will either be clockwise or anti-clockwise.

First, we will explain repulsion. Let's assume the same poles (regardless of whether they are the north or south poles) of a magnet approach each other. The lines of force will be propagating in opposite directions. One clockwise, the other anti-clockwise.

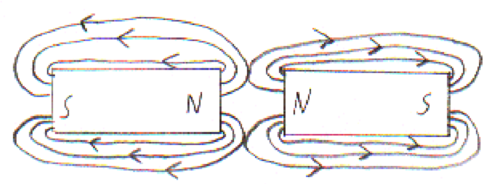

Fig.2

When the lines of force from each magnet interact with each other, they will interact in such a manner as to cause repulsion. The following diagram is comprised of two simple arrows which will propagate in a circular motion.

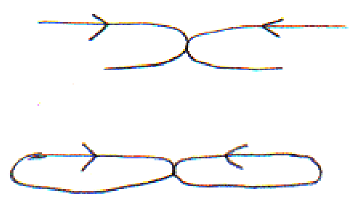

Fig.3

When the lines of force "connect" with each other, they will make contact. The contact is of such a nature as to "push" away. (The reader should keep in mind that in first year physics a Newtonian force could, in simple terms, be described as a push or pull.) If this transpires, there will be a repulsion. Let's utilize our children on roller skates to further the illustration. Let's say the children thrust out their arms in such a manner as to mimic the lines of force in diagram 3 (which of course is meant to be representative of the lines of force on a magnet). If they faced each other when they did this, the palms of their hands would connect and they would push each other away. Therefore, their "lines of force" (their arms) would push each other away and establish repulsion.

The reader's natural question is, how could this model be utilized to explain attraction? When the lines of force are going in the same direction, there will be an attraction.

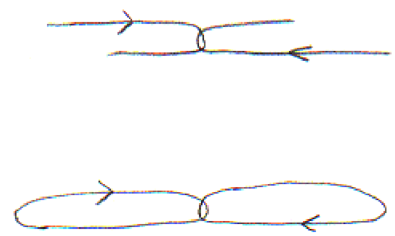

Fig.4

As the reader should be able to see from the diagram, there is a difference in the nature of the interaction when the lines of force are in the same direction. Instead of a "clash" between the lines of force, there will, instead, be a "coupling" action between them. It is this coupling which will cause attraction. Again, we will return to the children on roller skates. If they thrust out their arms in a similar manner as is illustrated in diagram 4, then their palms will *not* connect and subsequently repel. On the contrary, their arms (presumably at the elbows) will "interlock" (when their arms close back in order to form a circular loop), establish a certain coupling action and cause the children to be attracted towards each other. For the purpose of emphasis, it will be repeated that when we are dealing with relativistic "entities" (as is the case with these lines of force), an interaction between them will result in pressure. The pressure being induced in this case is of such a nature as to create a "pull" which will bring the magnets together.

In this model, there would be an incremental difference between the specific nature of attraction and repulsion. For the purposes of simplicity, we will assume there are only three lines of force. The outer lines, the middle lines, and the inner lines (the lines closest to the magnet). In repulsion, when the outer lines (which of course are propagating in opposite directions) make contact, this is the only factor necessary to induce repulsion. However, to induce attraction, more is required. Firstly, the outer lines of force will interact with each other (in the manner previously described) and draw the magnets incrementally closer to each other. At that stage, the middle lines will interact and draw the magnets even closer. Finally, the inner lines will interact and draw the magnets even closer. Although the process has been described in steps, the entire sequence transpires (almost) instantaneously as the lines of force are relativistic.

This model does explain the known facts about the electromagnetic field. When experiments to test QED have been conducted, one of the primary things that has been established is that "something" (which has always been assumed to be a virtual photon) travelling at light speed is mediating the electromagnetic field. However, as has already been stated the lines of force are relativistic. Secondly, when comparing this model to QED, this model is slightly better at explaining certain known experimental facts as it shows that monopoles *cannot* exist. If you cut a bar magnet in half, there is still a dipole as there are still lines of force exiting from both ends. QED on the other hand still leaves room for monopoles despite the fact that none have ever been found. (It goes without saying that if monopoles are ever conclusively found, this theory will be proven wrong. However, the finding must be conclusive, in contrast to the mistake that Stanford made in 1982.) Thirdly, explaining the repulsion and attraction via these lines of force is in slightly greater accordance with the "philosophy" of physics for the following reason.

Many years ago, I attended a superstring colloquium in which the following transpired. During the standard question and answer period at the end, a physics professor in the audience put the following question to the speaker. "Why are you presenting this to us?" The gist of the speaker's response was, what the hell is that supposed to mean? The professor then went on to state the following. The entire basis of physics is the experimental verification of theory. Superstrings is completely untestable not only for now, but for the foreseeable future as well. Therefore it's not physics. Since virtual photons are virtual how can we ever be absolutely certain that they're there? All we do know for certain is that something which is relativistic is mediating the electromagnetic field. We know that the lines of force are there since these lines of force appear when we place iron filings on top of a piece of paper that has a magnet underneath it. Therefore, if it were possible, (and it's clearly been shown that it is) would it not be more judicious to explain the electromagnetic force in terms of these lines of force?

The reader's primary objection to this model is reasonably clear. Namely, this model cannot be extrapolated to quantum entities such as the electron. I myself seem to be "acknowledging" this by stating that monopoles cannot exist. Yet with the electron, it *only* possesses a negative magnetic moment, not a dipole moment. Consequently, this model simply *must* be wrong. The reader's objections are perfectly understandable. However, if you will read the section on chemistry at this web site, I *have* been able to extrapolate this model to quantum entities. This statement may appear to be ridiculous as it seems categorically impossible that this model could be extrapolated. However, it is redundant to delve into the details of extrapolating this model to electrons in this paper as the material is dealt with under the chemistry section. Therefore, before the reader rushes to judgement, I ask that criticism (on the grounds outlined) be withheld until the chemistry section has been read.

A degree of clarification should be provided as it pertains to the last paragraph. When (or from the reader's perspective, if) I extrapolate this model to quantum entities, will I be able to explain things as well as QED can? *For the time being*, I cannot. Although I will explain how this model explains the magnetic moment of the electron, proton, etc., I cannot predict the electron's magnetic moment with the same theoretical/experimental "rigour" that QED can. However, in my defence, this theory is in its infancy. I've already pointed out that there are questions which I must answer in the future. The reader should also keep in mind that when QED was first formulated, there was a major problem with the infinities. This problem plagued QED for many years until renormalization was introduced. In a similar way, although I do not have complete answers yet, I trust that one day I will. There is the possibility that, one day, this theory will develop to such a magnitude, that it may become far more complex and intricate than contemporary quantum field theory.

In previous papers at this site, new physics has been developed when a particular phenomenon has been taken "to an extreme". Would new ideas emerge if the phenomenon of magnetism were taken to an extreme? In this analysis, we shall take "B" (magnetic induction) to an extreme but "H" (the magnetic field) will remain constant for reasons that will be presented.

This paper has presented the equation E=BH(CONSTANT). Since energy is an integral part of the phenomenon of magnetism, energy would increase if either magnetic induction and/or the field itself were to increase. If *both* magnetic induction and the field were to arbitrarily increase, then we would simply have a larger and larger field with stronger teslas. No useful physics would emerge from such a situation. Therefore, to yield useful physics, we shall keep the field constant but increase the teslas. In order to provide an illustration of why this is necessary, we shall resort to a very silly analogy.

Let's assume we have a balloon which we are blowing up. As we continue to blow air into it, it naturally expands. However, we are going to adopt the position that this is a "magical" balloon. When it seemingly reaches its maximum point of expansion, it "magically" acquires more rubber thereby allowing it to expand further without bursting. If such a (ridiculous) situation were to prevail, then the energy content of the balloon would indefinitely increase as well as the size of the balloon. Since there is no such thing as a magical balloon, we know that once the energy content of the balloon reaches a sufficient magnitude, it will burst, thereby releasing the energy of the balloon.

The situation is analogous with magnetism. If *both* "B" and "H" were to increase simultaneously, it would be comparable to having a "magical" balloon whose size and energy content increased indefinitely. However, by keeping the magnetic field constant, a continuous increase in magnetic induction may induce certain effects which would constitute new physics. If the energy content were continually increasing, there would eventually come a time when the energy content greatly exceeded the magnitude of the field. Energy content cannot increase indefinitely (within a designated "area") without some "deleterious" effect being induced. To draw a different type of analogy, why have attempts at fusion thus far failed? We cannot contain the requisite energies within a designated "area". Any known material would vapourize once its energy content exceeded a certain limit. In a similar way, if magnetic induction were to continually increase, a time would eventually come when a *constant* field would no longer be able to "contain" (loosely speaking) the magnitude of the induction. Eventually, the energy would be released (in a scenario superficially comparable to an explosion), and the lines of force would disappear. If, somehow, this process were possible in a static magnet, it would no longer be a magnet since it is the lines of force which are responsible for the attraction and repulsion.

How this process could possibly be achieved, I do not know. My only possible hypothesis is to utilize an electromagnet and *dramatically* increase the amperes through the system in order to increase the teslas of the system. The amperes required would be nothing short of phenomenal. However, unless "H" remained constant this idea would be useless regardless of the magnitude of the amperes pumped into the system. The reader may feel that the attainment of such a situation is impossible. In order to refute this position, I do not want to have to repeat the arguments that were outlined in my paper on the Heisenberg uncertainty principle in section IV. This issue (it's technologically impossible to achieve goal "X") was dealt with in considerable detail in that paper. Therefore, I will only briefly repeat two of the precepts that were stated there. We don't know what the future holds and what future discoveries may be made. Merely because something is impossible today that doesn't necessarily mean it will never become a reality. In a similar way, although I am not cognizant of a method of dramatically increasing "B" *without* increasing "H" that doesn't necessarily mean it will never become a reality.