LIGHT

When the wave-particle duality of light was established in the early 1900's, it was, of course, a step forward for physics. However, a deeper analysis is required with respect to the nature of light. To state that light is comprised of waves of light or photons of light is grossly inadequate. If one is trying to define light, one cannot utilize the same word (light) within the definition of the word that one is trying to define. What is the precise nature of the waves, and what is the precise nature of the photons. The reader may feel that an analysis of this nature will inevitably lead to a physics catastrophe of one kind or another as a result of the historical precedence established in the late 1800's. Specifically, the postulation of the ether and its subsequent failure. Therefore, there should be clarification of the position being advocated. It is *not* being stated that light cannot propagate in a vacuum. Nor will it be stated that there is a requirement of some type of medium for light to propagate in since the sun's light reaches us via the vacuum of outer space. There is no doubt that light does not require a medium in which to propagate, and can propagate very well through a vacuum without the need for some type of medium. What is being advocated is a more intense analysis that provides a much better comprehension of the waves and photons. In this paper, light will be defined as follows.

> *Light is comprised of waves. These waves are comprised of photons which propagate with a sinusoidal motion.*

If the reader has read the paper on the Heisenberg uncertainty principle, he will realize that what has been stated in regards to *individual photons* (as opposed to waves), is very similar to the concept that was stated in relation to electrons. Specifically, the concept of a particle propagating with a sinusoidal motion. A mathematical description of a photon is described via the following. Firstly, the relativistic velocity of the photon will be established.

$$x = ct \tag{1}$$

Secondly, the photon must propagate with a sinusoidal motion. This is established via the following.

$$y = a\cos(w_o t + f) \tag{2}$$

In order to state the final equation which describes a photon, equation one will be expressed as $t = x/c$. This then results in the following.

$$y = a\cos\left(\frac{w_o x}{c} + f\right) \tag{3}$$

Although this is similar to the dynamics of the electron, there is one critical difference between the two. When dealing with an electron, its velocity is independent of the internal dynamics which induce a sinusoidal motion. With the photon, its velocity and sinusoidal motion are intricately connected with each other.

In order to increase our comprehension of light, the following must be implemented. Firstly, we must analyze the precise nature of photons. From there, it is then a question of analyzing how the photons "conglomerate" to propagate as cohesive waves. A perspective of this nature will then provide us with a vastly superior comprehension of light.

Since, according to this analysis, waves are comprised of photons, let us proceed with the first stage and analyze these photons. The primary experimental facts to be explained via a theoretical analysis is why the photon is relativistic and why it has a frequency associated with it. The simplistic answer to this is to state that the energy within the photon exists in a certain state so as to imbue the photon with a relativistic speed and a frequency. An explanation behind this nebulous statement is as follows.

In order to provide some degree of lucidity to the explanation, certain spatial orientations will be attributed to the photon. A very loose representation of the photon is as follows.

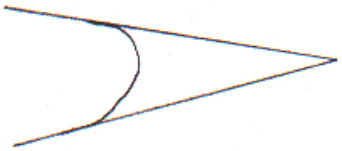

Fig.1

A representation of this nature has been developed for more than one reason. Firstly, this representation would be successfully indicative of a spin one particle. Since it has a superficial resemblance to an arrow, it would have to spin 360 degrees before it looked the same way again. However, there are more cogent reasons for this type of representation.

An (approximate) representation of this nature would serve to explain what was previously stated. Specifically, that the energy within the photon exists in a certain state so as to imbue the photon with a relativistic speed and a frequency. First, we shall analyze why this type of representation would induce a relativistic speed. As the reader can see, towards the back end of the photon there is, what could potentially be labeled, a type of "hole". In other words, there is no "back end" to the photon. The reason this would result in a relativistic particle is as follows. The energy within the photon could not be "evenly distributed" throughout the photon as a direct result of the unusual three dimensional configuration of the photon. Since the photon is, in essence, devoid of a "back end", the energy would not be effectively diverted there. However, since the representation provided is indicative of a "front end" that comes to a point, the photon's energy would be concentrated and directed towards the front of the photon. The fundamental ramifications of this are as follows. All of the photon's energy is concentrated in one direction within the photon. Since that direction is towards the "front end", this would inevitably induce a relativistic speed to the photon, assuming the energy is sufficient in magnitude. That energy would obviously be sufficient in magnitude as all photons are relativistic. (The reader may object to the

argument presented when it is compared with the pictorial representation provided. The pictorial representation would not necessarily be indicative of energy being directed towards the front, even if there was no "back end" to speak of. There are other areas within this photon where the energy could potentially be diverted. There are two things to be said in relation to an argument of this nature. Firstly, the frequency of the photon, and its relation to this configuration, has yet to be explained. Secondly, the pictorial representation is only meant to be an approximation. This is inevitable as nobody has ever "seen" a photon. The representation is only meant to be indicative of the following. The photon is "configured" in such a way so that the photon's internal energy would be concentrated and directed towards the front. A particle that was devoid of a "back end" but came to a point at the front would suffice to achieve this goal. The pictorial representation provided conforms to these broad parameters.)

The second quality of the photon that needs to be explained is its frequency and the reason that photons possess different frequencies. The frequency of the photon can simply be attributed to the photon propagating with a sinusoidal motion. But what *induces* this sinusoidal motion? An explanation is as follows. The photon's energy could not be continually directed towards the front unless there was some reason the energy were directed in a backwards *direction* (as opposed to the back end) and redirected towards the front. The latter process just explained would account for the photon's frequency. The specifics are as follows. Immediately subsequent to energy being directed against the front of the photon, that energy will, scatter in a backwards direction that is either in a downwards or upwards motion. What "factor" will decide whether the energy proceeds upwards or downwards is unknown. It may be nothing more than a fifty-fifty chance. Let's assume the energy proceeds upwards. When it initially proceeds in the backwards/upwards direction, once it scatters into the top end (towards the back) of the photon this would be the equivalent of the photon's "crest". (Even though the word crest is properly applied to wave phenomena as opposed to particles, we will nevertheless utilize the word crest in this context.) That same energy would then scatter from the crest *straight downwards* into the bottom end in order to establish the photon's "trough". From there, the energy would then be directed in a forwards motion again. It was stated that there may be nothing more than a fifty-fifty chance as to whether the energy is directed upwards or downwards once it begins to propagate in a backwards direction. Regardless of what may potentially decide this direction, the polarization of the photon will be determined by the initial direction in which the energy flows. According to *The Feynman Lectures on Physics* volume I, chapter 33, page 2, light which proceeds in an anticlockwise direction will have right-hand circular polarization. If the energy is initially directed upwards (and towards the back of the photon), the photon will have right-hand circular polarization. Should this explanation be lacking lucidity, an analogy will elucidate. Let's assume we have a pencil sitting on a table with the lead tip pointing in the right direction. If we push the lead tip upwards, the pencil will go upwards/anticlockwise. (This is not the best analogy as the energy within a photon is directed in a backwards *direction*, whereas the pencil is being pushed upwards at the front. Notwithstanding this fact, this analogy will have to suffice for our purposes.) This is the equivalent of right handed circular polarization with a photon. Conversely if the energy is initially directed downwards (and towards the back), the photon will possess left-hand circular polarization. (If the *initial* direction of the energy is downwards, the propagation of the photon will be initiated at the trough.) Therefore, the photon's sinusoidal motion/frequency and polarization has been explained. (The photon's circular polarization has not yet fully been explained. There are certain critical details which must be provided in order to complete the explanation. The explanation of circular polarization will be completed in a subsequent part of the paper.)

The next question may naturally be, what is the difference between a red photon and a violet photon. The simple answer may be that a violet photon has more energy than a red photon. However, more needs to be stated. It is my opinion that the primary difference amongst the energy levels of photons is not in the amount of energy contained therein, but that the same energy is being scattered within a smaller physical area. An explanation (and analogy) is as follows. Let's take the "conventional" Heisenberg uncertainty principle. (The reader is no doubt wondering what is meant by the use of the word conventional. That simply means the Heisenberg uncertainty principle which is independent of the analysis posted at this web site.) Let's assume we have a particle in a box. If we "magically" reduce the size of that box, the particle will reflect from the walls with greater "vigour" as its momentum has been increased. It's a superficially similar situation with the photon. A more energetic photon is a photon which is in possession of the same amount of internal energy as a less energetic photon, but has smaller dimensions. In the "conventional" Heisenberg uncertainty principle, it is equivalent to a particle being in a small box or the same particle being in a larger box. A red photon which is larger than a violet photon is *perceived* as possessing less energy as the intrinsic energy is distributed over a larger area. More precise details are as follows. If a red photon is in possession of slightly larger dimensions than an orange photon, the internal energy would have a slightly greater distance to traverse when propagating in a backwards direction before it initially scattered from the (let's say) top of the photon. At that stage, there would be a greater distance to traverse before it scattered into the bottom of the photon (in relation to an orange photon). *As a direct result of these greater differences* one photon would have a lower frequency than another photon. The reader may feel that there is a substantial flaw in this theory. If this concept of greater differences in the area to be traversed were true, since a red photon has a measurable difference in its frequency, then there should also be a measurable difference in its velocity. Yet both the red and violet photons are relativistic. This precept does not invalidate the theory for the following reason. The majority of the photon's intrinsic energy is directed in a forwards direction with only a limited amount "designated" for the photon's frequency. Therefore, the energy is *perpetually* impacting in the forwards direction. In order to achieve this constant impaction, there is (and this is speaking in extraordinarily loose terms), a "line up" of energy towards the front of the photon. In other words, there is a conglomeration of energy towards the front which serves to achieve this constant impaction. This is in stark contrast to the energy which is (again speaking loosely) "sporadically" propagating to induce the photon's frequency.

Now that there is a somewhat complete analysis of the photon (the fact that light is comprised of waves still has to be fully addressed), new physics can begin to emerge. According to Feynman, volume I, chapter 42, page 9, it was, "... Planck's viewpoint that only oscillators of matter were quantized,... ". It was Einstein who extrapolated this to light and ended up playing the most important role in establishing the photon theory of light (at least in my opinion). The equation $E = fh$ is applied to energy in general and shows that energy is quantized. What has been established thus far in this paper, produces an equation that is somewhat similar to Planck's quantum theory but is *only* applicable to light. This paper provides a more in depth analysis of light by examining the "internal mechanism" of light. It shows that light is a *source* of energy, not merely a form of energy. If light is subjected to "certain forces" (which will be momentarily described), light can be broken down to function in the capacity of an energy source. An equation to characterize the overall energy of light is as follows.

$$E = \sum_{\text{Foch space}} fh(\text{CONSTANT}) \qquad (4)$$

The constant will be the precise value of the *internal* energy of a photon (which will be the same regardless of the photon's frequency). Since this equation is so similar to Planck's quantum theory, the reader may wonder why we should even bother with it. Although the equations are similar, this paper is presenting a slightly more developed theory of light. The internal energies of all photons are the same. However, if that same energy is distributed over a smaller physical area, there will be certain discernible ramifications. Planck's quantum theory does *not* state that the internal energies of all photons are the same.

Given what is being postulated, it may be appropriate to point out the following. If we wish to view light in the capacity of a *source* of energy (as opposed to a mere form of energy) then the term (fh) would be fundamentally superfluous. This is for the simple reason that if we wished to assess the *internal* energy of all the photons within a designated Foch space, the energy of every photon would be the same. Therefore, a more appropriate equation may be as follows.

$$E = I_{(c)}\ (\text{CONSTANT}) \qquad (5)$$

The term $I_{(c)}$ simply refers to the intensity of light (i.e. the number of photons). However, the difference between equations four and five may be nothing more than a question of semantics. On the one hand a violet photon seems to be more energetic than a red photon, yet on the other hand they both possess the same amount of internal energy.

Certain papers under the physics section at this web site have had one thing in common. The phenomenon in question has been "taken to an extreme" to assess if new physics would emerge. A similar analysis can be applied here. If the frequency of a photon were taken to a phenomenally high level (beyond the energies of gamma rays) would new physics emerge? New physics does emerge which is along the following lines. As the frequency increases, the spatial dimensions of the photon becomes smaller. If the frequency were to increase to a very high level, the dimensions would become so small, that the energy could no longer be contained within the photon. The energy would virtually explode from within the confines of the photon. The photon would no longer exist but would be converted to energy. The reader may feel that this is an interesting idea in principle. However, in practical terms an "exploding photon" could not exist under any circumstances. As an example, a red photon cannot be "injected" with a sufficient amount of energy to cause it to "explode". This is not necessarily the case. General relativity dictates that as a photon proceeds towards a gravitational field, its energy will increase. (As a result of this paper, that entails that its spatial orientation has become smaller). Therefore, if a gravitational field (*or the equivalent thereof*) were sufficient in magnitude (perhaps a black hole) then a photon propagating directly towards it may reach sufficient energies to cause the photon to "explode".

(If you are reading this paper with the intent of gaining sufficient background information to comprehend the solution to the solar neutrino problem, you are now in acquisition of a sufficient amount of data to comprehend that paper. Since the rest of this paper is completely irrelevant to the solar neutrino problem, you may proceed to the paper under astronomy entitled, The Primary Source of Stellar Energy.)

Increasing the frequency of the photon, is one way of "taking light to an extreme". However, there is another method of "taking light to an extreme" which will also produce new physics. Specifically, the intensity of the light. What would transpire if we had a designated area (let's say a box) that contained a truly inordinate number of photons. I do not intend to take you through my analysis in a step by step fashion. I will only state the final result which has nothing to do with photons being confined to a box. However, in order to state the final result, the groundwork must be established via a scenario. Let's assume we have two photons propagating in outer space at a reasonable distance from each other. One is propagating along an imaginary "x" axis and the other is propagating along an imaginary "y" axis. Eventually they will meet at the same point. The photon on the "x" axis is a red photon and vertically polarized while the photon on the "y" axis is a gamma ray photon and horizontally polarized. (The final results of this analysis would seem to indicate that the polarization of the photon on the “x” axis shouldn’t matter. However, for the purpose of the explanation, we shall make it a vertically polarized photon.) Now, let's state that they meet at the same point, but meet in a certain way. (In the following analysis, I am not concerned with the probability of the situation actually occurring. I am fully cognizant that the probability of the following is phenomenally low. My only concern is the development of new physics.) The following conditions will prevail when the photons meet. The red photon will be at its node whereas the gamma ray photon will be at its crest. When they meet, the red photon will be slightly ahead of the gamma ray photon. What this entails is that although the photons will make contact with each other, the red photon will continue propagating in the same direction that it was propagating prior to the contact. If this situation were to prevail, what would transpire? If the two photons made contact at the precise moment that the gamma ray photon had reached its crest, the red photon would gain an incremental amount of velocity. (It should be emphasized that the "y" axis photon does not have to be a gamma ray photon. A gamma ray was merely chosen since a gamma ray reaching its crest would transfer the optimum amount of energy. Any photon would induce a similar effect. However, the amount by which the "x" axis photon was accelerated would be significantly lower with a lower frequency "y" axis photon.) Therefore, the red photon would be able to propagate at a superluminal speed. The reader would no doubt have more than one objection to this. Firstly, it would not be superluminal per se as the additional velocity imparted by the gamma ray photon would be so incrementally small that it would not be worthy of consideration. The extent by which the red photon would potentially exceed the speed of light is irrelevant. Even if it were by 10^{-100} % faster than the speed of light, it would still exceed the speed of light. The question is not what is the probability of this occurring, or to what extent the photon may travel faster than light, but if superluminal propagation is possible. Secondly, what if this process were to transpire successively? Namely, along the way the red photon encountered another gamma ray photon which made contact in the precise same way. If this transpired a myriad of times (even though the probability is close to zero) the red photon may reach a speed which is significantly greater than light. The second area of objection would pertain to special relativity. At the very least, time contraction would seem to preclude photons travelling at a superluminal speed. All I will state is that you must read my analysis of special relativity prior to proceeding with these critiques. No details of that paper will be mentioned in this paper as that particular paper is *very* unorthodox. You will simply have to read the paper. Another objection may state that the seeds of this theory's (superluminal propagation) destruction have already been laid in this very paper as a result of length contraction. I have attributed spatial dimensions to the photon and stated that the reduction of those dimensions will result in a higher energy photon. Furthermore, once those dimensions are sufficiently small, the energy can no longer be contained within the photon. My

defence is that length contraction would apply to objects with measurable rest mass, not photons. Secondly, a photon's energy will only increase if it is propagating towards a gravitational field or the equivalent thereof. In the final analysis, superluminal propagation (and communication) is, in principle, possible.

Before proceeding with an analysis of the precise mechanism by which photons "conglomerate" to propagate as "cohesive" waves, other points of interest should be mentioned. It has been stated that the photon is relativistic as (almost all of) its internal energy is concentrated and directed towards the front of the photon. This would be the essence of a relativistic particle. Therefore, does that mean that a neutrino would possess the same characteristic? Yes. If the neutrino has a similar characteristic (relativistic speed) to the photon, why are there differences? Why doesn't it have a frequency (or at least a measurable one) associated with it? Furthermore, in stark contrast to the photon, how can it travel through several light years of matter without interacting with anything? The primary answer to this lies in the neutrino possessing less energy than even the least energetic photon. The neutrino is to the photon what a brown dwarf is to a main sequence star. A brown dwarf never contained a sufficient amount of energy to initiate thermonuclear fusion and therefore it never reached the main sequence stage. It's merely a conglomerate of mass and some energy. In a similar way, the neutrino is nothing more than a failed photon. At the moment of its creation, its energy was insufficient to render it a photon. There was only a sufficient amount of energy to induce a relativistic speed. Furthermore, when dealing *exclusively* with the *spatial dimensions* of the neutrino (for the purpose of comparing it with the photon), its spatial dimensions are smaller than that of even the shortest wavelength photon. Therefore, there is insufficient physical area within the neutrino to enable energy to propagate in either an upwards or downwards direction when the energy propagates backwards. Consequently, there will be no frequency associated with the neutrino (or if there is a frequency, it would be so incrementally small that it would be inconsequential towards rendering an effective description of the neutrino). It is this "lack of a frequency" which enables the neutrino to travel through light years of matter without interacting with anything. The neutrino propagates *straight* through the "empty space" (speaking loosely) of atoms whereas the photon inevitably makes contact with the various components of atoms as a result of its frequency. Since neutrinos are chiral (specifically, left-handed) once a "designated amount" of energy was directed towards the front of the neutrino, it would be directed upwards/backwards and subsequently redirected towards the front of the neutrino again.

To complete the analysis of the "structure" of light, it is necessary to show how these "sinusoidal" photons propagate as waves. Before proceeding with the analysis, it should be stated that the reader must have some degree of familiarity with my paper on magnetism and the general nature of attraction as outlined under that paper. There are certain "ramifications" to energy constantly impacting against the "front part" of the photon and subsequently being directed in a backwards direction (internally speaking). Circular lines of force which are similar (but not the exact same) as lines of force from a magnet would emanate from the front end, curl to establish closed loops, and re-enter towards the rear part of the photon. Previously, circular polarization was described as the result of the photon's internal energy being directed either upwards/backwards or downwards/backwards. When circular polarization was explained, it was also stated that the explanation was lacking in certain details. The explanation of circular polarization will now be completed. Let's assume the energy is directed upwards/backwards. The lines of force will *only* be

directed in an anticlockwise direction. Conversely, if the energy is directed downwards/backwards, the lines of force will *only* be directed in a clockwise direction. It is these lines of force which are responsible for either the right-hand circular polarization or left-hand circular polarization of photons.

It would be appropriate to state how these lines of force differ from magnetic lines of force. Firstly, the lines of force from one end of a photon only propagate in one direction. Either clockwise or anticlockwise. Magnetic lines of force from one end propagate in both clockwise and anticlockwise directions. Secondly, lines of force from a photon will not interact with lines of force from a magnet. The primary reason for this is that the strength of the two forces is considerably different. The lines of force from a photon are significantly weaker and therefore have a longer range. The rationale behind this can be explained via a silly analogy. Let's assume we have two dogs that are tied by two different leashes to two different poles. However, one dog has a much stronger leash than the other. The dog on the stronger leash will not be able to move as far away from the pole than the other dog. The dog on the weaker leash will be able to move much further from the pole than the dog on the stronger leash. Furthermore, if the leash is weak enough, it may be possible to break the leash altogether and move completely away from the pole. Consequently, the weak lines of force from a photon would be able to propagate much further than the strong lines of force from magnets. The reader may feel that this explanation is inadequate to explain the precise reason that lines of force from photons possess a longer range than lines of force from magnets. A more in depth analysis is provided in the paper An Intensive Scrutiny of the Atom as it is in that paper that a more intense analysis becomes germane. In this paper, further details are not entirely relevant.

Any light wave, regardless of whether it's horizontally or vertically polarized (or some intermediate angle for unpolarized light) will have a combination of right and left circularly polarized photons. Let's take a light wave and establish an imaginary line down the wave's vertical centre (a vertical centre can be established even if the wave is horizontally polarized). On the left side of this wave will be photons in which the lines of force propagate in an anticlockwise direction (right-hand circular polarization). On the right side of the wave will be photons in which the lines of force propagate in a clockwise direction (left-hand circular polarization). The rationale behind this position is as follows. On either side of the wave, we could not have a combination of both right-hand circularly polarized photons and left-hand circularly polarized photons. Both types of photons must be maintained on one of the sides of the wave. If there were a combination of photons on both sides of the wave, the photons would interact with each other. Clockwise lines of force and anticlockwise lines of force would interact and negate the wave's "ability" to establish itself. However, when the photons are on opposite sides of the wave, there is no interaction among them and the wave can be established. The reader may be wondering what would transpire at the mid-point where photons of opposite polarization meet. Preliminary examination may indicate that nothing would transpire at that point. From all outward appearances there would be no repulsive force which would cause the photons to propagate away from each other. Although there would be no repulsive force at that point, there are certain photon dynamics which would, within a short period of time, cause the right-hand circularly polarized photons and the left-hand circularly polarized photons (and subsequently the wave) to separate from each other. Since the photons are relativistic, this factor alone would cause the photons to separate from each other *unless there was some type of binding force at the mid-point where photons of opposite polarization meet*. This would be the one place where the "need" for some type of binding force would be greatest if a cohesive wave were to be established. However, even with photons of the same polarization (right

or left circularly polarized) on either side of the mid-point, a binding force of some kind would be required since relativistic photons would have a tendency to move apart from each other. (The rationale behind this will be delved into in greater depth in a subsequent part of the paper). For the purpose of explaining how photons with a sinusoidal motion propagate in order to establish the waves of unpolarized light, let's assume the following. We have *only one* wave (as opposed to the multitude of different waves which comprise unpolarized light) which propagates in the direction of vertical polarization. How will the photons of this singular wave maintain their cohesiveness so that they continue to propagate as a wave (for a period of time) without separating? A binding force will be established (at the appropriate points of the wave) via a *second* wave which propagates at a right angle to the first wave and interacts with the first wave. The specific points where the two waves will interact will be at the troughs of the first wave and the nodes of the second wave. These points will be the *only* points of interaction between the two waves. The second wave will adhere to these "conditions" (propagating at a right angle and making contact only at certain points) but will always be under the first wave. How would this second wave constitute a "binding force" on the first wave? One "side" of the second wave (specifically at the node) will be in contact with the trough of the first wave. That entails that either clockwise or anticlockwise (depending on which side of the second wave is in contact with the first wave) lines of force can "interconnect" with *other* lines of force from the first wave. What other lines of force would these be? If lines of force are to be considered at all it would only be in relation to right or left circular polarization of the photon. There *are* other lines of force relating to a photon.

According to the precepts outlined in this paper, how is frequency induced? When internal energy is directed either upwards or downwards *temporary* lines of force would be induced in that direction. Specifically, when energy is temporarily directed in one of those directions, circular lines of force will be temporarily created. Since they are temporary, there would be certain aspects of them which would differentiate them from other types of lines of force explained at this web site. Let us *briefly* review the nature of the lines of force previously outlined in other papers. When a line of force emerges from one “end” of a certain entity, it cannot propagate linearly as a certain attractive force (the precise nature of which I am oblivious to) will cause it to loop backwards and propagate linearly. This linear propagation will continue until it reaches the other “end” and the attractive force will cause the line to loop back into the entity. (Lines of force further out are guided by the inner lines of force as outlined in the paper on magnetism). The lines of force emerging from the crest or trough of a photon are not the same. Regarding the lines of force that have been outlined in the preceding few sentences, closed lines of force simultaneously exist at both ends of the entity that is producing them. Closed lines of force cannot simultaneously exist at both the crest and trough of a designated photon for the simple reason that energy does not simultaneously exist in these areas. Consequently, there will, temporarily, only be closed lines of force *either* at the crest *or* the trough of a photon when energy is directed in these areas. In this vein, the lines of force will not “wrap around” to the opposite end (i.e. establish a closed circular loop with the other end) as with magnets and the lines of force emerging from the *front* of a photon. Therefore, an explanation of the lines of force from the crest or trough of a photon would be as follows. Let’s assume we have a right-handed circularly polarized photon. Within the photon, the energy will initially be directed upwards/backwards to establish the crest of the photon, then downwards to establish the photon’s trough, and finally towards the front of the photon again. When the energy is directed downwards to establish the trough, lines of force would emerge from the photon’s trough. *Within the trough*, the overall energy level will establish an optimum concentration within a certain physical area of the trough prior to it scattering towards the front end

of the photon. The line of force from the trough will re-enter the photon at the place where the energy begins to "taper off" (i.e. at the specific place within the trough where the energy is no longer at its optimum concentration). In the example just stated, this would be the area that is *towards* the front of the photon as opposed to the *actual front* of the photon. Subsequent lines of force (from the trough) would (immediately) propagate in the form of closed loops via the attracting mechanism of this initial line. As has been previously stated, the lines of force would only temporarily propagate when energy was directed within the trough. If we are dealing with a left-handed circularly polarized photon, subsequent to the loop emerging it will *re-enter* the photon at a different place as the internal energy from the trough would scatter in an upwards direction to establish the photon's crest. The reader may feel that there is a substantial flaw in this theory. What if we are dealing with the lines of force from a right-handed circularly polarized photon's crest? Given the pictorial representation of figure one, it seems highly unlikely that the lines of force could loop downwards to re-enter the photon at the place where the concentration of energy begins to "taper off". Figure one should not be taken too literally. The intent was to provide a pictorial representation which was indicative of a spin one particle and the internal energy was predominately directed towards the front. The pictorial representation provides this. In one respect or another, the lines of force from the crest would be capable of re-entering the photon at the physical area where the energy begins to taper off.

As was previously stated, the lines of force which are established as a result of right or left-hand circular polarization will bind with the loops which exist at the photons' troughs when energy is directed downwards. This binding will constitute the requisite force to maintain the cohesiveness of the photons (both at the mid-point of the wave and among the right and left circularly polarized photons on either side of the wave) so that they can propagate as waves. At this stage, one of the reader's questions may be, what "binding force" exists to maintain the cohesiveness of the second wave. We will now start to develop a better model of how photons propagate as waves. The factor which maintains the cohesiveness of the second wave is a third wave. The third wave propagates at right angles to the second wave with its (that is the third wave's) nodes interacting with the troughs of the second wave. What maintains this third wave? A fourth wave propagating at right angles with nodes interacting with troughs. *Within unpolarized light, for one wave to exist, there must always be another wave propagating at right angles with nodes and troughs interacting.* However, if this was the case, there would *always* be one wave too few and the photons would not always be able to propagate as waves. This is true and this aspect will eventually be dealt with in this paper. Furthermore, what happens if light is polarized so that all the waves propagate in a singular direction? They will not be at right angles to each other anymore. When this situation prevails, there would be a re-orientation of the angles at which the waves propagate. This re-orientation would maintain the cohesiveness of the photons (as waves) even if the waves were not at right angles and troughs and nodes were not interacting. If the crests from one wave interacted with the troughs from another wave, then this would induce the requisite binding force as long as the lines of force from each (crest and trough) were propagating in the same direction. The reader would obviously feel that this is automatically incorrect since an interaction of this nature would create destructive interference and we wouldn't see a wave at all. Not necessarily. Destructive interference would result if crest and trough met *at every wavelength.* If the light is completely polarized and the spatial orientation of every wave has been changed, this wouldn't necessarily be the case. Crest and trough wouldn't necessarily meet at every wavelength if the spatial orientation of every wave is changed. There would be constructive interference within the wave as well. The extent of destructive interference (or more specifically crests meeting

troughs) may be sufficient to induce a cohesive binding force on the photons but not sufficient to cause all the light waves to cancel each other out.

There is one final aspect to deal with as it pertains to photons with a sinusoidal motion propagating as cohesive waves. It pertains to another element of photons attracting each other. It has been stated that photons will retain a "side by side" cohesiveness when a second wave interacts at right angles with the first wave. However, there is a different factor which would keep one photon propagating directly in front of another. They would be the lines of force which are emitted *from the front* of the photon and re-enter the back of the photon when closed circular loops are established. Keep in mind that these lines of force only propagate along *one* side of the photon since photons either have right-hand circular polarization or left-hand circular polarization. As was previously stated in this paper, these lines of force are created when the photon's internal energy from the front is re-directed *either* backwards/upwards *or* backwards/downwards. For there to be an attraction (when dealing with any entity that emits these circular lines of force) the lines of force must be propagating in the same direction. That means that only photons of the same polarization will attract each other via the coupling mechanism described in the paper on magnetism. The following diagram is a rough approximation of the attracting mechanism. (Although a photon would have more than one line of force, only one line has been presented as this will suffice to illustrate the coupling mechanism).

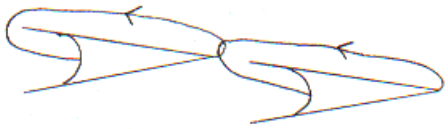

Fig.2

The reader may feel that a coupling mechanism of this nature is impossible. These lines of force are relativistic. However, the photon is also relativistic. A situation of this nature would seemingly be reminiscent of a science parody I once read about several years ago in some magazine. In this parody, there was a questionnaire which had the following question. The speed of light is 186,000 miles per second. If GM could make a car that went this fast explain why it would (or wouldn't) need headlights. The situation seems to be the same with photons and these lines of force. If both the lines of force and the photon are relativistic, how could the lines of force propagate *ahead* of the photon (which would be necessary for them to interact with lines of force from another photon). The most inner line of force would not propagate ahead of the photon for the reason just outlined. It would be right up against the photon. However, the other lines of force (specifically the outer ones) would be able to propagate ahead of the photon even if they were travelling at the same speed as the photon. This is simply because of their spatial orientation. The diagram does not provide a representation of the situation (as there is only one line of force) since the purpose of the diagram is to illustrate the coupling mechanism. However, the following description will (hopefully) suffice to illustrate the desired precept. The inner line of force emerges from the very edge of the front of the photon. When it propagates backwards, it is against the very edge of the photon. The next line of force must emanate from a point which is slightly closer to the middle of the front of the photon. The remaining lines of force will emerge from points which are further and further away from the edge from which the most inner line emerged. *As a direct result of this spatial orientation*, these lines will propagate in front of the photon. There will be an

additional difference (in conjunction with the differences previously stated) between these lines of force and the lines of force from magnets. The lines of force from a photon will be "squeezed" (speaking loosely) much closer towards the photon itself since both the photon and the lines of force are relativistic and the lines of force cannot "effectively" propagate in front of a photon. As already stated, it is only because of their spatial orientation when they emerge from the front of a photon that they propagate in front of a photon at all.

It is now time to explain why photons would not propagate indefinitely as a cohesive wave but would eventually break up into individual photons. Firstly, the coupling mechanism among the photons is reasonably weak. As was stated when drawing an analogy between the lines of force on a magnet and the lines of force associated with a photon it is like two different dogs tied to different poles on two different leashes. The dog on the weaker leash will be able to move further from the pole and it would be easier to break the leash. The *attractive* effect of the lines of force (as opposed to the lines of force themselves) on a photon can be broken without too much difficulty (when compared with the lines of force on a magnet). Obviously the photon is not static but is very dynamic. It is in a state of *constant* motion. It propagates forward and up and down. It is predominantly the photon's frequency which would suffice to cause it to break free from the attractive force of another photon *over a period of time*. Over what period of time this would be, I cannot state at the present. The reader may be wondering about the second binding force on waves. Namely two light waves propagating at right angles to each other and interacting at node and trough. It was stated that when light is propagating as cohesive waves, there will *always* be one too few waves to maintain a binding force at the mid-point of the wave where right and left-circular polarized photons meet. Since this is the case, one wave would eventually become "unbound" at the mid-point as there is no binding force on it. When this transpired, the wave that was being maintained by this other wave will become unbound as there is nothing to maintain its cohesiveness. This will induce a "snowball effect" and eventually all the waves would become unbound at their mid-points. The time that this transpires would be directly proportional to the number of photons (and subsequently waves) that were emitted at the source. The more waves, the longer the period of time over which the cohesiveness of everything will be maintained. Therefore, as a direct result of, (1) lines of force which are relatively weak, (2) the photon's *constant* state of motion, and (3) there being "one too few waves" emitted from every light source, that light will eventually propagate as individual photons with a sinusoidal motion, not as cohesive waves.

One additional point should be made as it pertains to the last paragraph. Although all photons propagate with a sinusoidal motion, I do not believe that every single photon within a light wave is propagating as part of a cohesive wave. The rationale behind this is as follows. Quantization is a very important overall concept in physics. If *all* of the photons propagated as part of cohesive waves, this would seemingly be in contradiction to the concept of quantized energy. Even though the *wave itself* is quantized (as a result of the presence of photons), light as a whole would not necessarily be quantized if that light was comprised *exclusively* of waves which was devoid of any photons that propagated as singular entities. Consequently, in order to maintain the concept of quantized energy, within light there would be a certain percentage of the photons which would propagate individually within that wave (with a sinusoidal motion) without being "bonded" to any other photon(s) via any of the binding mechanisms previously described.

In the paper on the Heisenberg uncertainty principle, there was a footnote in section I which stated that there was a serious anomaly in the analysis of the two-slit interference pattern as it pertained to photons. Specifically, in the analysis of the interference pattern, the varying velocity

of electrons (at the time of their emission from the gun) was being advocated in order to explain the full spectrum of the interference pattern. If the analysis of the interference pattern is to be viewed as a viable theory, how could I explain a varying velocity of photons given the fact that existing theory dictates that the speed of light is constant? Given the nature of the analysis of photons in this paper, it is possible that one photon could have an *incrementally* greater (or slower) velocity than the average velocity of a photon.

In section I of the Heisenberg uncertainty principle, the achievement of different velocities of electrons was advocated via the physical proximity of one electron to another. In all probability this is not the situation with photons given what was advocated on page one of this paper. On page one, it was stated that the primary difference between electrons and photons was that the sinusoidal motion of photons was intricately linked with its velocity (in contrast to electrons in which sinusoidal motion and velocity are independent). To explain the interference pattern, the difference in velocities of some photons must only be fractions of a centimetre per second different from the velocity of a photon's average velocity. A possible explanation is as follows. It would not be particularly radical to state that with a photon that has a slightly different velocity, an *incrementally* larger (or smaller) amount of its intrinsic energy is being directed towards the front of the photon (the reader should keep in mind that it is this direction of energy which is responsible for the photon's velocity). This would explain the slightly different velocities of photons. The reader may raise an objection to this postulate.

The speed of light has been measured to a very high accuracy (several decimal places). However, have the experiments measured the velocity of *individual* photons (as opposed to a light wave) to assess its *precise* velocity? Keep in mind, all that is required to explain the interference pattern is a photon to travel at a velocity which is fractions of a centimetre per second different from the average velocity of other photons. The concept is not particularly radical when applied to the two-slit interference pattern.

If *extraordinarily* precise experiments are performed and it is found that *all* individual photons travel with the *exact same* velocity, my response would be as follows. If the experiments I outlined in section I of the paper on the Heisenberg uncertainty principle provide the experimental predictions I stated, then that would place my theoretical framework on a reasonable experimental foundation. Therefore, if all photons do propagate at the exact same velocity, then it is an anomaly which I must explain within the framework of the two-slit pattern. In other words, it does not necessarily render the entire theory invalid. To state this differently, in science, anomalies can be viewed in two different capacities. They may, unto themselves, render a theory invalid. Or, they may be nothing more than anomalies which will one day be explained.

This completes the analysis of light. However, given this analysis it is absolutely imperative (at least in my eyes) that another aspect of physics pertaining to photons be dealt with. This would be EPR and Bell's theorem. The reason it is stated that it is imperative to deal with this, is that I find Bell's theorem so positively and absolutely ludicrous that I fail to see what person in their right mind could possibly accept such lunacy. The reader may "counter-accuse" me of the same thing. Bell's theorem has been tested and verified. Given this fact, how can I *not* accept it? I don't accept it because I am in possession of a sufficient level of common sense to realize that

certain facts do not necessarily point to "inevitable" conclusions. An example would be as follows. When pulsars were first discovered, it was realized that a *steady* signal was being produced by "something". The initial conclusion drawn was that natural phenomena could not produce such a steady signal. Therefore, it was believed that an alien civilization had been discovered. Subsequent to further study, it was realized that they were nothing more than rotating neutron stars. Here we have an example of how certain facts do not "inevitably" lead to certain conclusions. It is a similar situation with Bell's theorem. Merely because certain experimental facts have been produced as it pertains to Bell's theorem, that doesn't automatically mean that measuring the polarization of one photon automatically affects the polarization of a second distant photon. I intend to provide an alternative testable theory to explain what is transpiring.

Since Bell's theorem comes in various "flavours" (some experiments have entangled photons of different frequencies whereas others have the same frequency) let's establish one type of experiment so that the reader can more easily comprehend my theoretical perspective. Firstly, the two photons are of the same frequency. Secondly, we will assume that we have one polarizer at either side of the source emitting the entangled photons for a total of two polarizers. The two polarizers are in the same direction. Let's say set for vertical polarization. The polarizers are then turned in opposite directions (one clockwise the other anticlockwise) by thirty degrees. EPR dictates that there should be a fifty per cent anti-correlation (or correlation since when we're dealing with fifty per cent, they're both the same). During the "runs" of the experiment half the time there will be a correlation among the photons. Namely, either both photons will go through the polarizers or both photons will be absorbed by the polarizers. The other half of the time, one photon will be absorbed and the other will go through. However, when the experiment is run, EPR seems to fail since there is a seventy five per cent anti-correlation. From all outward appearances, Bell's theorem is proven. Merely because there is the fact of a seventy five per cent anti-correlation, that doesn't necessarily mean we should draw the conclusion that the photons are "magically" communicating with each other. Furthermore, I believe myself to be a rational person and I do not advocate the same beliefs held by others who are equally opposed to Bell's theorem. I am specifically referring to the alleged loopholes in the experiment. For example, I don't believe in the opposition which states that since the photon detectors only detect ten per cent of the photons, Bell's theorem is invalid. I believe that even if the photon detectors detected all of the photons, the same anti-correlation would manifest itself. Nevertheless, I do not believe in the final conclusion of Bell's theorem. Therefore, I am presenting an alternative conclusion.

At the time the photons are emitted from the source, although they are of the same frequency, seventy five per cent of the time they are not of the same phase. *At the time of emission*, one photon may be at its trough whereas the other one is at its node. The photon at its trough will be heading upwards whereas the other photon will be heading either upwards or downwards. By the time they each get to their respective polarizers the photon at its node (you cannot state which photon that would be) would go through the polarizer and the photon at its crest (or perhaps trough) would be absorbed. This would easily explain the seventy five per cent anti-correlation experimentally observed. Furthermore, this theory is testable. In order to test this theory, the experiment must be modified so that the two photons *arrive* at the polarizers in phase (even though they are out of phase at the time of their emission). We do not have to change the photons (or the source of the photons) to accomplish this. Instead make sure that the polarizers are not equidistant from the source. This can be accomplished via the following. During every "run" of the experiment one of the polarizers is maintained at the same distance from the source. However, the second polarizer is moved to a different distance. This does not mean that the

polarizer is moved *during the course* of a "run". For example, if an experiment is run for a time t, the polarizer is not moved in that designated length of time. It is moved subsequent to this "run" and prior to the next one. The movement required to observe the predicted effects of EPR should be one quarter the wavelength of the frequencies of the photons utilized in the experiment. Therefore, to test my theory, run the experiment when the polarizers are equidistant so that a seventy five per cent anti-correlation is observed. Then move one polarizer a distance equivalent to a quarter of a wavelength (of the photons being utilized) closer (or further, it shouldn't make a difference) to the emitter. At that stage, the exact opposite of the previous "run" should be observed. Namely, a seventy five per cent correlation.

Even if this prediction fails, I still refuse to accept (the final conclusion of) Bell's theorem. This is for the simple reason that the idea of one photon communicating with another merely because of entanglement is too foolish and ridiculous to accept. The reader may feel that I am the one being ridiculous and foolish if experimental facts are being denied. I am not denying the fact (seventy five per cent anti-correlation). I am merely refusing to accept the current final conclusion of this fact. If the reader still feels that this is a ridiculous position, let me defend it via an analogy that is outside the domain of physical science.

The reader is presumably cognizant of people who have undergone the following experience. Medical instruments showed that they were dead. Some time later, they were alive. They subsequently claim that they died, went to heaven, and then came back to life again. Many years ago, we may have had no explanation for this phenomenon. Some claimed that these series of fact proved the existence of heaven. Over the past several years we have begun to develop effective theories to explain it. We started to realize that their vital signs were so weak that medical instruments could not detect them. Therefore, they were *pronounced* dead even though they were still alive. In that time, they were hallucinating in a specific way. Carl Sagan has hypothesized that they were re-living the birth experience. However, there are other unexplained facts pertaining to this phenomenon which religious people insist prove the validity of this experience.

There are parents who claim that a child of theirs underwent this experience. When they "came back" they reported meeting an older sibling in heaven. The description of this older sibling accurately describes the older child. However, the parents claim that this older child died before the younger one was born. Furthermore, the younger one was never told of the existence of this older sibling. Religious individuals insist that this is conclusive proof of the existence of heaven.

I beg to differ. Firstly, I have my doubts as to whether any of these alleged facts are actually true. I've read books on other subjects in which it is clear that the author was resorting to blatant fabrications merely to fortify his point of view. It wouldn't surprise me in the least if it's the same with this particular type of experience. However, even if these facts are properly documented, that doesn't necessarily mean that the children actually went to heaven and met an older sibling whose existence they were oblivious to. A religious person may ask, what other possible conclusion could you draw on the basis of these facts?

1. A child dies and subsequently comes back to life.
2. They accurately describe an older sibling who died before them.
3. The child was oblivious to the existence of the older sibling.

Firstly, all of these "facts" aren't actual facts per se. Clearly they didn't actually die. In the same way, although I am not particularly amenable to the idea of loopholes in the experimental verification of Bell's theorem, it is within the realm of possibility that a seventy five per cent anti-

correlation is produced as a result of loopholes of one kind or another. Returning to points two and three, even if those facts are true, I don't necessarily *have to* accept the conclusion that they died and went to heaven for the simple reason that the conclusion isn't rational enough. The religious person would then ask, what conclusion do you draw on the basis of these facts? I don't know. However (and this is critical), *merely because I don't possess a viable answer now, that doesn't necessarily mean that a logical explanation will never be developed some time in the future.* It is a similar situation with Bell's theorem. Even if my prediction fails and there is still a seventy five per cent anti-correlation when one polarizer is moved by a quarter of a wavelength, I won't accept that measuring one photon alters the properties of the other photon. To be perfectly blunt, ***it's stupid***. If you ask me what other possible conclusion I could draw on the basis of these facts, you're at the same level as the religious person who insists that these children are dying and going to heaven. Merely because I can't explain it now, that doesn't necessarily mean that there will never be a logical explanation in the future.