THE RELATIONSHIP BETWEEN QUANTUM THEORY, GRAVITATION AND HUMAN CONSCIOUSNESS

AN HYPOTHESIS

by

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January 2014

PREFACE

The objective herein is an to find a possible relationship between quantum theory, gravitation and the nature of consciousness. This may seem to be a somewhat exotic proposal, nevertheless I believe that such a connection exists and I begin with a further appraisal of the state vector reduction.

In my paper entitled "The Geometry of Space-time" I developed the idea that the universe was expanding under the influence of a negative gravitational field which increased in field strength linearly with distance from the observer's point of origin. This led to the calculation of the total mass of the universe which in turn led to an ability to write the values of all the physical constants in terms of each other. Secondly, another paper entitled "On the Gravitational effects of an Electromagnetic Wave" described the similarity between the shaping of the geometry of space-time by an electro- magnetic wave and the shaping of space-time by a gravitational field. A further paper written in the year 2000 but not previously published until recently entitled "The Treatment of Space as a Solid Structure" proposed that the universe is itself quantised under the influence of gravitational potential field lines. Hopefully the relevance of all the foregoing will become apparent as the state vector reduction is examined more closely.

I would like to stress that in compiling the following that I have drawn very heavily on the Penrose / Hameroff description of their theory of Orchestrated Objective Reduction and other of Penrose's works.

There are two diametrically opposed views regarding the interpretation of quantum theory. The first is that quantum theory is an approximation of reality and which is useful only as a tool by which to explain the structure of the universe on the microscopic scale. The second viewpoint is that quantum theory is in fact a realistic description of nature on the microscopic scale and that we should accept that description of nature for what it is, and seek to explain its conclusions however bizarre they may at first appear to be and it is to this second viewpoint that I subscribe and that it is to that end that this paper is in part addressed.

In my previous works I have described some of those phenomena in quantum theory which seem to be so strange in comparison with the classical world in which we live. It is not necessary to describe these phenomena again in detail other than to list some of them such as Bell's theorem which clearly illustrates that the outcome of quantum events is not mirrored in the classical world. Secondly it is the outcome of the E.P.R thought experiment which clearly illustrates how causality is violated in quantum theory. Thirdly it is the well known Aspect experiment which clearly shows that in fact the outcome of the E.P.R. experiment is verifiable in practice. Lastly it is the outcome of the Penrose thought experiment which clearly illustrates the time symmetry of quantum theory as opposed to the time a-symmetry of the classical world. As it is this paradox between time symmetry and time a-symmetry upon which some of the propositions in this paper are based it is worth emphasising this point briefly describing Penrose's experiment and I quote Penrose verbatim here.

Penrose's experiment demonstrates conclusively that it is the act of observation which introduces time a-symmetry into the classical world from the time symmetry of the quantum world.

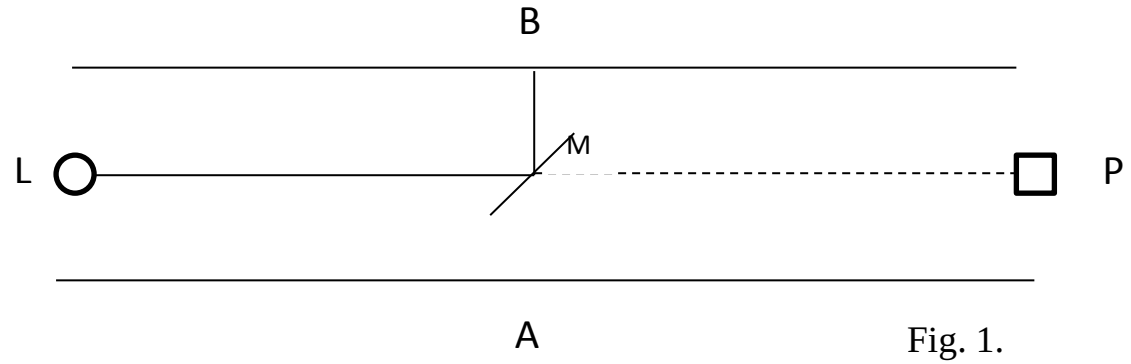

Fig. 1.

The example shown above illustrates the time irreversibility of a quantum experiment. Let us see why. Here we have a lamp L and a photocell P. Between L and P there is a half silvered mirror at an angle of 45^0 to the line LP. A photon is emitted at L. The photon's wave function strikes the mirror and the wave function splits into two. There is an amplitude of $\frac{1}{\sqrt{2}}$ for the reflected part of the wave and an amplitude of $\frac{1}{\sqrt{2}}$ for the transmitted part of the wave and the probability given by the square of the moduli of these two amplitudes is $\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{2}$ which defines the alternatives. Therefore we can answer the question "given that L registers, what is the probability that P registers?" and the answer we get is "one half". However the time reverse of this question is "Given that P registers, what is the probability that L registers?" and the answer we get to this question is not one half----------it is one! Thus in the case of our time reversed example, quantum theory gives completely the wrong answer. In other words, making an observation is associated with an irreversible process which can be said to produce three effects namely 1/ It provides the arrow of time, 2/ It shows that it is not possible to make a macroscopic observation which is time reversed and most importantly, 3/ The macroscopic world will only admit solutions which are time a-symmetric in the forward direction.

There are two physical phenomena which convince me that quantum theory is the true description of the physical world. The first of these is the simple fact that the orbits of electrons are stable because the orbits are indeed quantised. The orbits of electrons simply could not exist in the classical world and this stability is proof in itself of the veracity of quantum theory.

The second phenomenon is that the outcome of the Penrose experiment. That is to say the time a-symmetry which exists in the classical world cannot exist in the quantum world as demonstrated in the experiment.

The main reason that I have described the Penrose experiment in such detail is that while the E.P.R. experiment and the Aspect experiment are common currency in physics, the Penrose experiment is not and in my view it should be much more widely considered because, as will be shown, it is this time a-symmetry which is an important feature in any attempts to describe a union between gravitation and quantum theory.

The interface between the quantum state and the classical state illustrates the continuing debate centring on the seeming incompatibility between the two states.

A form of the familiar two armed experiment is shown as illustrated by Fig.2 below:-

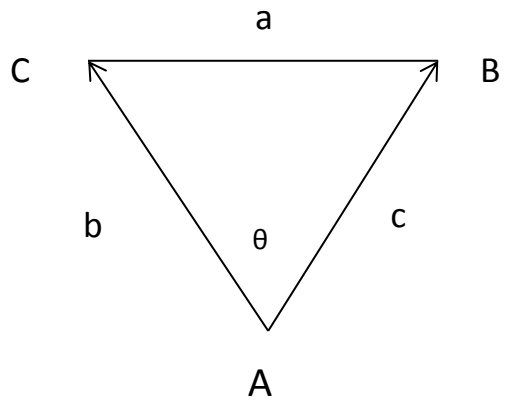

Fig. 2.

Let us imagine that an observer at A where a beam splitter is situated observes a spin 1 photon being split into two spin $\frac{1}{2}$ quanta each of which registers at B and C simultaneously according to A's reference frame. We know that one of the observers at either B or C will register a spin up quanta and one will register a spin down quanta. Also we know that when B and C each try to signal each other, both observers will be under the impression that their own observation will have been made first and that the outcome of the other observation will have been affected by his own actions. Clearly this appears to represent a defiance of causality and common sense at least as far as the observers at B and C are concerned. Nevertheless the Aspect experiment has shown that in fact it does appear that causality is violated in respect of B and C. In fact this and other experiments have shown that the seeming violation of causality and other strange manifestations of quantum theory do indeed also seem to violate relativity theory and without putting too fine a point on it , it seems that both quantum theory and relativity theory will need to be amended to accommodate these phenomena. Here it should be noted that the simultaneity of events only occurs at point A in this experiment and I will return to this point later.

Since local realistic models have been ruled out as a solution to the state vector reduction we must look to non-local models and more particularly to non-local hidden variables as an explanation of the state vector reduction.

The state vector reduction occurs at the point where the wave function of the quantum state moves across the interface between the quantum state and the classical world. The state vector reduction actually occurs when the superposed state given by $w\langle\alpha|+z|\beta\rangle$ (where *w* and *z* are complex numbers) become the squared moduli real numbers of the complex conjugates of *w* and *z* i.e. $|w|^2 : |z|^2$ and are expressed as a probability as to how the classical macroscopic state will be measured.

At the interface of the quantum and classical worlds there is a fundamental difference between the two states and that difference is in the relative expressions for time in each of the two wave functions. The Schroedinger equation representing the quantum state is entirely deterministic until a measurement is made at which point it becomes probabilistic in the classical world. That is to say that probabilities and the a-symmetry of time only enter into the classical world when the squared moduli of complex numbers take effect i.e. when a measurement is made at which point there is a large magnification raising the quantum state to the classical level.

The principle difference between quantum theory and classical theory is the question of time. Time is symmetric in the quantum world, that is to say the equations of quantum theory work equally as well moving backward or forward in time whereas in the classical world time is totally a-symmetric and moves only in the forward direction. Further we can say that as time works equally well either backwards or forwards in time in quantum theory then in quantum theory time does not flow at all since $(+t) + (-t) = 0$. In fact time only enters into the equation when a measurement is made. Furthermore I would say that time only flows when that observation enters into consciousness but I will return to this point later. Furthermore I will show that time a-symmetry is essentially a product or a condition resulting from gravitational forces and I will go on to show that quantum events do in fact involve forces which are the equivalent of gravitational forces.

In the case of time a-symmetry it is commonly believed that it is the lack of simultaneity in observation which causes events in one wing of a two-armed apparatus to jump into a state orthogonal to the observation in the other wing

and that prior to any observations being made, the two arms of the apparatus comprise one superposed wave function.

Simultaneity is the key word here in that when one measurement is made the other measurement manifests itself instantaneously at least as far as the observer at O is concerned and I this is because both particles operate within the same relativistic time/light cone, this time/light cone being the time/light cone created at the point of separation of the two spin $\frac{1}{2}$ quanta which are orthogonal to each other. Because of this we can write a relativistic equation combining the time lines of the two spin $\frac{1}{2}$ quanta as follows:-

$$T_{ab} = \frac{T_a + T_b}{1 + \frac{T_a T_b}{c^2}}$$

That is to say that at any point along the lines $A + B$ in the two armed diagram shown in Fig. 3 the time reference frame for both arms is the same. In other words the two events do both occur within the same time cone and are thus simultaneous with each other as far as the observer at O is concerned, and the apparent violation of causality as evidenced by the Aspect experiment occurs at the points A and B.

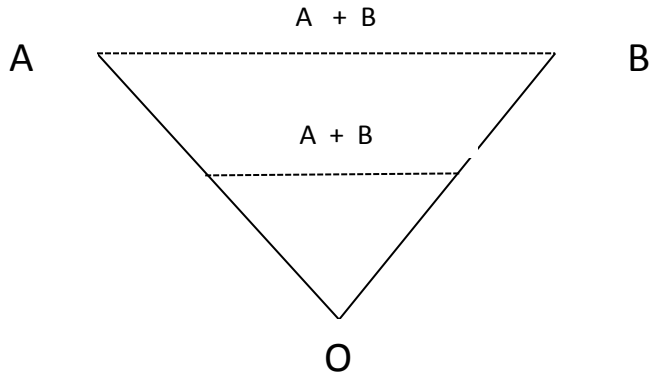

Fig. 3

The Copenhagen interpretation of quantum mechanics broadly stated, is that it is observation by some form of consciousness-and more particularly human consciousness- which causes the wave function to collapse when it's state is measured. This is markedly different from the Penrose-Hameroff model which roughly speaking states that it is not consciousness which causes collapse of the wave function, but that consciousness itself occurs at the point of collapse, that

is to say consciousness is a manifestation of self-collapse of the wave function which is itself caused in some way by the effects of quantum gravity.

Having thus established that the a-symmetry of the flow of time enters into the classical world only at the point of observation O, then this leads one to suppose that without the presence of consciousness that time cannot exist and without the presence of time consciousness cannot exist and all seems to point to the fact that it is the existence of conscious perception itself perception which brings the state vector reduction into being. In view of this let us re-examine the mathematical process involved in the state vector reduction and to do this I refer directly to Penrose's description and quote verbatim from "Shadows of the Mind" pages 263-264.

There is a rule for determining the probabilities for the alternative outcomes of a measurement on a super-posed state . This rule states that for a measurement which decides between two alternative states $|A\rangle$ and $|B\rangle$ by using detectors at A and B then upon the detectors encountering the superposed state $|A\rangle z|B\rangle$ the ratio of the probability that the detector at A registers to the probability that the detector at B registers is $|w|^2 : |z|^2$ where these are the squared moduli of the complex numbers *w* and *z*. The squared modulus of a complex number is the sum of the squares of its real and imaginary parts thus for $z = x + iy$ where *x* and *y* are real numbers the squared modulus is :-

$$|z|^2 = x^2 + y^2$$

$$= (x + iy)(x - iy)$$

$$= z\bar{z}$$

where $\bar{z} = (x - iy)$ is the complex conjugate of *z* and similarly for *w* i.e:-

$$|w|^2 = x^2 + y^2$$

$$= (x + iy)(x - iy)$$

$$= w\overline{w}$$

Thus it is at this point and only at this point that time a-symmetry and probabilities enter into the classical world and therefore it is at this point that the outcome of a quantum event can react with or interfere with, so to speak, the classical world. So what is the nature of this reaction or interference?

Here the time line of the quantum event "merges" with the time line of the entire classical universe and then becomes super-posed with the entire classical universe. That is to say the two wave functions i.e. those of the classical and quantum worlds unite and become one single superposed state. The process by which this is achieved is demonstrated by the diagram shown below.

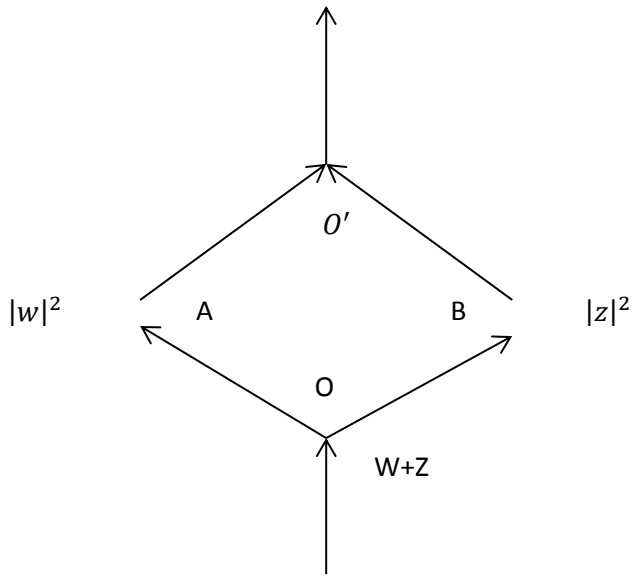

Fig. 4.

What is happening here is that a photon encounters a beam splitter at *O*, splits into two entangled spin $\frac{1}{2}$ particles which are encountered and observed at potentials *A* and *B*. The entangled wave function is then "absorbed" into the collective wave functions of the classical universe as a whole with the time line moving forward in time in coherence with the classical universe at point O'. Therefore we see that from an observer's viewpoint at point *O*, the encounters with the two potentials at *A* and *B* are completely simultaneous and it is only when *A* and *B* attempt to measure each other's results that time a-symmetry manifests itself after the fashion of an E.P.R. state but that a-symmetry is not relevant to the observer at *O*.

Returning now to Fig. 4 we can develop this concept further by adding in to the diagram the precise effects which occur at the interface of the two states of matter i.e. the point at which time a-symmetry and probabilities enter into the classical world.

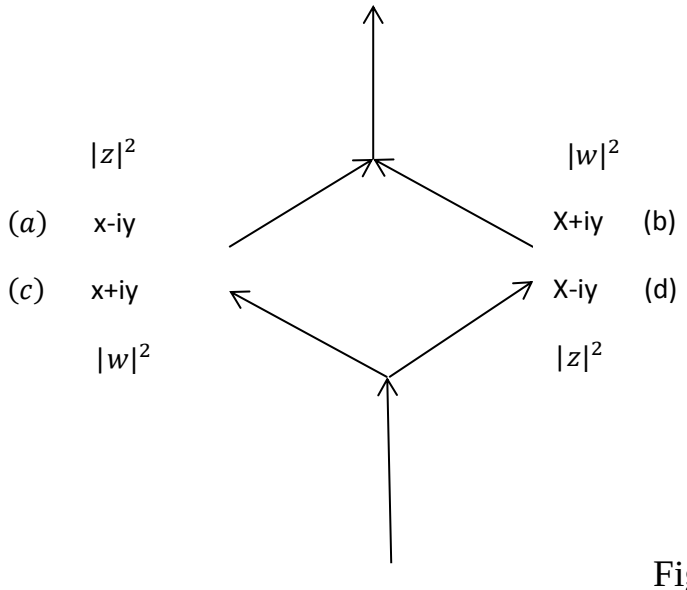

Fig. 4(b)

Firstly we note that for any angle A we have :-

$$x + iy = cosA + i \sin A = -1$$

and that:-

$$x + iy = \cos \pi + i \sin \pi = -1$$

Now from Euler's proof we know that $e^{\pi i} = -1$ and from this we can infer that:-

$$e^{-\pi i} = \cos \pi - i \sin \pi = 1$$

and that:-

$$e^{-\pi i} = \cos A - i \sin A = 1$$

and therefore finally we can write ;-

$$x + iy = -1 \ and \ x - iy = 1$$

Therefore at the interface of the two wave functions there are in effect four expressions of the ratio $|w|^2 : |z|^2$ and which are marked *a, b, c, d* i.e. two horizontal expressions and two vertical expressions. These four expressions take the form of a 2 X 2 matrix i.e.:-

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

and the determinant of a 2 X 2 matrix is given by :-

$$\det A = ad - bc$$

which in this case reads a :-

$$\det A \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix} = 0$$

In other words the two wave functions interfere constructively to merge completely to form one physical state.

Thus at the interface of the two wave functions there exists a 2X2 matrix which has the solution zero. This means that the combined outcome of the two wave functions has an infinite number of possibilities and any examination of that combined function will lead to the detection of a probability outcome exactly as anticipated. This leaves us with the conclusion that it is the classical universe which has made a "decision" as to the spin state that it will "accept" into its own wave function. This spin state must be in constructive interference with the timeline of the relevant gravitational potential field line of the classical universe that obtains at the precise moment of entry into the classical universe. The re-combination of the two entangled states takes place upon the encounter with the two potentials at *A* and *B*and the process is to all intents and purposes the reverse of the process encountered at *O* i.e. $|w|^2 : |z|^2$ returns to it's superposed state $w|A\rangle + z|B\rangle$ which is now embodied in the wave function of the entire classical universe and to the forward flow of time in a manner similar to the constructive interference of two wave functions.

It is at the interface of the two wave functions that we are confronted by the difference between two gravitational forces or more precisely the difference between the gravitational force which is manifested at the quantum level and the negative gravitational force which is exerted by the mass of the universe and which is more fully described in my papers "On the Gravitational Effects of an Electromagnetic Wave" and "The Geometry of Space-time.

It will be recalled that the expression relating to the change in frequency of an electromagnetic wave which is under the influence of a gravitational force is $z = \frac{gr}{c^2}$. Now while *z* itself is generally presented as a dimensionless figure both

r and g can be calculated and as the change in frequency is proportional to the change in gravitational potential of the field then a numerical value can be placed on the potential difference *z* and to achieve this we can resort to the familiar Planck units.

It will be recalled that Planck units (also known as natural units) represent the point at which relativistic space-time dimensions and quantum conditions share an interface and therefore can react with one another. The Planck units to be used are as follows:-

Planck time $t_p = \sqrt{\frac{G\hbar}{c^5}} = 5.4x10^{-44}\ secs$

Planck length $l_p = \sqrt{\frac{G\hbar}{c^3}} = 1.6x10^{-35}\ mtrs$

Planck mass $m_p = \sqrt{\frac{\hbar c}{G} = 2.1x10^{-5}\ gram}$

Planck energy $E_p = \sqrt{\frac{\hbar c^5}{G}} = 2.0x10^{9}\ joul$

and here we note that the constants $\hbar$, *c* and *G* are all normalised to 1.

With regard to the gravitational conditions which obtain inside a spherical electromagnetic wave and noting that the said gravitational field is repulsive, that is to say that the photons contained therein are moving apart from one another we can examine the expression for *z* as applied to the wave function and quantum state within the sphere. Taking the expression for *z* we can calculate the value for g (i.e. the acceleration due to gravity) within the sphere by writing $g = \frac{c-0}{t_p}$ i.e. the photons have been accelerated from rest to c and since the value for c is constant therefore $g = \frac{3x10^8}{5.4x10^{-44}} = 5.6x10^{51} m.s^{-2}$.

Subsequent to this a value can be placed on *z* and this is especially pertinent because *z* an expression for the change in frequency of an electromagnetic wave under the influence of a gravitational field and similarly it is an expression for the change in potential in a gravitational field. In expressing a value for *z* at the quantum level we can again write $z = \frac{gr}{c^2}$ and knowing the value of g and substituting l_p for r we can write :-

$$z = \frac{(5.6x10^{51})x(1.6x10^{-35})}{9x10^{16}}$$

$$= \frac{9x10^{16}}{9x10^{16}}$$

= 1

It has previously been noted that the values of the Cosmological Constant Λ and g are related on the classical scale via $g = \Lambda = 4\pi G\rho$ so that if both G and z are normalised to 1 we can write $\Lambda = \frac{c^2}{r} = \frac{c^2}{l_p} = \frac{9x10^{16}}{1.6x10^{-35}} = 5.6x10^{51}$

$\therefore\ \Lambda = g.$

The force required to initiate the expansion of the spherical wave at the quantum level can be calculated in the conventional way i.e:-

$F = m_p g = (2.1x10^{-8})x(5.6x10^{51}) = 1.18x10^{44}\ N.$ and the energy required is given by $W = E = Fl_p = (1.2x10^{44})x(1.6x10^{-35}) \approx 2.0x10^{9}\ j.$

which is equivalent to the Planck energy already described.

Thus we have a situation where there are two opposing gravitational forces, these being the gravitational force which binds the wave function and the geometry of space-time at the quantum level and the other being the gravitational force exerted by the whole mass of the universe on the wave function and the geometry of space-time at the quantum level. Both these gravitational forces are in opposition to each other and the force exerted by the mass of the universe as a whole is slightly greater than the gravitational force exerted by matter at the quantum level.

The difference between the two gravitational forces can be expressed as follows.

First we calculate the gravitational force exerted at the quantum level i.e:-

$F_q = m_p g = (2.1x10^{-8})x(5.6x10^{51}) = 1.18x10^{44}\ N.$

At the classical level the gravitational force exerted by the whole mass of the universe at any particular point in space is given by:-

$$M = \frac{R_o c^2}{2G}$$

$$M_u = \frac{(4.26x10^{32})x(9x10^{16})}{1.33x10^{-10}}$$

$$= 2.88x10^{59}\ kg.$$

Here $G = 6.67x10^{-11}m^3kg^{-1}s^{-2}$

$$c = 3x10^8 m.s.$$

$$R_o = \frac{1}{2}c^2\ light\ years = 4.26x10^{32}m.$$

And thus the force exerted by the mass of the universe at any particular point in space is given by:-

$$F_u = M_u = (2.88x10^{59})\ x\ (2x10^{-10})$$

$$= 5.76x10^{49}\ N.$$

Here $g = \frac{c-0}{t_u} = \frac{3x10^8}{1.4x10^{18}\ secs.}$

$$= 2x10^{-10}$$

Thus the force exerted by the universe as a whole is in effect .0002% greater than the force exerted by matter at the quantum level i.e:-

$$\frac{1.18x10^{44}}{5.76x10^{49}}\ x\ 100 = .0002\%$$

This results in an increase to the Planck wavelength by a similar proportion i.e. to $8.1x10^{-30}\ m.$

This energy gap represented by the difference between two opposing gravitational fields represents the difference between F_u and F_q which is akin to the self energy of two separate bodies and when the mass-energy difference leads to a specific separation of space-time geometry , the system will collapse into a single universal state , that is to say into the classical or macro universe. Here nature has made a choice between two space times or wave functions. That choice takes place over a period of time which is .0002% greater than the Planck time i.e. $2.7x10^{-38}\ secs.$

The gravitational energy of the difference between F_u and F_q and here F_q is the gravitational force exerted at the quantum level and is quantified as :-

$$F_q = 1.18 \times 10^{44} N.$$

and the gravitational force exerted by the entire universe is quantified as:-

$$F_u = 5.76 \times 10^{49} N.$$

Thus the gravitational force exerted by the entire universe exceeds the gravitational force exerted at the quantum level albeit only by a small amount but sufficient to cause the expansion of the wave front and thus the change in frequency during a quantum event. This change in frequency has two effects. Firstly it allows the volume of space created by the quantum event to expand as described in "On the Gravitational effects of an Electromagnetic Wave" and secondly it identifies the precise point at which the state vector collapses and where quantum events enter into the classical world.

The following is a rather simplistic demonstration of this point.

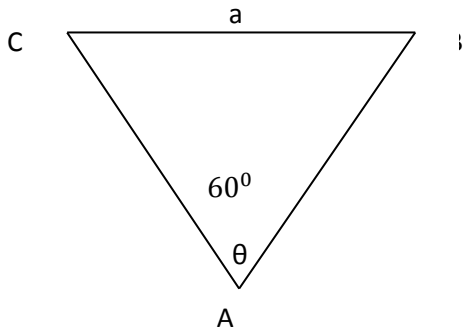

Fig.5.

The triangle *A,B,C* is equilateral with sides of length equal to the Planck length 1.6×10^{-35}. Any increase in the angle θ increases the Planck length side a which then exceeds the Planck length and I submit that it is at this point that the collapse of the wave function occurs or more particularly, when the area of the spherical wave front exceeds $4\pi l_p^2$ and which event has been caused by the attraction of the mass of the universe overcoming the gravitational force exerted at the quantum level.

The title of this paper is "The relationship between Quantum Theory, Gravitation and Human Consciousness and so the next section of the paper will concern itself with the question of consciousness and will attempt to describe how it is that consciousness arises in the human brain and more particularly how it is that consciousness is the product of both quantum and gravitational influences.

To sum up so far it seems to me that we have a classical world which is able to "decide" which values of a quantum event it is willing to accept into its structure and that the classical world has the means to effect this "decision" through gravitational forces. Furthermore the exercise of these gravitational forces has the effect of introducing time into the classical world and thus provides the direction of time to the Second Law.

It will be noted that I have used the words "decision" and "decide" which seems to imply that a conscious decision has been made by the classical world. Now this may seem to be a very strange assertion to make but to my mind, I am forced to conclude that somehow the classical world does contain within itself a quality or condition which others have described as "secular consciousness". This being the case it would seem relevant to examine and to try to locate where it is that consciousness itself exists in the natural world.

So far we have described how it is that certain aspects of gravitational theory are not complete because the value of *z* has never been quantified but this is now changed because *z* has now been shown to be the expression for a change in frequency of an electro-magnetic wave under the influence of a gravitational field as well as being the expression for the change in gravitational potential within an electro-magnetic wave. This change in frequency and wavelength has a similar effect on the geometry of space-time in exactly the same way as does a gravitational field and in fact one could describe the situation as being similar to the Principle of Equivalence familiar to students of gravitational theory. We further note that electro-magnetic radiation is red shifted i.e. it is of a lower frequency when observed in a weaker gravitational field than in a stronger field or put another way, frequency is reduced in an area of higher gravitational potential.

It will be recalled that the most striking point of the Penrose experiment as previously described is that quantum effects are time symmetric, that is to say that time does not flow at all at the quantum level. In order to break this

symmetry and to induce the flow of time the attractive quantum gravitational force must be exceeded in field strength by the negative or repulsive gravitational force exerted by the universe at large and which has been shown to be the case.

Now since it is the case that the classical universe contains the arrow of time (and hence the second law of thermodynamics) we can conclude that the quantum world by definition does not contain these qualities and that it is consciousness itself which somehow is contained within the fabric of the classical universe.

The gravitational self -energy for a quantum super-position of a mass whose displacement sufficiently perturbs space-time for collapse of the wave function to occur and therefore for both consciousness and the arrow of time to enter into the classical universe is given by:-

$$E = \frac{\hbar}{t}$$

and therefore the time taken for the quantum state to reduce to the classical state is given by:-

$$t = \frac{\hbar}{E}$$

and here we note that *E* is the gravitational self - energy between two mass distributions which in are denoted as F_u and F_q as previously described. The difference between the two forces is given by:-

$$\frac{5.76x10^{49}}{1.18x10^{44}} = 4.8x10^5\ N.$$

Converting this force into energy in joules gives:-

$$4.8x10^5 N\ x\ 8.1x10^{-30} = 5.9x10^{-34}\ joules$$

Which in terms of the time taken for self - collapse of system gives:-

$$\frac{\hbar}{E} = \frac{1.055x10^{-34}}{5.9x10^{-34}} = 178\ m.s.$$

How does the foregoing relate to the question of human consciousness? And here I refer again to the work of Penrose and Hameroff who have proposed in a

body of comprehensive but controversial work that consciousness in the human brain arises in the microtubules which are constituent parts of the neuron. Their proposition is that consciousness occurs in the brain as a result of the self-collapse of the wave function which in turn is the result of the effects of gravitational forces which occur at the quantum level and it is this concept which I have sought to explain in this paper

Hameroff and Penrose having submitted a proposition that it is in the microtubules of the brain that consciousness is seated, they further assert that consciousness occurs at the point where the wave function collapses and this concurs with my own view on the subject. As previously stated, I think that collapse of the wave function occurs at the point where the radius of the spherical electromagnetic wave exceeds to Planck length.

Penrose and Hameroff have indicated that collapse of the wave function in the brain occurs over a time scale of *500 m.s*. which is reasonably close to the time scale of *180 m.s.* estimate as outlined above. Furthermore they estimate that the collapse takes place within the tubulin monomer which has a diameter of $2.5x10^{-8}\ mtrs$. And it will be noted that the energy gap between the two gravitational fields previously described is $8.1x10^{-31}mtrs$.

Further Penrose and Hameroff have expressed the view that current explanations of consciousness suggest that it is a manifestation of emergent firing patterns within specific areas of the brain in the range 40 to 80 hertz. The frequency at which consciousness could be said to occur in the gravitational energy gap is180m.s. = 6 Hz.

The foregoing, has shown that consciousness and the flow of time and therefore perception of the classical world as we know it does not come into existence until the classical world "admits" those qualities into it's own wave function. This means in general terms that the universe itself is pervaded at all points and in all dimensions by a "secular universal consciousness" similar to that first proposed by Hameroff and that human consciousness occurs through some form of Orchestrated Reduction in the brain that one could suppose and that this reduction is orchestrated by the all-pervading secular consciousness already described.

For quantum events to occur, the quantum system must be kept separate from the classical system and this is exactly what occurs in the microtubules in the brain as described in detail by Hameroff and Penrose. The interaction of the

quantum system with the classical system immediately destroys the quantum system and it is at this point that time starts to flow and that consciousness comes into existence . Moreover it is at this point that consciousness comes in to contact with those Platonic qualities which are not mathematical in nature and which are therefore non-computational and from which we can infer that consciousness itself is non-computational.

All this being said, this does not explain exactly what consciousness is and this a mystery which seems to me to be nowhere near being answered at the present time; that is to say we have now defined where and at what point consciousness occurs and perhaps we can move forward to explain what consciousness actually is.

It was Whitehead's view 1929, 1933 that the precursors to consciousness have always been present in the universe and that biology evolved a mechanism to convert conscious precursors into actual consciousness and this seems to me to be an eminently reasonable observation.

END