The Constants of Nature, G, *h*, e, m_e, m_p, m_n, μ_e μ_p and μ_n, explained by reinterpreting μ_0 and ε_0.

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Abstract:- The Standard Model of Particle Physics is held up as one of the most successful theories in physics, but it is littered with dubious renormalised infinities, fundamental particles that have never been directly detected and even fails completely to explain the force of gravity. In this paper I revive the idea of the aether which was proposed as the medium through which Maxwell's electromagnetic waves travelled. By comparing the formula for the speed of light in free space to that of sound in any medium I have reinterpreted μ_0 as the density of free space and ε_0 as the compressibility of free space. I propose that the actual structure of free space is a tetrahedral lattice of nodes similar to many crystals found in nature and that these nodes are connected with identical connecting rods under compression. The length of these connecting rods is a new fundamental constant but with this very simple model I can easily explain the nature of, and derive values for Planck's constant, h, the Gravitational Constant, G, the charge of the electron, e, the mass of the electron, m_e, the mass of the Proton, m_p, the mass of the Neutron, m_n, the Magnetic Moment of the electron, μ_e of the Proton μ_p, and of the Neutron μ_n In explaining the origins of these fundamental constants, I have also explained the nature of matter and light and the three main forces, i.e. Electromagnetic, Strong Nuclear and Gravity. In the case of matter, it explains the nature of inertial and gravitational mass and in the case of light it explains why the photon has no gravitational mass. This model also explains many unexplained phenomena such as β^- decay parity violation, single particle interference experiments, Stern-Gerlach experiments, Bell inequality experiments, Aharonov Bohm effect and many more. It also has a very simple explanation for Dark Energy, Dark Matter and the Matter-Antimatter asymmetry.

Introduction

I have always been intrigued by the fact that the proton and the electron have the exact same magnitude of charge, but they have totally different masses. To me they must at least have something fundamental in common and this is one reason why I have never been convinced of the validity of the standard model of particle physics. It describes the proton being composed of quarks with fractional their charges even though the electron, which is considered a fundamental particle, has only unit charge. This feels physically wrong and in my view is nothing more than a mathematical abstraction. The Standard Model also, does not explain Dark Matter, Dark Energy, Gravity or why neutrinos have mass or change spontaneously between types. There are other short comings as well, but it is safe to say that the Standard Model is woefully inadequate. The principal of Occam's razor states that the simplest solution is probably the more correct one and I have used this principle to guide my own thinking, often discarding ideas because they were getting too complicated. The

standard model of particle physics is littered with inconsistencies and is nothing more than multiple layers of mathematically complex abstractions describing physically meaningless ideas.

I am also uncomfortable with the explanations put forward by Quantum Mechanics to explain many, so called, weird observations. Interpretations such as “Many Worlds” and “Superposition of States” just make no physical sense to me and are again only mathematical abstractions. While I appreciate that it has great predictive power it has no clue as to what is actually happening as demonstrated by Richard Feynman in his “*shut up and calculate*” comment. This reminds me of the infamous epicycles that were extremely accurate at predicting planetary orbits, but which were totally wrong physically.

General Relativity has been very successful at explaining the realm of the very large, but it cannot derive the fundamental constant of Gravitation, G. It therefore does not actually explain what gravity is because if it did then it should be able to derive a value for G at a minimum.

The reason, I think, that science has failed to unify Special Relativity, Quantum Mechanics and the Standard Model of Particle Physics is because the interpretation of the real world by Quantum Mechanics and General Relativity are largely incorrect and that the Standard Model is nonsense.

The great 19th century physicist, Lord Kelvin, said,

“It seems to me that the test of “Do we or not understand a particular subject in physics?” is, “Can we make a mechanical model of it?” I have an immense admiration for Maxwell’s model of electromagnetic induction. He makes a model that does all the wonderful things that electricity does in inducting currents, etc., and there can be no doubt that a mechanical model of that kind is immensely instructive and is a step towards a definite mechanical theory of electromagnetism” [1].

The model I propose in this paper is a mechanical model as desired by Lord Kelvin which is both elegant and powerful in its simplicity.

1. Reinterpreting μ_0 and ε_0

The generalised form of the one-dimensional differential equation describing a sound wave in a solid is

$$\frac{\partial^2 y}{\partial x^2} = \sqrt{\frac{K}{\rho}} \cdot \frac{\partial^2 y}{\partial t^2} \qquad (1.1)$$

where
K is the Bulk Modulus of the medium in units of Pressure or Nm^{-2}
ρ is the density of the medium in Kg m^{-3}
The velocity of the sound wave through the medium is $\sqrt{\frac{K}{\rho}}$
This can also be written in the form

$$\frac{\partial^2 y}{\partial x^2} = \sqrt{\frac{1}{\rho\beta}} \cdot \frac{\partial^2 y}{\partial t^2} \qquad (1.2)$$

where
β is the compressibility of the medium in $m^2\ N^{-1}$
and the velocity of the sound wave through the medium is $\sqrt{\frac{1}{\rho\beta}}$
From Maxwell's equations, which describe electromagnetic waves, we get similar expressions for the propagation of Electric (E) and Magnetic (B) fields as follows

$$\nabla^2 E = \sqrt{\frac{1}{\mu_0\varepsilon_0}} \cdot \frac{\partial^2 E}{\partial t^2} \qquad (1.3)$$

$$\nabla^2 B = \sqrt{\frac{1}{\mu_0\varepsilon_0}} \cdot \frac{\partial^2 B}{\partial t^2} \qquad (1.4)$$

μ_0 is the permeability of free space in $N\ A^{-2}$ or $N\ s^2\ C^{-2}$
ε_0 is the permittivity of free space in $C^2\ N^{-1}\ m^{-2}$
The velocity of light is $\sqrt{\frac{1}{\mu_0\varepsilon_0}}$
The similarity of the two expressions for the speed of sound in a medium and the speed of light suggests that electromagnetic waves must also travel through a medium and that μ_0 is the density of that medium and that ε_0 is the compressibility of that medium.
While the expression $\sqrt{\frac{1}{\mu_0\varepsilon_0}}$ does have units of $m\ s^{-1}$ the units of μ_0 and ε_0 do not match with the units of their respective counterparts ρ and β.
The units of ε_0 are $C^2\ N^{-1}\ m^{-2}$ and the units of β are $m^2\ N^{-1}$. The simplest way to make these two quantities have the same units is if the units of Charge are m^2 instead of Coulombs.
$C^2\ N^{-1}\ m^{-2} \rightarrow (m^2)^2\ N^{-1}\ m^{-2} \rightarrow m^4\ N^{-1}\ m^{-2} \rightarrow m^2\ N^{-1}$
If we apply this same change to μ_0 then the units change as follows
$N\ A^{-2} \rightarrow N\ C^{-2}\ s^2 \rightarrow N\ (m^2)^{-2}\ s^2 \rightarrow Kg\ m\ s^{-2}\ (m^2)^{-2}\ s^2 \rightarrow Kg\ m^{-3}$
By changing the units of charge from Coulombs to m^2 the two parameters, μ_0 and ε_0, are now exactly equivalent to their counterparts ρ and β.
This is a very strong indication that light does actually travel in a medium and that μ_0 and ε_0 are its density and its compressibility respectively.
I am of the view that at the fundamental level, nature is simple, and that nature repeats patterns at different scales. After some trial and error and observations I have concluded that the medium of space has a structure just like the crystal structure of Silicon, Germanium or Diamond.
These crystals structures are essentially two interpenetrating face centred cubic lattices offset by a quarter of the cube's

Figure 1.1

Figure1. 2

diagonal length in the x,y, and z directions. Each atom is bonded to four neighbours in a tetrahedral arrangement as in fig 1.1
Four of the structures in Fig 1.1 combine to enclose a volume or cell as shown in Fig 1.2.

The resonant frequency of the diamond crystal structure is due to the relative movement of the two offset FCC lattices and can be approximated using the formula (1.5) below which is an approximation for a system with a large number of connected oscillators.

$$\omega_n = \frac{2}{l}\sqrt{\frac{k}{\rho}}\ Sin\left[\frac{n\pi}{2(N+1)}\right] \qquad (1.5)$$

where
k is the Bulk Modulus of the medium in units of Nm^{-2}
ρ is the density of the medium in Kg m-3
l is the length between the nodes
N is the number of nodes
n is the order of the oscillation
When N is very large then the highest mode (ie when n= N) frequency ω_{max} is given as

$$\omega_{max} = \frac{2}{l}\sqrt{\frac{k}{\rho}} \qquad (1.6)$$

Earlier, I claimed that k and ρ are equivalent to $1/\varepsilon_0$ and μ_0 but we still need to know the value of l in equation 1.6 before we can calculate ω_{max}. I will come back to this later in this paper.

The following is my proposal for the structure of the fabric of empty space and the nature of the "vacuum energy" within it.

a) The fabric of space has a tetrahedral lattice structure built from components as depicted in fig 1.1
b) This structure is essentially two interpenetrating face centred cubic lattices (FCC) offset by a quarter the length of the cubic diagonal in the x, y and z directions.
c) The resonant frequency of vibration of this structure is due to the relative movement of these two separate FCC lattices.
d) Each cubic cell of one of these lattices have one of the tetrahedral structures depicted in fig 1.2 contained within it and they all have the same orientation throughout the entire structure. The other cubic lattice cells also contain one of the structures depicted in fig 1.2 but they are all orientated 180^0 to those in the first lattice. These two oppositely orientated tetrahedral structures

do not occupy separate space but are also interpenetrating.

e) The vacuum energy is the total of the kinetic and potential energy of the nodes and connecting rods as this structure vibrates.

f) I propose that a virtual electron is just the oscillations of the tetrahedral structures depicted in fig 1.2 contained within a cubic cell of one of the FCC lattices and that a virtual positron is the equivalent structure in the other FCC lattice. I will refer to these structures going forward as either virtual electrons or positrons.

g) These virtual electrons and positrons are therefore always present in the vacuum of space and possess energy as a consequence of the lattice vibrations.

2. The Electron and Positron

It is well established that electrons exert a force on each other and therefore do work on each other. In order for some system to do work it must have an energy source and therefore electrons must have a continuous energy source otherwise electrons would have ceased to be electrons as soon as their "stored energy" was exhausted. At some point in the past, electrons and positrons were created and I

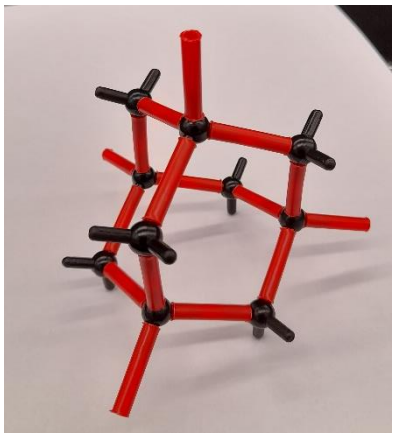

Fig 2.1

propose that an electron is a virtual electron that has a different mode of oscillation, and that this mode of oscillation is sustained by extracting energy from the fundamental vibration mode of the tetrahedral lattice structure. Fig 2.1 depicts a virtual electron. This structure has ten nodes, four "axial nodes" which are connected to three other nodes of the virtual electron and six "lateral nodes" which are connected to just two other nodes of the virtual electron. I call the four axial nodes such because they are each connected to an axis. The four axes are included in fig 2.1, the open ends of which coincide with four of the corners of the FCC cell in which the electron is located. As can be seen in fig 2.1, at the top of the virtual electron is a "tri star" formation concentric with the vertical axis. At the bottom of the structure is a distorted hexagonal formation, also concentric with the vertical axis. These two formations are connected by three vertical connecting rods parallel to the vertical axis. If the tri star formation partially rotates about the axis in one direction and the hexagonal formation rotates in the opposite direction, then the three connecting rods will be tilted over and stretched. As they tilt over, they will cause the tri star formation and the hexagonal formation to get closer to each other and therefore reduce the volume contained within the electron. This reduction in volume will also cause a stretching and distortion of the lattice structure around the electron. When the structure expands again, the counter rotating motion of the tri star and hexagonal components moves to another pair on one of the other axes. This process continues with the counter rotating motion cycling in turn around all four axes while contracting and expanding the electron structure. A real electron is therefore a virtual electron that has been set in this mode of oscillation, and which gets its energy from the lattice. The positron is exactly the same as the electron except that it is created from a virtual positron. As the electron oscillates it will cause waves of disturbances in the lattice to radiate away from it and this activity is what explains many of the properties of the electron.

3. Electric Charge

To explain why it is valid to change the units of charge to m^2 we need to get a new understanding of what charge actually is.

In the previous section I stated that the electron structure has two counter rotating components which cause the continuous contraction and expansion of the electron. This oscillating causes three different types of waves to be emitted and like all waves, they carry energy. The energy E, carried by a wave has the general form

$$E = \rho V(\tfrac{c}{\lambda} A)^2 \qquad 3.1$$

where

ρ is the density of the medium
c is the velocity of the wave
λ is the wavelength of the wave
A is the Amplitude of the wave
V is the volume occupied by one wavelength.
The power (W) in the wave is the energy times the frequency

$$W = \rho V(\tfrac{c}{\lambda} A)^2 \cdot \left(\tfrac{c}{\lambda}\right) \qquad \text{as f} = \tfrac{c}{\lambda} \qquad 3.2$$

The Intensity (I) of the wave is the power per unit area. If the volume V is a cylinder of length λ and radius r, then

$$I = \rho \tfrac{\pi r^2 \lambda}{\pi r^2} (\tfrac{c}{\lambda} A)^2 \cdot \left(\tfrac{c}{\lambda}\right) \qquad 3.3$$

$$I = \rho(\tfrac{c}{\lambda} A)^2 \cdot c \qquad 3.4$$

The pressure (P) exerted by the wave on the area is I/c therefore

$$P = \rho(\tfrac{c}{\lambda} A)^2 \qquad 3.5$$

The force F exerted on the area is therefore

$$F = \rho(\tfrac{c}{\lambda} A)^2 \cdot \pi r^2 \qquad 3.6$$

If we replace the density ρ with μ_0 then

$$F = \frac{1}{\varepsilon_0} \cdot \frac{\pi r^2 . A^2}{\lambda^2} \qquad 3.7$$

In the case of the electron λ = πl and as the tri star formation rotates A^2 will be some function $k_1 l^2$ where k_1 is a constant and *l* is the lattice unit length. As the distorted hexagonal ring as shown in fig 4.1 rotates rapidly it will flatten out to form a regular hexagon of side *l* and the nodes will transcribe a circle of radius *l* as the rotate. We can therefore use *l* as the radius when calculating the area in equation 3.7. Equation 3.7 can therefore be rewritten as

$$F = \frac{1}{\pi\varepsilon_0} \cdot \frac{l^2 \quad k_1 l^2}{(l)^2} \qquad 3.8$$

As an electron can move only in increments from one cell to an adjacent cell. The minimum distance it can move is $2l\text{Cos}\Theta_h$, where Θ_h is the angle the tetrahedral makes with the horizontal, therefore it can only move a distance $n2l\text{Cos}\Theta_h$ where n is an integer and equation 3.8 can be rewritten as

$$F = \frac{1}{4\pi\varepsilon_0} \cdot \frac{l^2 \quad k_1 l^2}{(n.l.cos\theta_h)^2} \qquad 3.9$$

This equation embodies the fact that distance is quantised, and therefore so is the force. The force an electron experiences at a distance of n lattice cells from another electron depends only on ε_0, the amplitude squared of the emitted wave and the cross sectional area. For equation 3.9 to match the magnitude of the force in the Coulomb expression it must be the case that

$$k_1 l^4 = q_1 \cdot q_2 \qquad 3.10$$

We can therefore look at the electric charge of the electron as the energy emitted by the electron in the form of waves into the surrounding lattice as the electron oscillates. This wave produces a force on another electron by either constructively or destructively interfering with the nodes of that electron causing an imbalance in the force it feels from the pressure in the surrounding lattice.

4. Calculating the lattice unit length

Before trying to calculate the lattice unit length, we need first to understand the geometry of the electron structure as this determines the amplitude of the electric wave generated and how that wave interacts with another electron. The shape of the electron is a regular octahedron with a flattened trigonal pyramid attached to four of the faces. Fig 4.1 below shows an octahedron with the pyramids formed by the lattice connecting rods of the electron cell. These four pyramids, if put together would form a regular tetrahedron. The six vertices of the octahedron correspond to the six nodes at the faces of one of the FCC unit cells and the apex of the four pyramids correspond with the corners of the other FCC unit cell.

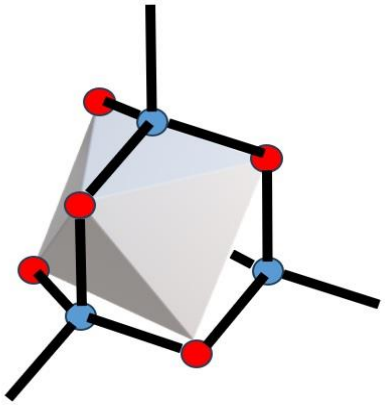

Fig 4.1

The tri star component is part of a tetrahedral structure which means for purely geometric reasons the height of the trigonal pyramid is 1/3 that of the lattice unit length and the component of the connecting rod perpendicular to the spin axis is *l* x $\text{Cos}\Theta_h$. As this component rotates rapidly it will flatten out and therefore transcribe a circle of radius *l*. I will assume that the tri star component rotates through an angle of 120^0 so the amplitude of the oscillation is *l* x 2π x 120/360 which is equal to 2.0944 x *l*. When the wave interacts with another electron it will positively interact with 6 of the nodes and negatively with four of them. The net is therefore only 2 nodes or 0.2 of the total. The amplitude expression will therefore have to be reduced by this factor.

I have already reinterpreted ε_0 as the compressibility of the lattice so $1/\varepsilon_0$ is the pressure exerted by it. This is Newtons per m^2 but the pressure that compresses the electron is the pressure per lattice node or node area. To calculate this quantity, we need to know the number of nodes per m^2 which I will call N_{sm}. From a simple observation of the lattice structure N_{sm} is $1/(l^2\,\text{Cos}^2(\Theta_t/2))$ where Θ_t is the tetrahedral angle of 109.47^0 but as the connecting rods are not normal to the surface this figure needs to be multiplied by $\text{Cos}(\Theta_t/2)$ to give

$$N_{sm} = 1/(l^2\,\text{Cos}^3(\Theta_t/2)). \qquad 4.1$$

If the Node Area is a_N The pressure per Node area, or Nodal pressure, which I will denote as $1/\varepsilon_N$ is

$$\frac{1}{\varepsilon_N} = \frac{1}{\varepsilon_0 \, N_{sm} \, a_N} \quad = 1.36\,x\,10^{49} \qquad 4.2$$

Suppose we have a flat flexible surface with a grid of squares on it with circular dots at the vertices. If we now stretch this surface evenly in the plane of the surface to such an extent that the squares are now twice as big then the number of dots per m^2 will have reduces by 2^2 while the area of the dots will have increased by 2^2. We can therefore see that the dot area is inversely proportional to the square of the number of dost per m^2. In the limit where the dot area and the square area commence at zero then the dot area is equal to the square of

the number of dost per m^2. We can therefore rewrite equation 4.2 as

$$\frac{1}{\varepsilon_N} = \frac{N_{sm}^2}{\varepsilon_0 \, N_{sm}} = \frac{N_{sm}}{\varepsilon_0} = 1.36 \, x \, 10^{49} \qquad 4.3$$

I will refer to the value, ε_N , in future as the Nodal Permittivity.

When the electric wave interacts with the nodes of an electron it is the Nodal pressure that it will apply and therefore the force is amplified by a factor of $\varepsilon_0/\varepsilon_N$. The expression for k_1 is therefore

$$K_1 = 0.2 \times 2.0944^2 \times \varepsilon_0/\varepsilon_N = 1.057 \times 10^{38} \qquad 4.4$$

We now have all that is needed to calculate the lattice length by inserting these values into equation 3.10

$$l^4 \times 1.057 \times 10^{38} = q_1 \, . \, q_2$$

$$l = 4\sqrt{\frac{(1.602 \, x \, 10^{-19})^2}{1.057 \, x \, 10^{38}}} \qquad 4.5$$

$$l = 1.248 \, x \, 10^{-19} \, m \qquad 4.6$$

This is an initial attempt to calculate the length of the lattice but later calculations using entirely different approaches have led me to conclude that the length is slightly shorter. I have assumed that as the tri star and hexagonal components rotate, they flatten out to transcribe a radius *l*. It might be the case that the lattice stretches a little more than this thus transcribing a larger radius producing a larger area and amplitude. The more accurate value for *l* is

$$\boldsymbol{l = 1.2347 \, x \, 10^{-19} \, m} \qquad \mathbf{4.7}$$

I will use this length further on in this document to derive values for Planck's constant, the mass of the electron, the mass of the proton and the gravitational constant, G.

In an earlier section I gave a formula for the fundamental frequency of the lattice i.e.

$$\omega_{max} = \frac{2}{l}\sqrt{\frac{k}{\rho}} \qquad or \qquad f = \frac{1}{l\,\pi}\sqrt{\frac{k}{\rho}}$$

When we use the value for *l* just calculated we find that the lattice frequency f is

$$f = \frac{1}{1.23 \, x \, 10^{-19} \, x \, 3.14}\sqrt{\frac{1.13x10^{11}}{1.26x10^{-6}}} \quad Hz \qquad 4.8$$

$$\boldsymbol{f = 7.73x10^{26} \; Hz} \qquad \mathbf{4.9}$$

5. Electric and Magnetic Fields

When the electron oscillates three types of waves are emitted. In this section I will describe two of them. If we just look at the vertical spin or rotation axis, then above and below the cell there are connecting rods that connect the electron cell to the bulk lattice. These rods are all parallel to a rotation axis. There are seven above the cell and six below the cell but the central one of the seven doesn't contribute to any rotation of the lattice. As the cell contracts the tri star and hexagonal components rotate counter to each other a total of 120^0 each. As they rotate during the contraction they will cause the rods parallel to the spin axis above and below the cell to twist around each other like the fibres in a rope and as the cell expands again the rods will untwist back to the original position. As the rotating components are counter rotating the twist above the electron will be in one direction while the in phase twist below the electron will be in the opposite direction. This is the reason why the electron has a North and South pole. After the expansion of the electron is complete the rotating components do not continue to rotate in the opposite direction because another tri star and hexagonal couple start to rotate about one of the other spin axes instead. This twisting/ untwisting action causes transverse waves to propagate through the lattice bulk in opposite directions from the electron but largely confined to a direction parallel and concentric with the rotation axis. As the electron cycles through all four axes there will be a wave propagating in opposite directions along each axis. This is the electrons magnetic field.

The second wave to be emitted when the cell contracts and expands is emitted at right angles to the rotation axis. As the nodes on the rotating components oscillate back and forth a plane transverse wave and is emitted around the entire circumference of the electron. Unlike the magnetic wave which is highly directional this wave spreads out as the rods connecting the electron to the bulk lattice in this direction are divergent. As the electron cycles through all four axes it will on average emit a radially uniform wave of this type. This is the electron's electric field.

As can be seen from the description of the nature of the electric and magnetic fields they are fundamentally very similar in that they are both produced by the same action and are both transverse waves propagating through the lattice structure at the speed of light. According to Maxwell's laws, a changing electric field produces a magnetic field and vice versa. This is easily understood using this model. A change in an electric field corresponds to a change in the amplitude of the electric wave and if such an amplitude change occurs while propagating through a lattice cell then the cell will experience a torque for as long as the amplitude of the electric wave continues to change. The torque will be in one direction for an increase in the amplitude and in the opposite direction for a decrease in the amplitude. This torque causes the same twisting of the lattice structure as described above and therefore constitutes a magnetic field. The reverse of this process is a changing magnetic field producing an electric field.

6. Particle Interaction with Electric and Magnetic Fields

When an electron emits a wave that carries the electric charge it will have a frequency which is equal to that of that of the lattice frequency ω_N. It will be in phase with the oscillation of the FCC lattice which contains the electrons but out of phase with the FCC lattice that contains the positrons. This is because the two lattices move in opposite directions.

Before continuing it needs to be stated that when a particle moves through the lattice due to a force acting on it, it is only the vibration mode, and the energy associated with it that migrates from one virtual particle position to a another. There is no physical movement of lattice nodes or connecting rods through the lattice. It is similar to the concept of the phonon.

When an electric wave from an electron meets a positron, it will be out of phase with six of the nodes in the positron and therefore destructively interfere with them while constructively interfering with the other four. There will therefore be an imbalance of forces around the positron which will cause it to move in the direction of the emitting electron.

Similarly, when an electric wave from an electron meets another electron, it will be in phase with six of the nodes in the electron and therefore constructively interfere with them while destructively interfering with the other four. Again, there will be an imbalance of forces around the electron causing the electrons to move apart

As described earlier the magnetic force wave is a twisting/untwisting transverse wave. These waves will have the same frequency as the contraction and expansion of the electron and positron. If we imagine a magnetic wave travelling from an electron in the +z direction that encounters an electron travelling in the +x direction the twisting phase of the magnetic wave will encounter it while the electron is in its contracting phase and will therefore only cause a small torque to the cell that contains the electron. As the untwisting phase encounters the electron it will have fully expanded and will therefore receive a much larger torque in the opposite direction. The overall torque will therefore be in this direction, and this will cause the cell containing the electron to twist which gives the electron a component of velocity in the +y direction. If the same magnetic wave encounters a positron travelling in the +x direction its twisting phase will encounter the positron when it is fully expanded and therefore apply more torque to it than during the untwisting phase. The net torque is therefore opposite to that applied to an electron and therefore a component of velocity in the -y direction will be given to the positron. The faster the electron or positron are travelling then the stronger is the coupling between the particle and the magnetic wave and therefore the amount the particle is turned is greater and the greater is the component of its velocity in the y direction. The coupling is stronger at higher speeds because as the magnetic wave travels forward at the speed of light it also rotates at the speed of light. The faster the particle is travelling at right angles to this wave the longer it spends in contact with the crest of the wave. This also explains why a magnetic field does no work on an electron as it does not do any translational movement of it.

7. Electron Spin

When an electron contracts, the tri star component can rotate either clockwise or anticlockwise and as the electron cycles through all four axes the rotation of each will be the same i.e. all four clockwise or all four anticlockwise. In addition to this rotation direction is the order in which the rotation moves from one axis to another. I will refer to this going forward as the spin order. If an electron encounters an external magnetic field the direction of this field can be any arbitrary direction and not necessarily aligned with any of the spin axes of the electron. In order for the electron to align with the external field the sequencing of the spins of the four rotors will change so e.g. one rotor might spin four times and another three and the other two just once. The vector sum of these four will then be aligned with the external field. If one electron has its tri star component rotating clockwise then it will have its North pole pointing up and if another has it rotating anticlockwise, then it will have its South pole pointing up. This explains the two spin states of the electron.

8. Electron Mass

When the electron is compressed, there is work being done on it by the pressure of the surrounding lattice and just like with a gas the energy required to compress it is the product of the pressure and the volume change.

As the mass of the electron arises from its change in volume it is reasonable to assume that mass should have units of m^3 in a similar manner to how the units of charge are m^2. I will show that this is the case later in this paper. The units of density are therefore m^3/m^3 or dimensionless. The density of the lattice can be interpreted as a change in volume per unit volume.

The volume of the electron can easily be calculated by summing the volumes of the various solids from which it is composed. As shown in fig 4.1 it is composed of an octahedron and four trigonal pyramids that when combined form a tetrahedron.

The volume of an octahedron, V_o, of side a, is given by the formula

$$V_o = \frac{\sqrt{2}}{3}\, a^3 \qquad 8.3$$

The volume of a tetrahedron, V_T, of side a, is given as

$$V_T = \frac{a^3}{6\sqrt{2}} \qquad 8.4$$

In the electron structure the side length a is given by

$$a = 2l\, Sin\left(\frac{\theta_t}{2}\right) \qquad 8.5$$

When we use the value of 1.23 x 10^{-19} for *l* then the volume of the electron V_e is 4.829 x 10^{-57} m^3

The energy, E, required to compress the electron is therefore

$$E = \frac{V_e \mu_0}{\varepsilon_N} \qquad 8.6$$

$$E = \frac{4.829\ x\ 10^{-57}\ \ x\ \ 1.257\ x\ 10^{-6}}{7.35\ x\ 10^{-50}} \qquad 8.7$$

$$E = 8.26\ x\ 10^{-14}\ \ Joules \qquad 8.8$$

To convert this to mass we divide by c^2 so the mass of the electron, m_e is

$$m_e = \frac{8.26\ x\ 10^{-14}}{(2.99\ x\ 10^8)^2}\ \ Kg \qquad 8.9$$

$$\boldsymbol{m_e = 9.19\ x\ 10^{-31}\ Kg} \qquad \mathbf{8.10}$$

This value is only 0.89% greater than the measured value

9. The Electron Magnetic Moment

The SI units for magnetic moment are JT^{-1}. If we convert these units into the units of this model by measuring Charge in m^2 and mass in m^3 then the units for magnetic moment are m^4s^{-1}.

In the case of a bar magnet the magnetic moment is the product of the pole strength multiplied by twice the length of the bar which in the case of the electron is approximately 2*l*. The units of pole strength in SI units are Amp Meters which when converted to my units is $m^3\ s^{-1}$. We can assume that the velocity component of this is the velocity of light which just leaves the amplitude squared term to be identified. When the tri star and hexagonal components rotate rapidly, they flatten out which causes the lattice cells immediately adjacent to them along the spin axis to expand at right angles to the spin axis. As the tri star component is one third of a lattice unit high it will also cause them to contract along the spin axis by *l*/3. The rotation will also cause the connecting rods in these two cells that are parallel to the spin axis to twist into a helical structure thereby shortening the cell further. It is very difficult to calculate a figure for this, so I am going to just estimate the total contraction at *l*/2. These cells therefore expand at right angles to the spin axis and contract parallel to it but without actually changing in volume. As this distortion takes place there is a change in the local density within the cells with it increasing in some parts and decreasing in others but again without changing the overall density of the cell. This oscillation in density then propagates outwards along the spin axis as subsequent cells along the spin axis are in turn, twisted. The amplitude of this density oscillation is μ_0 x *l*/2. When this wave interacts with another particle it will do so in a manner similar to the way the electric wave does and therefore the amplitude of the wave must be modified in the same way.

The magnetic moment of the electron, μ_e, can therefore be calculated as follows

$$\mu_e = \left(\mu_0 \frac{l}{2}\right)^2 x\ 2l\ x\ c\ x\ 0.2\ x\ \frac{\varepsilon_0}{\varepsilon_N} \qquad 9.1$$

$$\boldsymbol{\mu_e = 1.0738\ x\ 10^{-23}\ \ m^4 s^{-1}} \qquad \mathbf{9.2}$$

This value is approximately 16% greater than the measured value of 9.285 x 10^{-24} but since I only roughly estimated the length contraction of the cells at *l*/2 this is a very good approximation.

10. The Strong Nuclear Force

When a positron or an electron contract they twist the connecting rods in the bulk lattice around them and as described already this twisting and untwisting produces a wave that radiates away as the particles magnetic field. However, close to the particle where the twisting is at a maximum there will be a contraction in the length of the lattice cells extending out from the particle along the spin axis. This is like the way a loosely wound rope contracts in length when it is twisted more tightly. If a positron and an electron align along a spin axis with their tri star formations facing each other and with opposite spins, then they will strongly attract each other when they twist the lattice structure along the spin axis between them. Because they are out of phase with each other they take their turn in twisting the lattice structure and pulling the particles together. The force is much stronger than the electric force because it involves the actual contraction of the lattice as opposed to just a wave in the lattice as is the case for the electric force. If one examines the lattice structure you will observe that if a positron and an electron are aligned along their spin axes then when

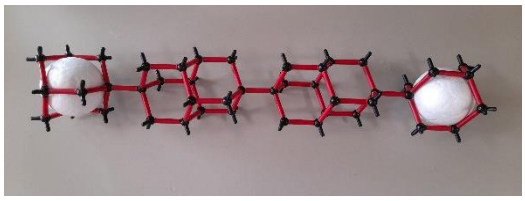

Fig 10.1

their centres are eleven lattice unit lengths apart there will be only a single lattice connecting rod that lies halfway between them on the same shared spin axis, as shown in fig 10.1. At the next position that this occurs the two particles would be in contact with each other. The two particles will therefore only be attracted to this minimum distance between them and will be confined there by the twisting lattice. If the particles move any closer together, they will feel a very strong repulsive force as the lattice structure itself is compressed and pushes back against the moving particle. This is the strong Nuclear Force (SNF). Three known characteristics of the SNF are its short

range, its greater relative strength and its repulsion at shorter distances which are easily explained by this model. The same force will exist between two electrons or two positrons. In the Standard Model of particle physics the electron does not experience the Strong Nuclear Force (SNF) but I think that this is incorrect. Two electrons in free space rarely get close enough to experience the SNF due to the electromagnetic repulsion and electrons and positrons usually annihilate each other. In this model electrons and positrons that approach each other from directions other than that described above will merge and produce two photons (described in detail later). I think it is difficult for a positron and an electron to maintain an approach along a common spin axis due entirely to the structure of the lattice. It is easier for an electron to deflect from this type of path and approach the positron in a manner that will cause both to annihilate. It is therefore highly unlikely that we will see a free electron and a free positron experience the SNF in normal circumstances.

11. The Proton

It is well understood that the sixfold symmetry of the macro structure of snowflakes has its origins in the molecular structure of hydrogen bonded water molecules. It is often the case in nature that the same or similar pattern keeps repeating at different scales and so it is with the proton. Just as the electron is composed of ten vibrating nodes of the lattice the proton has the same electron cell shape but, in this case, the ten nodes are electrons and positrons. There are four electrons situated at the four axial nodes and six positrons at the six peripheral nodes. An additional electron is trapped in a potential well near the centre giving an overall charge of +1e.

We know that protons are extremely stable, so the constituent positrons and electrons cannot be bound by just the electric force. The proton structure briefly described above has electrons and positrons bound together by the SNF acting along common spin axes between the constituent particles. This structure is what gives the proton its extreme stability as it is flexible enough to distort and dissipate the energy of collisions and yet is so strongly bonded together by the SNF that they have remained intact since creation. Earlier I stated that it is difficult for positrons and electrons to experience the SNF because it is rare for them to maintain an approach along a common spin axis but in the hot and dense environment of the early universe a certain proportion of interactions between positrons and electrons would result in pairs bounded by the SNF. Alternatively, it might just be a case of waiting a sufficiently long time for the event to occur in a cool environment. Most of the collisions would have resulted in annihilation of the two particles only for them to possibly reform again. The SNF bound pairs would now be attracted to the opposite electrically charged ends of other pairs and just as water molecules form hexagonal structures as it freezes so too would these electron positron pairs and stabilise them enough for the SNF to connect the pairs together along common spin axes to form into distorted hexagonal rings. Once a ring has been formed additional collisions by single positrons attracted to the electrons in the ring eventually attach by the SNF to form the three “connecting rods” between the hexagonal component and the tri star component. The three positrons at the top of these three “connecting rods” will strongly attract an electron where it then gets bound by the SNF to just the three positrons at the top. This structure will have a net positive charge of 2e and therefore attracts electrons, one of which gets pulled into the centre of the structure and gets trapped in an electric potential well created by all ten other particles. The overall charge of the proton is therefore reduced to + 1e. This is only one of many possible paths to creating a proton, but it is equally likely that an anti-proton structure would form by this mechanism. It only depends on which side of the hexagonal ring that additional particles successfully connect and complete the structure.

12. Gravitational Constant, G

One of the great puzzles in physics is why the Force of gravity is so weak compared to the electromagnet force and what is the origin of the value for G. To explain this, we need to first understand a certain property of the lattice. Waves can propagate through the lattice like longitudinal waves on a string, but a different type of wave can be transmitted directly through the lattice connecting rods. These waves are longitudinal tension waves and travel at a much higher speed than the speed of light. I already introduced the concept of the Nodal Permittivity ε_N when calculating the mass of the electron and it is this which determines the velocity of the tension waves directly through the lattice connecting rods. I will refer to these waves as Katrina waves. These waves see the same lattice density as the longitudinal waves so their velocity, c_K can be expressed as

$$c_k = \frac{1}{\sqrt{\mu_0 \varepsilon_N}} = 3.29\ x\ 10^{27} \frac{m}{s} \qquad 12.1$$

I already calculated the lattice frequency, which is the same as the electron frequency, so the lattice period T_L is

$$T_L = \frac{1}{7.73\ x\ 10^{26}} = 1.29\ x\ 10^{-27}\ s \qquad 12.2$$

The distance, d_k, a Katrina wave will travel in this time is

$$d_k = c_k T_L = 4.26\ m \qquad 12.3$$

The volume of a sphere, V_k, with this radius is

$$V_k = \frac{4\pi}{3} (d_k)^3 = 3.23\ x\ 10^2\ \ m^3 \qquad 12.4$$

As we know the lattice length, we can easily use basic geometry to calculate the number of Nodes per m^3. I will refer to this quantity as the Nodal density, N_D and it has a value

$$N_D = 3.45\ x\ 10^{56}\ \frac{Nodes}{m^3} \qquad 12.5$$

When we do a dimensional analysis of G using my reinterpreted units, we find that G has units of N/m^4. We can decompose this into N/m multiplied by $1/m^3$ which is the surface tension per volume or more accurately the change in surface tension per change in volume. For a sphere the surface tension is dependent on the circumference and for a sphere the change in radius, dr, for a change in volume dV, is

$$\frac{dr}{dV} = \frac{1}{2r^2} = 3.28\,x\,10^{37} \quad m^{-2} \qquad 12.6$$

When the electron contracts it causes the connecting rods at both ends to stretch thus changing the pressure they exert. The magnitude of this change is

$$\frac{dr}{dV}.\frac{1}{\varepsilon_0} = 3.7\,x\,10^{48} \quad Nm^{-4} \qquad 12.7$$

While the electron is compressing this changing tension in the lattice connecting rods at both ends of the electron propagates through the lattice connecting rods as Katrina waves for a distance of d_k. Since the wave is only emitted from opposite ends of the electron the tension is distributed over all the nodes in half the volume V_k. The change in tension created in the initial connecting rod is thus reduced by a factor of $N_D/2$ as the Katrina wave propagates through the lattice during the Lattice period. When the electron expands again the Katrina wave stops propagating and instead this reduced pressure in the lattice propagates outwards at the speed of light as a gravity wave. The magnitude of this pressure reduction is therefore

$$\frac{dr}{dV}.\frac{1}{\varepsilon_0}.\frac{2}{V_k N_D} = 6.638\,x\,10^{-11} \quad Nm^{-4} \qquad 12.8$$

This number matches the Gravitational constant, G, to 0.5% accuracy so in this model the Gravitational constant, G is

$$\boldsymbol{G = 6.638x\,10^{-11} \quad Nm^{-4}} \qquad \boldsymbol{12.9}$$

Gravity is therefore caused by a change in the surface tension around an electron as it oscillates but its effects are drastically reduced by the dispersing effects of the Katrina waves before the gravity wave starts propagating.

13. Proton Mass and Gravity

As this gravity wave propagates through a volume of lattice it will give an impulse to every node as it passes. Any particles in this volume will therefore be given an impulse, forcing them towards the emitting particle and the magnitude of the impulse will be proportional to the volume of the particle and the amplitude of the gravity wave. If the proton gravitationally attracts an electron 1836 times more than another electron does, then the amplitude of its gravity wave must be 1836 times greater than that of the electron. When an electron and a positron bound by the SNF in the proton structure contracts and twists the lattice rods between them, the distance between them will shorten. The actual full length of the structure in fig 10.1 is 12.333 lattice unit lengths. As they get twisted out of alignment with the spin axis by the rotating electron each of the 12.33 lengths effectively contract by the same amount as the electron does. The positron will then do the same and cause an additional contraction. The distance between the positron and the electron will therefore have shortened by 24.66 times the amount the electron contracted. If the tension in the lattice behaves like a spring, then the energy will be proportional to the displacement squared or in the case of the proton it will be 24.66^2 or 608.44 times that of the electron. As the spins of all the particles in the proton are aligned the three parallel connecting rods attached to a tri star structure will all contract together and therefore triple the force applied to the lattice. This would give a force of 1825.33 times that of the electron. When this is added to the amplitude of the gravity waves emitted by the eleven positrons and electrons in the structure then the total amplitude is 1836.33 times that of the electron. This calculated value is only 0.01% greater than the known value of 1836.15. The Proton- Electron mass ratio can therefore be expressed in the formula

$$\frac{m_p}{m_e} = (3\ x\ (12.33\,x\,2)^2) + 11 \qquad 13.1$$

$$\boldsymbol{\frac{m_p}{m_e} = 1836.33} \qquad \boldsymbol{13.2}$$

A gravity wave from a proton is therefore 1836.33 times greater than that of an electron and therefore its gravitational mass is 1836.33 times greater.

I calculated the volume of the electron earlier as 4.83 x 10^{-57} m^3. When we calculate the volume of the proton, V_p, using an octahedral and tetrahedral side length of 12.33 times that of the electron we find that the volume is 8.86 x 10^{-54} m^3. This is 1836.33 times that of the electron. Therefore, the effect of a gravity wave on a proton will be 1836.33 times greater than the same gravity wave on an electron. The number of lattice cells within a particles volume therefore dictates its Inertial mass. I have therefore shown that both the Gravitational and Inertial mass ratios of the proton and the electron are 1836.33. Inertial mass is due to the volume of the particle and Gravitational mass is due to the amplitude of the gravity wave that the particle can generate.

The actual proton electron mass ratio is 1836.15 and this discrepancy can be explained by the fact that the proton structure has to contract in order to generate gravity waves. 1836.15 is therefore an average. It is also the case that the ratio of the change in volume of the proton to the change in volume of the electron as they oscillate is 1836.15. It is more likely that it is the change in volume of a particle that determines its inertial mass as this is the property of the particle that distinguishes it from a non-oscillating lattice cell which has the same volume as an electron but no mass.

14. Proton Relative Magnetic Moment

From a previous section we seen that the proton is composed of six positrons and five electrons. This means that the magnetic moment of the proton is derived from just one net positron as the contribution of the five electrons is cancelled by five of the positrons. This single positron tries to rotate the volume of the proton as it rotates itself. Even though all the particles in the proton contribute to the overall Magnetic Moment, we can treat it mathematically as a single oscillating positron at the circumference of the larger proton. As the positron rotates it has little effect on the proton as it is like trying to open a gate by turning it at the gate post. As the positron is at the circumference of the proton the relative length of the arm through which it tries to turn the proton is

the diameter of the proton which is 2 x 12.33 x $Cos\Theta_h$. Inside the volume of the proton there are 3060 nodes and inside the oscillating positron there is a net two nodes or 0.2 of the total contributing to its oscillation. The Relative Magnetic Moment of the proton is therefore

$$\frac{\mu_e}{\mu_n} = \frac{3060}{12.33\ x\ 0.943\ x\ 0.2} \qquad 14.1$$

$$\boldsymbol{\frac{\mu_e}{\mu_n} = 658.02} \qquad \boldsymbol{14.2}$$

This differs from the measured value of 658.21 by 0.03%

15. The Neutron

The neutron is just a proton with an additional electron added to the structure. This would appear to be blatantly obvious as it is well known that the neutron decays to a proton and an electron during β^- decay. We also know that free neutrons decay with a half-life of about 15 minutes, so the additional electron is not very strongly attached. An electron will obviously be electrically attracted to a positive proton and as an electron approaches the "hexagonal" ring of a proton along the spin axis of the ring, a simple analysis of the Coulomb force on the electron from the eleven constituent particles of the proton shows that the net force on the electron will be zero at a distance of approximately five lattice cells. This however is a static analysis so we must also consider the dynamics as well. As the electrons and positrons are 180^0 out of phase with each other the approaching electron feels alternating attractive and repulsive forces such that the approaching electron is sometimes entirely inside the proton structure and sometimes outside. When the electron is located at five lattice cells away from the proton structure it will add five electron masses to the inertial mass of the proton but since we can assume that it is inside the proton structure for half of the time then the average mass added to the proton is just 5/2 or 2.5 electron masses. The inertial mass of the Neutron, m_n, can therefore be written as

$$m_n = m_p + 2.5\ x\ m_e \qquad 15.1$$

$$m_n \quad 1.6749\ x\ 10^{-27} + 2.5\ x\ 9.108\ x\ 10^{-31} \qquad 15.2$$

$$\boldsymbol{m_n = 1.6749\ x\ 10^{-27}\ \ Kg} \qquad \boldsymbol{15.3}$$

This calculation is 99.9999% that of the known mass.

When the electron enters the proton during the period when the electrostatic forces are only attractive, it will come within one lattice unit length of the central electron as neither of them are repelling at this time. The strong nuclear force will now pull them together when they eventually rotate around their common spin axis. When we use the same formula (13.1) in this situation that I used to calculate the Gravitational mass of the proton we find that that the mass of the two electrons is increased by four additional electron masses. While the electron is outside the proton it contributes one electron mass to the Gravitational mass of the Neutron but when it is inside, it contributes four electron masses. The average is therefore (4+1)/2 or 2.5 so the Gravitational and Inertial masses of the Neutron are identical.

16. Neutron Relative Magnetic Moment

The magnetic moment of the neutron is about -2/3 that of the proton. I showed that the magnetic moment of the proton was due to a single electron on the "circumference" of the proton trying to spin the mass of the proton. From the previous section on the Neutron mass, I showed that the mass of the Neutron can be explained by an additional electron being added to the structure at approximately the centre of one of the hexagonal rings. This additional electron tries to spin the entire mass of the Neutron and because it is located on a spin axis the arm it is trying to spin the Neutron with is half that of the electron in the case of the proton. In addition, because it is on the spin axis it has two arms with which to spin the Neutron so therefore this electron is able to spin the Neutron four times more efficiently than the electron in the proton. However, because it is situated at the hexagonal ring and not at the centre of the Neutron its ability to spin the Neutron is diminished. If we approximate this diminished ability as the ratio of the particles not on the plane of the spinning electron to the total number of particles in the Neutron i.e. 5/12, then we can approximate the relative magnetic moment of the proton and Neutron as

$$\boldsymbol{\frac{\mu_n}{\mu_p} = -\left(4\ x\ \frac{5}{12}\right) + 1 = -0.666} \qquad \boldsymbol{16.1}$$

The +1 in equation 16.1 is required as the magnetic moment of the proton has to be overcome to get the Neutron spinning in the opposite sense. I could have used the relative distances that the electron is away from the centre to calculate the 5/12 term but there is a lot of uncertainty in the calculation due to the dynamics involved. This simple calculation combined with the Neutron mass calculation demonstrate the validity of the Neutron model.

17. The Hydrogen Atom

To explain the hydrogen atom, one needs to essentially explain how electron orbitals are created and why electrons accelerating in orbits around the nucleus do not radiate away their energy and collide with the nucleus. Bohr's model of the atom just took the orbitals as a given without explaining how they came about and never explained why the electrons did not radiate away their energy while accelerating around the nucleus. Quantum Mechanics fudges this problem by claiming that the electron is everywhere at once which is totally unsatisfactory.

Earlier I explained how the structure of the proton contracts and expands to produce gravity waves which radiate into the lattice structure around the proton. In turn, the lattice surrounding the proton gets pulled radially inward at the same frequency. We therefore have the situation where a medium is

moving in the opposite direction to a wave, so this causes spherical standing waves to form around the proton with nodes at half the wavelength. However, as the inward wave of the lattice movement gets closer to the proton it gets slower as the surface area through which it is trying to pass gets smaller. This causes the nodes of the standing wave to be further apart the closer they are to the proton. The electron orbiting the proton will tend to only occupy orbits at the nodes of the spherical standing wave and this is why the orbits are quantised.

As stated earlier the proton is composed of six positrons and five electrons. At the surface of the proton next to one of the electrons an approaching electron will feel a very strong repulsive force. Next to a positron it will feel a very strong attractive force. There will therefore be locations around the surface where the attractive and repulsive forces balance each other, and an approaching electron will feel no force at all. In the volume around the proton, all the way out to the most distant orbital, there will be locations where the net force is zero or near zero.

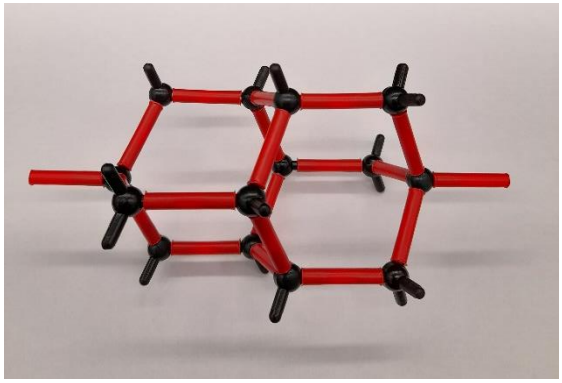

Fig 18.1 Photon Structure

The electron around the proton therefore occupies these regions of zero or near zero force but confined to the nodes of the gravity waves. The orbits are quantised because of the gravity waves but the electrons do not radiate away their energy because they are not experiencing any force and therefore not accelerating. When an electron gets excited to a higher energy orbit it will have to leave a region where it experiences no force and traverse a region where it does until it reaches another region where it experiences no force. If an electron absorbs a photon with too much energy, it will overshoot this region and be attracted back to the energy level it came from and reemitting the photon. It is only when the photon energy is just right to promote the electron to the zero force region that the photon is absorbed.

The Bohr model, to be fair to it did accurately predict the frequencies of the lines in the hydrogen spectrum and was an intellectual leap forward in describing the hydrogen atom and is still in my view better that the current Quantum Mechanics model. In QM, an electron follows a wave function that has complex or imaginary components that cannot be considered mathematically real or therefore physically real either. Its only saving grace is that it predicts the electrons behaviour correctly but so too did the Bohr model.

18. The Photon

In 1937 Louis de Broglie published a book titled *Matter and Light* in which he proposed the theory that the photon is a compound particle composed of an electron and a positron. It was very successful in describing the electromagnetic properties of the photon, but he couldn't explain why it was massless.

Earlier I described that an electron is an oscillation of a cell where the "tri star formation" rotates in opposition to the "hexagonal formation" and in doing so causes the lattice around it to stretch which then radiates reduced pressure waves that produce gravity. When a positron and an electron annihilate each other, the process usually produces two high energy photons which have the same energy as the rest mass energy of the two particles. When the positron and the electron encounter each other, they will be in opposite orientations and overlap each other because they each reside in their own FCC lattice. Because they overlap so much, a virtual electron and positron will become involved in the encounter. During high energy annihilations more than two photons can be produced and this means that more pairs of virtual electrons and positrons become involved. The result of the encounter is that the electron pairs up with a virtual positron and the positron pairs up with a virtual electron as shown in fig 18.1.

This structure has a single distorted hexagonal component in common and only two independent tri star components. The two tri star components oscillate out of phase with each other as one comes from an electron and the other from a positron. As the distorted hexagonal ring is common to both it no longer rotates as the rotating oscillations from the two component particles have cancelled each other out. Instead, it just oscillates from a distorted hexagonal ring to a flat hexagonal ring. There is therefore no change in volume as the photon structure oscillates so no gravity waves are produced. The photon therefore has no gravitational or inertial mass. This is the part that de Broglie was unable to explain. When the positron and electron merge, they cancel out their ability to create gravity waves and therefore have no gravitational mass.

Just as the electron cycles through all four spin axes so too does the photon. The positron and electron that comprise the photon share a single distorted hexagonal component and therefore as it cycles through the four spin axes it has the effect of causing the positron and electron to orbit around each other. The photon will in effect be rotating around two orthogonal axes which produces the alternating electric and magnetic fields that we know are associated with photons. The frequency of this rotation is the photon's frequency. Because the photon structure has the same number of nodes in each of the two FCC lattice structures it will not experience any net electric or magnetic forces and because it does not contract like the electron it is possible for one photon to easily pass through another without interacting.

Photons are also emitted by accelerated charged particles and can therefore have a continuous spectrum of frequencies depending on how much they are accelerated. If we temporarily imagine the lattice cell and the electron as a sphere travelling between two offset ladders that are separated by a distance a little less that the diameter of the sphere and with rungs of a similar separation it may be easier to visualise how a photon is created. As the sphere moves along the length of the ladders it will encounter a rung and rotate about it while also moving forward until it encounters a rung on the other ladder. It will then rotate in the opposite direction about it until it reaches the next rung on the first ladder and then the whole process repeats. At each subsequent step the sphere rotates a little faster as the ball's forward speed increases. The electron does the same as it is accelerated through the lattice transferring its oscillating pattern from one lattice cell to the next. The longer it is accelerated for the faster it will travel and therefore the higher the frequency of the oscillation. When the accelerating force is removed the electron will stop but the oscillation superimposed on it will continue in the direction that the electron was travelling, only now, the oscillation has been transferred to a virtual electron positron pair. This oscillation is identical to the ones produced during the electron positron annihilation but can have any frequency. As with the electron and positron, any energy dissipated by the photon in the emission of electric and magnetic fields is recovered from the lattice.

19. de Broglie Waves

When a particle moves through the lattice it moves in the same sense that a phonon does in moving packets of vibrational energy. These packets of energy move from one lattice cell to the next and therefore it is not a smooth steady process but is instead a stop start process. When an electron moving at "constant" velocity enters a lattice cell it will transfer its momentum to the one side of the lattice cell and come to a stop. The lattice cell then redistributes the momentum to the rear of the cell and causes the electron to start moving again in the same direction that it was moving. All the momentum is returned to the electron, and it continues with the same "constant" velocity. This disturbance of the lattice cells as the electron passes causes waves to be emitted in a similar manner to a bullet emitting sonic waves.

When the electron with momentum p is brought to a stop by stretching the lattice cell by an amount dx in a time dt then we can write that the kinetic energy lost by the electron dE is

$$dE = \frac{dP}{dt}\, x\, dx \qquad 19.1$$

$$dE\, x\, dt \;= dP\, x\, dx \qquad 19.2$$

We know from the Heisenberg Uncertainty principal that dE x dt = *h* and since the electron comes to a stop dE = E and dP = P so equation 19.2 can be rewritten

$$h \;= P\, x\, dx \qquad 19.3$$

$$\frac{h}{P} \;=\; dx \qquad 19.4$$

If we assume that dx is the wavelength of the wave that is produced in the lattice then we get the expression for the de Broglie wavelength, λ, of a moving particle

$$\lambda = \frac{h}{P} \qquad 19.5$$

These waves are longitudinal waves and therefore travel at the same, but much greater velocity of Katrina waves. When a photon that is approaching a double slit emits a de Broglie wave, the de Broglie wave will have sufficient time to pass through the slits and set up an interference pattern before the photon arrives. When the photon then passes through one of the slits it will encounter the wake of the de Broglie wave and be steered by the interference pattern within it. The same applies for interference experiments with massive particles. The Aharonov Bohm effect can be explained by de Broglie waves reflecting off the region of space containing the magnetic field as it is seen as a discontinuity. These reflected waves then interfere with other de Broglie waves setting up an interference pattern that steers the electron.

20. Planck's Constant

Planck's constant has units of Js which is also the units of Action. Action is the difference of kinetic and potential energy in any system and in any oscillating system the maximum potential or kinetic energy is the Action in joules. Planck's constant is intrinsically linked to the photon, and it is the photon structure described earlier that I will use to derive a value for the constant. The photon is a collection of fourteen nodes that can have many modes of oscillation and each of these will have an Action associated with it.

In previous sections I calculated the lattice unit length, *l*, at 1.234×10^{-19} m. From this we can determine the following

Lattice FCC cell diagonal	4.03×10^{-19} m
Lattice FCC cell edge	2.85×10^{-19} m
Lattice FCC cell Vol	2.32×10^{-56} m^3
μ_0 is the lattice mass density	
mass per FCC unit cell	2.91×10^{-62} Kg
Nodes per FCC unit cell	8
Mass per node	3.64×10^{-63} Kg
Energy per node	3.27×10^{-46} J
Energy per photon (14 nodes)	4.58×10^{-45} J

Each node normally has 6 degrees of freedom, 3 translational and 3 rotational. The whole structure also has 6 degrees of freedom, 3 translational and 3 rotational giving 12 degrees of freedom. However, because the photon travels at the speed of light and nothing can travel faster that this then the two translational degrees in the direction of travel are not available to the photon nodes which leaves 10 degrees of freedom. Only half of these are available because the two FCC lattices vibrate

out of phase with each other. 14 nodes with 10 degrees of freedom have 14^{10} modes of vibration.

Number of available modes of vibration 1.44×10^{11}

Modes x energy per photon 6.626×10^{-34} J

This calculation tells us that Planck's constant represents the Action of all the possible available modes of vibration of the nodes that comprise the photon. The energy density of free space therefore represents the energy contained within just one mode of vibration which presumably is that associated with the fundamental frequency of the two interpenetrating FCC structures. When a photon is absorbed by an electron its frequency will determine how many times the total Action will be extracted from the lattice and converted into the kinetic energy of the electron. This is the same source of energy for the electron and positron but in the case of these particles the energy is converted into mass and electromagnetic waves.

21. Proton Antiproton Asymmetry

Earlier I described a sequence of steps that were required to create a proton or an antiproton from positrons and electrons by having them approach each other along their spin axes. This required ten steps which all had a low probability of occurring because there are much easier ways for positrons and electrons to approach each other. I think therefore that the probability of the first proton or anti proton forming was very, very small but once the first proton formed the fate of the antiproton was sealed. This was because the first proton then became a scaffold to create and ensure that the next particle created was also a proton. Because the proton is positively charged it attracts electrons, even if these electrons are at the centre of a free tri-star component. If the first proton attracts one of these components it will slow it down while holding it near one of its hexagonal rings. This makes it easier for a free hexagonal ring to be attracted to it where the SNF will bind them together as a proton shell. This new structure eventually breaks away from the first proton and captures an electron to become a proton itself. The first proton cannot attract a tri star component with a positron at its centre which is what would be required to help create an antiproton so the rate of proton creation exponentially increases after the first proton is created. Even if an antiproton did manage to form very shortly after the initial proton it would never be able to catch up to the rate of proton formation. They would eventually annihilate with protons leaving only the protons we have today.

22. Dark Matter

As I stated at the beginning of this paper the structures in nature keep repeating at different scales and by using that guiding principle this model suggests a very simple explanation for Dark Matter. After all the protons were created in the early universe, a large proportion of them captured electrons and became neutrons. As I described earlier, the electron is just attached to essentially the outside of the proton in the centre of one of the hexagonal rings. This protruding electron enables two neutrons to join together by having both join to the same electron and this process can continue until six neutrons form a ring. This structure would be very stable as it is essentially bound together by the SNF, the same process that binds neutrons and protons in atomic nuclei. These structures are obviously neutral and therefore have no net electric or magnetic fields, but they will have mass and will have gravitational effects. There would have been a very high probability that a high proportion of the protons became neutrons because there is no difficulty in the electron positioning itself at the hexagonal ring of a proton. Additionally, there is a high probability that two or more neutrons would have come together to form rings in the presumably neutron dense environment because the favourable position of the positrons on the hexagonal ring would attract it to the protruding electron of another neutron. There is therefore a high probability that there is a very high percentage of dark matter relative to ordinary matter which is what we see.

23. Dark Energy

The original energy in the universe was just the energy of the fundamental oscillation of the two FCC lattices but as particles and photons oscillate, they first absorb this energy and then radiate it in all directions. While moving they also radiate de Broglie waves of even lower frequencies. Every moving body in the universe from electrons to black holes will produce de Broglie waves so there is a continuous spectrum of frequencies propagating in all directions through the lattice and as shown earlier these waves can exert a force on any body they interact with. The attractive and repulsive electromagnetic forces are only caused by waves with the same frequency as the fundamental frequency by either enhancing or reducing the lattice oscillations around a particle but all other waves will have little if any impact in interfering with the lattice vibrations and will therefore just cause a relatively small repulsive force between particles. This effect will be negligible between small, charged particles but will be significant between neutral cosmic bodies.

As this force is always repulsive and slowly increasing there is a tendency for all bodies in the universe to move away from each other. This explanation of Dark Energy does not require a Big Bang to have initiated an expansion of the Universe, but it does predict that as the energy of the fundamental oscillation gets degraded to longer and longer wavelengths the electrons and positrons and photons will cease to be as they no longer have an energy source. This type of Dark energy however does not explain the increased speed of expansion with distance.

To explain this, we need to look at the lattice structure itself. We can picture the lattice as nodes connected by springs under compression and therefore as these springs slowly extend the fabric of space will expand and the greater the distance between any two points the greater the expansion will be as all the springs between all the nodes between the two points will contribute to the expansion.

If the Universe were infinite, then there would be an infinite resistance to the expansion and therefore no expansion, so I have to conclude that the Universe is finite. If it is in fact finite, then there may come a time when the lattice connecting rods are stretched to a point where they are under tension and then

a contraction of the Universe will commence. This contraction will continue until all the lattice connecting rods are under sufficient compression to first stop and then reverse, leading to another expansion phase which we are in today. So, in this model space is just a lattice structure that just slowly expands and contracts and at a certain stage of the expansion the energy conditions are right for spontaneous oscillations to occur which constitute electrons and positrons.

This description is very similar to that of ever increasing entropy. We understand entropy increases can be explained by the degradation of energy and maybe this is the source of entropy increase.

I briefly mentioned the Casimir effect earlier which can be explained by the exclusion of certain wavelengths from a very narrow gap. The wavelengths in question are the wavelengths that make up the continuous spectrum of oscillations in the lattice.

24. Relativistic Time Dilation

The Lattice vibrates at its fundamental frequency so we can look at the period of one oscillation as the fundamental unit of time. Electrons and positrons also oscillate at this frequency so anything that changes the oscillation frequency of an electron will change its rate of time relative to the lattice.

People often perceive time to pass at different rates, and someone might comment that they don't know where someone finds the time to do all the things they do while conversely when one gets a lot less things done than they were hoping to they wonder where the time went to. I appreciate that this is probably psychological but if one extends the idea then an electron oscillating at a higher frequency will experience time passing at a slower rate. Time, after all, is the reciprocal of frequency.

As an electron travels through the lattice one cell at a time as described earlier it compresses the connecting rods in front of it which then causes de Broglie waves. The compressed connecting rods will also push back on the electron structure with greater force than would be the case for a stationary electron and therefore increase the frequency of oscillation and perhaps also the amplitude of oscillation. The greater the speed of the electron the greater the increase in the frequency of the oscillation and therefore the greater the time dilation.

25. Relativistic Mass Increase

In the section on gravity, I outlined how a gravity wave is produced. The reason it is so weak compared to the electric force is because the tension is distributed over such a huge number of connecting rods in the spherical volume around it before it is released as a gravity wave. The gravitational mass of a particle is just a measure of how much gravity wave energy it can emit.

If the description of time dilation is correct, then as the electron oscillates at a higher frequency it will emit gravity waves more frequently therefore increasing the time averaged force it can apply. As the frequency of oscillation is higher the time that the Katrina waves have to attenuate the tension is reduced so the amplitude of the gravity wave is also greater. These two effects cause the apparent gravitational mass of the electron to increase.

I described earlier that it is the change in volume of a particle that determines its inertial mass. As a particle oscillates faster due to its motion through the lattice its volume will be changing at a faster rate than the same particle at rest and I propose that it is this that gives the particle its increase in inertial mass.

26. Relativistic Length Contraction

Length contraction has never been experimentally measured but was put forward as an explanation for the null result in the Michelson-Morley experiment.

I have two proposals for how length contraction might actually be caused. Just as an electron aligns its spin with an electric or magnetic field it also aligns its spin with the direction of motion. Gravity waves will therefore only be emitted in the + and - direction of travel and as the amplitude and frequency of the gravity waves increase with speed any structure will have its atoms pulled together by greatly increased gravity waves and cause it to contract along the direction of motion.

The second proposal involves the strong nuclear force. As I said earlier the amplitude of the compression of the moving electron may also increase therefore the strong nuclear force will pull the electrons and positrons closer together in the proton structure. As the spins of the positrons and electrons in the proton are aligned with the direction of motion so too is the contraction of the proton. When the proton contracts more than a stationary proton it contracts the radii of the standing waves around it and therefore the orbits of the electrons. Again, any structure will therefore contract in the direction of motion. As time dilation, mass increase and length contraction all stem from an increase in the oscillation frequency of moving electrons and positrons it is not surprising that the same γ factor is used in the relativistic equations describing them.

27. Stern Gerlach Experiment

In a standard SG experiment a beam of silver atoms is passed through an inhomogeneous magnetic field, where the beam is split into two narrow beams corresponding to the two spin states of the unpaired electron in the atoms. If one of these beams is then passed through another SG apparatus at right angles to the first, then the beam is split in two again despite all the unpaired electrons in that beam supposedly having the same spin.

If one considers the four spin axes of the electron as unit vectors in a coordinate system, then any arbitrary spin direction can be composed of the vector sum of integer multiples of the four unit vectors. The orientation of the electron is fixed with respect to the lattice so for an electron to align with an external magnetic field requires that the four individual axes do not get to rotate the same number of times. Some rotate more times than others depending on the direction of the external magnetic field to produce an electron magnetic field either parallel or anti parallel to the external magnetic field. Any

laboratory frame of reference will be constantly changing relative to the lattice and so too will the direction of any "fixed" external magnetic field. The process of electron spin alignment with an external magnetic field is therefore a very dynamic one. I will refer to this changing of the relative number of rotations around each axis so as to align with an external field as the spin sequence.

When a beam of silver atoms enters a SG apparatus the unpaired electrons align either with or against the field in a 50/50 split as that is the probability that an electron has clockwise or anti clockwise spin. The inhomogeneous magnetic field then separates the two beams. The electrons in one of these beams will all have clockwise spin, but the spin order will be random as will the spin sequence associated with each spin order. When this beam enters a second SG apparatus the spins of the rotating components will all be scrambled as the electrons settle into a new set of spin orders and sequences to enable them to align with the new external field. They will however align 50/50 either parallel or antiparallel to the new field.

If this beam were instead directed to a second SG apparatus with the external magnetic field in the same direction as the first, then the beam does not split into two. This is because the electrons maintain their spin orders and sequences on leaving the first SG apparatus and therefore there is no scrambling of the spin orders and sequences as they enter the second as they are already aligned with this field.

28. Entanglement

When two particles are entangled, e.g. two electrons, it is not just their spins that align opposite to each other. Their spin order and sequence are also exactly opposite. Therefore, when the spin of one of the pair is measured using an external magnetic field with an arbitrary direction the other is found to have the opposite spin in an external magnetic field with the same direction. When the two particles enter their respective external magnetic fields, no matter how far apart they are, they will arrive at a new spin order and sequence that is opposite to the other because they were exactly opposite to each other to start with.

29. The Residual Strong Nuclear Force

While it is the Strong Nuclear Force (SNF) that holds the electrons and positrons together within the structures of the proton and neutron it is the Residual Strong Nuclear Force (rSNF) that holds protons and neutrons together within an atomic nucleus. As described earlier the SNF arises from the twisting of the lattice between a positron and an electron along their common spin axis. When two protons or hadrons come close together their relative orientations will be dictated by the structure of the lattice. They can only be orientated such that the axial node or electron in one proton will be aligned with, and facing, a hexagonal ring of the other hadron at a distance of about one proton diameter. The three positrons in the hexagonal ring will have a spin axis parallel to the spin axis of the electron in the other proton. As these four axes are parallel to each other the twisting of the lattice by the four particles concerned will cause an attractive force similar to the SNF but because they are not common spin axes the force is not as strong. The additional electron in the neutron structure which is on average at the centre of a hexagonal ring enables a proton and a neutron to get close enough together for the rSNF to bind them together but the electron ends up being confined halfway between the two. As the electron is sufficiently far away from either hadron it no longer contributes to the mass of the neutron as described earlier which accounts for some of the mass defect during nuclear fusion. The electron no longer has the energy it had while the neutron was free and because it is confined between two hadrons it can no longer easily escape the neutron as in β^- decay which explains why neutrons are stable inside neclei.

30. Bell Inequality

In his 1964 paper *On The Einstein Podolsky Rosen Paradox* [2], John Bell made one assumption on which his entire thesis rests. In his paper he says the following

Measurements can be made, say by Stern-Gerlach magnets, on selected components of the spins $\vec{\sigma}_1$ and $\vec{\sigma}_2$ If measurement of the component $\vec{\sigma}_1 . \vec{a}$, where $\vec{a}$ is some unit vector, yields the value + 1 then, according to quantum mechanics, measurement of $\vec{\sigma}_2 . \vec{a}$ must yield the value -1 and vice versa. Now we make the hypothesis [2], and it seems one at least worth considering, that if the two measurements are made at places remote from one another the orientation of one magnet does not influence the result obtained with the other. Since we can predict in advance the result of measuring any chosen component of $\vec{\sigma}_2$, by previously measuring the same component of $\vec{\sigma}_1$, it follows that the result of any such measurement must actually be predetermined.

The vital assumption [2] is that the result B for particle 2 does not depend on the setting $\vec{a}$, of the magnet for particle 1, nor A on $\vec{b}$.

When the spin of an electron is measured it is its interaction with the external magnetic field that is in fact measured. The electron can therefore only have two possible spin states, either aligned with or against the field. When two entangled electrons are created, they have opposite spin directions, spin orders and spin sequence, therefore when one attempts to measure their spins with an arbitrarily orientated external magnetic field the two electrons will necessarily behave opposite to each other and align with the field in opposite directions to each other.

While Bell is correct to say that one measuring magnet will not physically influence the other measuring magnet, he is incorrect in his assumption that the setting of the magnet for particle 1 does not determine the measurement of particle 2. Quantum Mechanics claims that each electron is in a superposition of both spin states with an equal probability of either being the spin state of the first electron to be measured. It is of course true that the spin of the first electron to be measured will have a 50% chance of either aligning with or against the external field but once we know which way it aligns, the second electron can only align in the opposite sense as all its spin properties are opposite to the first. The first electron aligns with the field in a particular direction because that is the direction that requires

the least amount of change to its spin sequence and order and not because it randomly selects one of two superimposed states. The second electron aligns in the opposite direction because it will go through the same minimum number of changes to its spin sequence and order.

As Bell's assumption is incorrect his conclusion is also incorrect.

31. Superconductivity

When a superconductor becomes superconducting at the critical temperature, a phase change occurs whereby all the electrons that have clockwise spin align with each other by aligning their magnetic fields. Just like in a plasma filament where the charges at the centre of the filament follow along magnetic field lines so too do the electrons in the superconductor. Each electron in the superconductor follows the magnetic field line of the electron in front of it and in conductors where currents circulate these chains of electrons just complete a circle and continue circulating indefinitely. I envisage that at the surface of a superconductor there will be many separate chains of electrons all running parallel to each other. The electrons with anticlockwise spin form separate chains of their own and are probably located between the chains of clockwise rotating electron chains at the surface. I described the magnetic field earlier as a twisting and untwisting of the lattice and in a superconductor the lattice over almost the entire surface will be undergoing this twisting parallel to the surface. This is why no external magnetic field can penetrate this surface unless it exceeds some critical value. Cooper pairs are often cited in relation to superconductivity and while I'm not sure what they are I propose they are just referring in some way to the fact that there are two types of electron chains carrying the current.

32. The Wu Experiment

In 1956 an experiment [3] was carried out by Chien-Shiung Wu to test for parity violation in β^- decay of neutrons in Cobalt 60. The experiment involved placing the Cobalt in a very strong external magnetic field and observing what directions the electrons were emitted in. At the time it was expected that there would be an even distribution of electrons, but it was found that the electrons had a preferred direction opposite to the spin direction of the Neutrons. This can easily be explained by this model. When the Neutrons align with the external field, they will orient in such a way that the additional electron will be on the spin axis therefore if the spin axis is vertical the electron will be located near the centre of the hexagonal ring at the bottom of the Neutron. When it decays it will preferentially exit the Neutron from the bottom as is observed.

33. Single Photon Mach Zender Interferometry Experiments

In all single photon Mach Zender Interferometry type experiments, single photons are passed through a 50/50 beam splitter and then caused to interfere with themselves later. Quantum Mechanics says that the photon travels both paths in a superposition and then one is selected at random when a measurement is made but this makes no physical sense. Quantum Mechanics cannot explain how a single photon interacts with a single microscopic electron in the beam splitter and causes it to be reflected at the same macroscopic incidence angle. It uses the Feynman integral over all possible paths to determine the most probable trajectory for the electron. This claims that the photon somehow explores all possible paths between two points and that the sum of the phases of all these paths contribute to the probability of the photon taking a particular path. This again, like in most of Quantum Mechanics, is a mathematical construct with no meaningful physical process underlying it. Quantum Mechanics failure to explain this fundamental interaction at the start of all these types of experiments means that its conclusions about the results of these experiments are incorrect.

When a photon approaches a beam splitter it will be emitting de Broglie waves which travel ahead of the photon due to their much greater speed. These de Broglie waves will impact with a macroscopic area of the beam splitter and be reflected by the particles in it. This reflected wave will then interfere with incoming de Broglie waves and set up an interference pattern which then directs the path of the photon such that the reflected angle is equal to the incident angle. This is analogous to the usual wave explanation for reflection so there is nothing controversial in that. What is different is that the waves are de Broglie waves travelling at 10^{19} times faster than light which enables the photon to "sense" the macroscopic structure of the beam splitter through the interference pattern of the de Broglie waves which depends on the macroscopic structure of the beam splitter. It is the much faster de Broglie waves that "explore all possible paths" and not the photon itself. The mathematics describing the de Broglie wave interference pattern will be the same as Feynman's path integral analysis and that is why it gives the correct answer but without actually understanding the actual physical process.

If the photon gets reflected then there is a change in its momentum but if the photon doesn't even need to interact with an electron during reflection, then there must be something else going on that conserves momentum. I propose that as the photon changes direction it creates two virtual photons which are just a virtual electron and positron rotating around each other just like a real photon but without producing electric and magnetic fields. One of these virtual photons travels in the same direction as the real photon was originally travelling and the other travels in the opposite direction to the real photon's reflected direction. These virtual photons have the same frequency as the original photon and will reflect and refract just like a real photon as they will also emit de Broglie waves. The virtual photon that travels in the direction that the real photon was originally travelling is usually made, in these types of experiments, to travel along a path that interferes with the path taken by the real photon. The virtual photon will then interfere with the real photon and possibly change its path. This interference mechanism explains all the observations of these types of experiments without the need for superposition of states and other absurd explanations. I prefer to refer to the virtual photons as Dark Photons as they are real physical entities.

34. The Tau Particle

The Standard Model of Particle Physics tells us that the Tau particle is an elementary particle similar to the electron but with almost twice the mass of the proton. In this model the structure of the Tau can be explained by the collision between two protons. When the protons collide a hexagonal ring from one proton will impact with the tri star formation of a second proton. The structure of the lattice dictates that this is the only orientation that colliding protons can be in as shown in fig 34.1. As the electrons in the hexagonal ring of one proton approach

Fig 34.1

the positrons in the tri star formation of the other, they will interfere with the SNF bonds of the positrons of the hexagonal ring causing them to break, thus releasing the positrons, which then repel away from each other (not shown in fig 34.1). The same happens the single electron in the tri star formation but it gets trapped inside the structure (still intact in fig 34.1). Three positrons are lost as the protons collide, so the overall charge of this structure is -1e. Its volume will depend on how close the positrons and electrons approach each other but from fig 34.1 it is easy to see that it is a bit less than two proton masses. The volume of the trigonal pyramid at the top of the proton structure is 1/20 of the total proton volume and as about two of these volumes are lost in the collision, we can say that the mass of the structure is approximately 1.9 times that of the proton, so its inertial mass is 1.9 times that of the proton. The actual measured Tau-Proton mass ratio is 1.8938 so as this structure has the correct mass and charge of the Tau, I propose that this is actually the Tau particle. This structure is very unstable as the electrons and positrons from the two protons that initially met eventually annihilate the three pairs. The decay products of the Tau are most often a neutral pion, a charged pion and a Tau Neutrino (25.49%) or a charged pion and a Tau Neutrino (10.82%) and I will discuss these pion particles next.

35. The Neutral and Charged Pions

When the tau particle in fig 34.1 breaks apart as the three pairs of electrons and positrons annihilate, all that will be left is a distorted hexagonal ring from one of the original protons as shown in fig 35.1 and a tri star formation. Two of the electrons that were inside the Tau are attracted to the tri star formation making it overall neutral and therefore not immediately detectable. The remaining electron resides at the centre of the

Fig 35.1

hexagonal ring giving it an overall charge of -1e. The volume of the distorted hexagonal structure is actually that of a twisted trigonal prism where the triangle has the same area as that of the trigonal pyramid base, so its volume is just three times that of the pyramid or 0.15 of the proton mass. The measured charged pion to proton mass ratio is 0.148. As with the masses of all particles discussed in this paper these are average masses because the particles are continuously contracting and expanding so this is a very good approximation. As this structure has the same mass and charge as the charged pion, I propose that it is actually the charged pion. The neutral pion is just missing the central electron and therefore has slightly less mass. The charged pion has more mass because the central electron will be oscillating along the central axis and briefly popping outside the volume, contributing more to the inertial mass of the particle the same way as the electron in the neutron does. The hexagonal ring is obviously neutral as it contains three pairs of electrons and positrons, and it is also its own anti particle. It usually decays fairly quickly into pairs of photons as the particle pairs annihilate each other. The charged pion on the other hand decays in a different way and I will discuss that in the next section.

36. The Muon

The charged pion usually decays to a muon and a muon neutrino (99.98%) or to an electron and an electron neutrino (0.012%) but it can also produce electron-positron pairs or pairs of photons. If the central electron in a charged pion annihilates with one of the positrons in the ring, then an open ring with a

Fig 36.1

net charge of -1e will result as shown in Fig 36.1. The muon has a mass of about 0.79 that of the neutral pion which is very nearly 5/6 which is not surprising since the pion just lost one of its six constituent particles. As this structure has the same mass and charge as the muon, I propose that this is actually the muon.

Muons themselves eventually decay to an electron and an electron neutrino. The muon contains an electron and two electron positron pairs so when this structure breaks apart it will produce an electron and two neutral electron-positron pairs which largely go unnoticed.

37. The Kaon

When the structure in fig 34.1 decays it can do so in more ways than one. Instead of the three electrons annihilating with the three positrons as discussed earlier to produce a pion the three positrons can be annihilated by the three electrons trapped inside the tau particle. This will result in a neutral pion and another structure that consists of a tri star formation with three

Fig 37.1

electrons still attached by the SNF as shown in fig 37.1. The volume of this structure is 0.5 times that of the proton and therefore its inertial mass is 0.5 times that of the proton and its charge is -1e. The mass of the charged kaon is 0.52 times that of the proton, so I propose that this structure is the charged kaon. If an additional electron is trapped inside this structure and oscillates in and out of this volume, then it will add more inertial mass making the neutral kaon heavier than the charged kaon which is what is actually observed.

There are two types of kaons designated K_S and K_L because the lifetime of one is about 10,000 times longer than the other even though they have identical masses. If there is an electron-positron pair trapped inside a kaon then it will add nothing to its inertial mass or charge, but it will reduce the lifetime by annihilating rapidly with an electron-positron pair in the structure.

With the four subatomic particles just discussed I have only detailed their most common decay paths. A review of the literature on the decay of these particles list many more, some of which I think are not correct such as the K_L decaying into three neutral pions. In this model there is just not enough positrons and electrons in a single K_L to create three neutral pions. In the chaotic environment of a particle collider there will be multiple protons colliding and disintegrating in multiple ways and many of the published decay paths for a single particle may be the result of multiple neutral particle fragments interacting with the single decaying particle making it look like it decayed into something that it actually didn't.

When referring to the mass of these particles I have always just referred to the inertial mass as this is directly proportional to the volume of the particle. The gravitational mass of these particles will not be the same as their inertial mass, but it is only ever the inertial mass that is measured in a particle collider.

38. The Neutrino

When the four particles, the Tau, the Kaon, the Pion and the Muon disintegrate, the decay products usually include neutrinos. This disintegration involves the breaking apart of electrons and positrons that are held together by the SNF which was described earlier as a twisting of the lattice structure between the pair of particles. When the two particles are ripped apart there is still a twist remaining in the lattice. This twist or distortion propagates away as it is no longer confined between to massive particles. The propagation of this distortion is a neutrino. As neutrinos have very little mass the distortion of the lattice is minimal and therefore neutrinos interact very little with matter. The three flavours of neutrinos maybe due to the direction that the neutrino is travelling relative to the lattice. It can travel parallel to the twist along the same axis of the twist, or it can travel at right angles to this or any combination of the two. The characteristics of the twisting action will be different in the three different scenarios thus producing different outcomes when they do interact with matter. Since all matter is moving or rotating relative to the lattice the trajectory of a neutrino will be constantly changing relative to the lattice and therefore changing flavour as it travels. According to this model there are not three distinct neutrinos associated with the electron, muon and tau as they are just the result of breaking SNF bonds between electrons and positrons regardless of what particle is decaying.

39. Bohemian Mechanics

My explanation for many phenomena with this model such as single particle interference, light reflection and the Aharonov Bohm effect uses my concept of de Broglie waves which travel at approximately 10^{19} times the speed of light, the same as the Katrina waves which I used to explain the Gravitational constant.

Bohemian Mechanics which is a deterministic and non-local pilot wave theory is very successful at replicating the predictions of Quantum Mechanics but is largely ignored because it required that particles affected each other superluminally, meaning that information can be transmitted instantaneously over long distances. General Relativity requires that nothing can travel faster than light but General Relativity is incomplete as Einstein himself accepted.

The de Broglie and Katrina waves that I have proposed in this paper are superluminal but not instantaneous but at a speed of 10^{19} x c are as close to instantaneous as makes no difference. David Bohm considered that the pilot waves that his theory described were real as opposed to the imaginary wave function of Quantum Mechanics so the de Broglie waves that I have described could readily be the pilot waves of Bohemian Mechanics.

40. Conclusions

By proposing a tetrahedral lattice structure for the aether with a density of μ_0, a compressibility of ε_0 and a lattice unit length of *l* one can easily explain the nature of matter and light and the interactions between them. It provides us with a deeper understanding of the origins of Planck's constant and the Gravitational constant and allows us to express these and many other constants in terms of these three properties of the lattice. If the explanation for Dark energy given in this paper is correct, then these three constants of nature are not constant at all but are gradually changing as the lattice unit length imperceptibly increases.

It explains the structure and properties of many of the unstable subatomic particles as the disintegrating remains of shattered protons instead of the nonsensical zoo of fundamental particles as promoted by the Standard Model. It also provides a simpler and unified alternative explanation to the nature of reality than do either Quantum Mechanics or General Relativity and explains many phenomena that these two theories have failed to do.

It provides a solution to the main objection to Bohemian Mechanics which is the only sensible alternative to Quantum Mechanics.

41. Additional Follow on work

As I am not a mathematician or affiliated with any institution, I do not have the skills or the resources to rigorously test and validate this proposal by building a computer model of it, so I hope that someone is sufficiently interested in these ideas to take on that task. A lot of researchers have done work with pilot wave theories so perhaps their work could be modified to include the de Broglie waves that I have described. No doubt, I have made some mistakes and incorrect assumptions as I have worked entirely on my own without having anybody to consult with, but I hope that they are few and minor.

42. References

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