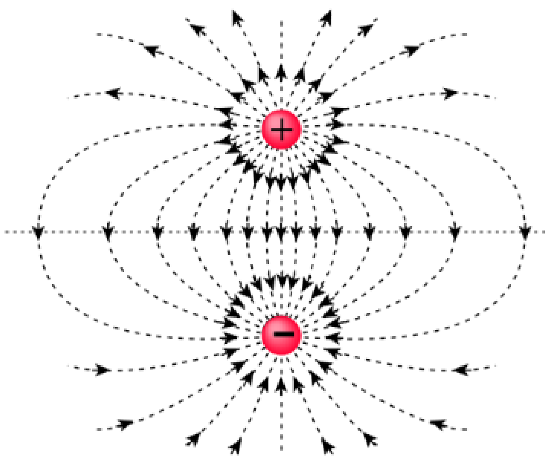
2024

On the Nature of Space, Light, and Matter and their interactions



Michael Gunning

4/24/2024

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On the Nature of Space, Light, and Matter and their Interactions

A theory which describes the nature of space, the structure of matter and the electromagnetic and gravitational interactions between them.

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Abstract

In this paper I propose a structure for the fabric of space from which logically flows the nature and structure of matter and light. It explains the properties of fundamental particles such as mass, charge, spin, magnetic moment etc, and how matter interacts with light. It predicts the existence of what I call a longitudinal photon which readily explains the results of all single photon Mach-Zender type interferometry experiments. It also predicts the existence of Dark energy and Dark matter and explains what they are. It provides a simple explanation for Stern-Gerlach type experiments and also for those testing the Bell Inequality. It also explains Quantum Tunnelling, Gravity, Superfluidity, Superconductivity and the Casimir effect. It provides insight into the nature of time and entropy and their direction. It explains the origins of the Fine Structure Constant and why it has the value that it has. It also explains why some of the main conclusions of the Standard Model of Particle Physics are incorrect. Finally, it proposes a structure for Black Holes and the nature of their gravity as well as a possible explanation for the many anomalies discovered by the James Webb Space Telescope.

1. Introduction

I have always been intrigued by the fact that the proton and the electron have the exact same magnitude of charge but have totally different masses. To me they must at least have something fundamentally in common. 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 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 and 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. I would add to that the more beautiful solution is probably the more correct one. The standard model lacks beauty and is definitely not simple. I am also uncomfortable with the explanations put forward by Quantum Mechanics to explain many, so call, weird observations. Interpretations such as "Many Worlds" and "Superposition of States" just make no physical sence 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. 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".

I would share Einstein's instinct that *"God does not play dice with the Universe"* and that there is no *"Spooky action at a distance".* The reason, I think, that science has failed to unify Special Relativity and Quantum Mechanics is because the interpretation of the real world by Quantum Mechanics is largely incorrect and that by Relativity is largely correct. My model is a mechanical model as desired by Lord Kelvin which is both powerful in its simplicity and elegant in its beauty.

2. The Fundamental Building Block

The idea for this fundamental building block came to me while reading explanations for the Casimir Effect[1]. The Casimir Effect is the attraction experienced between two parallel conducting plates placed very close together. It proposed that fluctuations of different wavelengths of the vacuum energy were being excluded from the gap between the plates, thereby reducing the pressure inside the gap and causing the plates to move towards each other. These fluctuations consisted of virtual particle-antiparticle pairs of different wavelengths. I couldn't visualise any structure ever coming from such a haphazard and chaotic environment, so I thought about regularising and ordering it. Instead of having an infinite number of virtual particle-antiparticle pairs of different wavelengths, I replaced them with a dipole of fixed charge and length (Figure 1). I am not putting forward a detailed explanation of what a dipole actually is other than to speculate that the positive monopole is a source of energy from the vacuum and that the negative monopole is a sink for

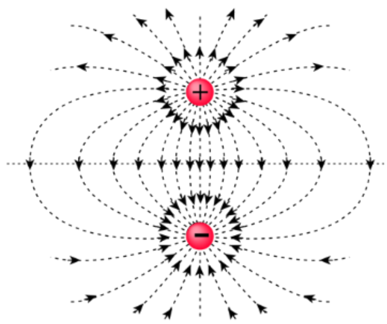


Figure 1

energy back to the vacuum. The two monopoles thus always come in pairs and act as a unit. Like poles on different dipoles will repel each other and unlike poles will attract as per the Electrostatic Coulomb force.

This dipole is thus the single building block of everything, and the only force is the Electrostatic Coulomb force.

3. The Fabric of Space

The fabric of space is a regular cubic lattice structure in three dimensions made up of these dipoles end to end. At each lattice node there are six dipoles, two in each of the three mutually perpendicular axes, x,y and

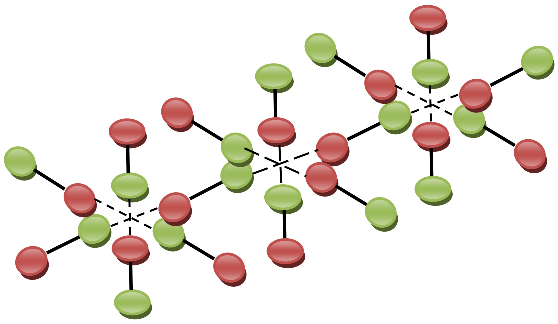


Figure 2

z. There is a total of three negative dipole ends and three positive dipole ends at each node ensuring that each node is electrically neutral. The direction of the dipoles in adjacent parallel rows alternate so there is no bias in any particular direction. All the dipoles can however oscillate at the natural frequency of the lattice structure, and each can oscillate transversely around their centre in any plane. They can also oscillate longitudinally, parallel to a line joining the two monopoles. The lattice depicted in figure 2 shows three of these nodes. The fabric of space is therefore a continuously quivering three-dimensional lattice of dipoles. I will refer to this structure in the rest of this paper as the space lattice.

4. Chirality and Handedness

As demonstrated by the Wu Experiment[2] conducted in 1956, beta particles emitted by Cobalt 60 violated the conservation of parity (p-violation). This showed that there is a difference between left and right with one direction taking precedence over the other. This directional preference can be explained by the rotation of the lattice structure around two mutually perpendicular axes. Centripetal forces on the dipoles caused by this rotation will dictate which direction a dipole will preferentially start to oscillate. So, in the Wu experiment when a beta particle is created it will prefer to move in the general direction which the lattice dipoles prefer. This fact has many consequences which will be expanded on later.

5. The four basic particles

There are only four basic particles, the electron, proton, positron, and antiproton. I will deal with neutrinos later.

Particles are formed in pairs as follows. When the monopoles of a dipole somehow get separated from each other they become unstable, but they can be stabilised by other dipoles surrounding it. A positive monopole will be surrounded by dipoles with their positive ends pointing outwards and a negative monopole will be surrounded by dipoles with their negative ends pointing outwards. There are four different outcomes after a dipole breaks in two.

1. If the monopoles separate by just a small distance, then they will just be attracted back to each other to reform.
2. If the dipoles get separated by a relatively large distance, then each monopole is surrounded very quickly by twelve dipoles with the same charge facing outwards as the charge of the monopole. Twelve is the Kissing number for packing similar sized spheres. The exposed end of the dipoles in this shell will be close together and therefore still unstable. More dipoles will be attracted to them and will build up another shell around the first one. This process will continue until the dipoles at the eventual surface will be the same distance apart as the dipoles in the space lattice. These two particles are the proton and antiproton. Because they have opposite charge, they will be attracted to each other. They will squash each other into two discs and will come together to a point where the two original monopoles are only separated by the length of two dipoles. This is insufficient to keep the monopoles from joining back together and the two particles annihilate each other, and the dipoles arrange themselves back into the space lattice.
3. If the monopoles separate by a short distance but longer than in case 1 then the dipoles that approach them will not be attracted as strongly as in case 2 because they are affected by both monopoles. This gives time for more dipoles to enter the scene and so instead they form two separate but larger shells around the two monopoles. As the dipoles form the shells, they will experience some sideways repulsion from each other, and the shells will expand radially outward until the spacing between the monopoles on the outer edge are the same as that in the space lattice. The shell may only be one dipole length in thickness. These two particles are the electron and the positron. Like in case 2 the two particles have opposite charge and will attract each other to such an extent that they will squash themselves into two disks allowing the monopoles to come close enough to reform into a dipole. At this point the two particles annihilate each other, and the dipoles rearrange themselves back into the space grid.
4. If the monopoles separate by a distance between case 2 and 3 then one of the particles will by chance start to get surrounded by up to twelve dipoles before the other. Dipoles orienting themselves to approach the other monopole will now not be as strongly attracted as they will be influenced by the strong opposite charge forming around the other monopole and will instead form a shell around the remaining monopole and settle at the same radius as the particles in case 3. Because the two new particles are of much different size but of opposite charge, they just remain attached to each other. The monopoles are now well separated from each other and cannot recombine which leaves two very stable particles. If the positive monopole becomes the small particle, then it is a Proton, and the large particle is an Electron. If the negative monopole becomes the small particle, then it is an Antiproton, and the other particle is a Positron.

By this mechanism Protons and Electrons (Matter) are always formed together as are Antiprotons and Positrons (Antimatter). If by chance a tiny fraction more Matter is formed than Antimatter, then eventually all the Antimatter will annihilate with the same amount a Matter leaving just the Matter we see today. It is only a case of creating enough total matter so that the imbalance is what we see today. This mechanism requires that stable Matter can only be formed if Protons and Electrons are very different in size. I suggest that the period of inflation after the big bang was caused by the creation of Positrons and Electrons as the shells around them expanded outwards towards their equilibrium diameter pushing the space lattice apart. This description of matter is in keeping with our general understanding that the proton is a relatively large and positively charged dense object with a measurable radius and the electron is a negatively charged point object because its shell is so large in comparison and is nearly as “open” as the space lattice. I should also add here that as there is no lattice inside the electron the usual concepts of distance and time, which are properties of the lattice, do not apply so the monopole which can orbit at speeds far in excess of c. To an outside observer restricted by the confines of space and time by the lattice, the monopole inside the electron shell will appear to be almost everywhere at once. This may be why the electron's position appears so fuzzy.

6. Rest Mass of Particles

In the description above of how particles formed it states that the spacing between the outward facing ends of the dipoles in the surface of both the proton and the electron are the same as that of the space lattice. They can't be any wider as the space lattice itself would not electrostatically permit it. Because the spacing is the same there is a free dipole end in the space lattice to match up with every dipole end in the two particle's surfaces but because the particles are spherical, and the space lattice is cubic the dipoles will not come together easily. The lattice will have to stretch and twist in order for the dipoles ends to pair up. This causes a tension to build up in the lattice. As two dipoles on opposite end of a lattice node are pulled apart a distance, d, they will experience a coulomb force which is inversely proportional to $\varepsilon_0 d^2$, where ε_0 is the permittivity of free space. These two dipoles will also be oscillating slightly and as they reach the end of their oscillation the distance between them will have increased a little further. The coulomb force will therefore reduce a little more by a factor proportional to d^2. The bigger the oscillation is then the bigger will be the reduction. The mathematical relationship describing this effect is complicated, but it will have the form $C_\mu \mu_0 d^2$ where C_μ is a constant and μ_0 is the permeability of free space. The force is therefore also inversely proportional to this amount and the total force is the product of the two and we can write that the Force F is,

$$F \propto {}^{1}\!/_{\epsilon_0\, \mu_0\, d^4} \qquad (1)$$

If the lattice is stretching around a particle with radius r, then the total force for all dipoles will be inversely proportional to r^4 as d is linear function of r. As the tension T, is the force per unit area where the area is the surface area of the particle then we can write that,

$$T \propto {}^{1}\!/_{\epsilon_0\, \mu_0\, r^6} \qquad (2)$$

Tension T, is the force per unit area which is the same as pressure. Pressure multiplied by volume gives the Energy and we know that the velocity of light c is,

$$c = {}^{1}\!/_{\sqrt{\epsilon_0}\sqrt{\mu_0}} \qquad (3)$$

Therefore

$$E = \frac{k}{r^3} c^2 \qquad (4)$$

This equation has the same form as between E and c as that from General Relativity[3] theory therefore k / r^3 is the rest mass of the particle.

The mass of a particle is therefore inversely proportional to it volume.

The rest mass of a particle derives from the tension it creates in the space lattice when the particle is formed. As was stated earlier, the electron is larger than the proton so therefore it will be lighter than the proton which is what we observe. We know that the mass of the proton is 1836 times that of the electron therefore the electron has a diameter 12.21 times that of the proton.

7. Movement of particles at constant velocity

When a particle moves at a constant velocity v as measured by an observer it is effectively unzipping the space lattice immediately in front of it. As the grid separates the momentum of the particle carries it forward, stretching and tensioning the space lattice until it reaches a point that the particle has no momentum left and comes to a stop. The space lattice at the rear of the particle will be continuously zipping back together. As it does, this it will apply more tension to the space lattice behind the particle which will only be relieved by the particle moving forward again. The energy dissipated by the particle unzipping the space lattice in front of it is returned to the particle via the zipping of the lattice behind it. The process is then repeated, and the particle therefore continues moving in a straight line at an average velocity v. For a non-relativistic particle, the actual velocity will be anywhere between 0 and 2v and its momentum anywhere between 0 and 2mv. This maybe the origin of the Heisenberg Uncertainty Principal which states that we cannot know the position and momentum of a particle at the same time.

We know that the energy ΔE expended in moving a particle ΔX is the Force F by the distance ΔX.

$$\Delta E = F.\Delta X \quad (5)$$

$$\Delta E = \Delta P.\Delta X/\Delta t \quad \text{As Force F equals rate of change of momentum P} \quad (6)$$

$$\Delta E.\Delta t = \Delta P.\Delta x \quad (7)$$

$$\hbar = \Delta P.\Delta x \quad \text{As per Heisenberg Uncertainty principal as } \Delta E.\Delta t = \hbar \quad (8)$$

As the velocity went to zero therefore $\Delta P = P$ and $\Delta x = \hbar /P$ (9)

This is the formula for the de Broglie wavelength λ of a particle and therefore Δx is λ

As the lattice in front of the particle deforms and then relaxes it radiates a wave of wavelength λ in front of it. There is also a wave radiated from the rear of the particle, but its wavelength is about half that of the de Broglie wavelength. This is analogous to the wave produced by a subsonic bullet.

The most important new insight here is that a moving particle radiates a wave in all directions around it transmitted through the space lattice. As the lattice has no mass the wave will propagate indefinitely but will eventually become just part of the ripples of the space lattice.

In addition, as the moving particle tries to unzip the lattice it will increase the tension before the lattice gives way. The particle therefore experiences an increase in mass as it moves which is what is observed. As the particle reaches relativistic speeds the tension does not have sufficient time to release as it can only travel at c. The particle can never travel at c or greater because the lattice would not even unzip as the tension required to open it would not have reached it before the particle did. I will refer to this description of the motion of particles as lattice stepping and the waves produced as de Broglie waves in the rest of this paper.

8. Electric Fields

An electric field is a region of the space lattice where all the dipoles in a single direction are aligned in that same direction with respect to the polarity of the dipoles. The strength of the field will depend on the extent of the polarity alignment. A charged particle such as an electron will have all the negative ends of its surface dipoles facing outward. When placed in an electric field it will be forced to interact with the dipoles of the field. The electron will start to move in the direction of the field as there will be a greater net number of negative dipoles behind the electron than in front of it. In an extreme case, all the dipole ends behind the electron will be negative and all the dipole ends in front will be positive. As the electron moves forward lattice dipoles will align themselves with the electric field behind the electron and continue to push it in the direction of the field. The greater the field strength i.e. the alignment of the dipoles, the greater the force on the electron. This explains the Lorentz force F for an electric field E on a particle of charge e.

$$F = eE \qquad (10)$$

9. Magnetic Fields

A magnetic field is a synchronous oscillation of dipoles around one of the three axes of the space grid. If the oscillation is around the z axis, then the dipoles in the x and y directions will oscillate in the xy plane. Magnetic fields are generated by the moving dipoles in the shells of particles. As the oscillating motion of dipoles in the shells of particles couple with the spin or translational motion of the particle they will tend to oscillate dipoles in the lattice more in one direction than the other. This bias in the oscillation of the lattice dipoles determines the direction of the magnetic field. The strength of the field is determined by the amplitude of the oscillation.

When an electron at a velocity v enters the magnetic field along the x axis at right angles to the field direction z it will be radiating de Broglie waves in front of it. These de Broglie waves are longitudinal oscillations in the space grid, and these oscillations interfere with the oscillations of the dipoles in the magnetic field causing them to reduce in amplitude. If we look at the extreme case where the oscillations stop then all the dipoles in the y direction will have lined up with all like poles facing one direction as determined by the bias referred to above. This is an electric field which then acts on the electron as described in the last section. The oscillations don't have to stop but the de Broglie wave will cause some bias in the dipole charge distribution thereby creating an electric field of some magnitude. In this example if the electron enters along the x direction it will be deflected in the y direction which is the right-hand rule for charges in magnetic fields. If the particle is travelling faster, then the de Broglie wavelength is shorter and the frequency higher. The faster the magnetic field dipoles are oscillated by the longitudinal de Broglie wave the less they oscillate in the y direction and therefore the larger the electric field that is created and hence, force on the particle. If the particle enters along the z direction, then the de Broglie longitudinal waves cannot interfere with the oscillations of the magnetic field dipoles and no force is experienced by the particle. This agrees with the Lorentz force F in a magnetic field B

$$F = qv \times B \qquad (11)$$

10. Magnetic Fields of particles

The dipoles making up the shell of an electron oscillate near the fundamental lattice frequency as they are spaced similarly to the lattice dipoles on the outside surface of the shell but taper slightly inwards at the inner surface. These oscillations are all synchronous which will naturally create a pattern over the surface where the amplitude of the oscillation is maximum for dipoles around the equator of the electron and reducing in amplitude the nearer the dipoles are to the poles. The electron will therefore have two poles by virtue of the oscillating dipoles in its shell. We can call the axis through the poles the spin axis as this is what it would be conventionally called. When an electron encounters the dipoles in the space lattice the oscillating dipoles in the electron shell will start oscillating the dipoles in the lattice with the same frequency as the electron's dipoles such that the positive ends of the lattice dipoles will all be facing the electron. It is behaving like a forced harmonic oscillator where the driving force frequency is close to the natural frequency of whatever is been oscillated. There is therefore a strong coupling between the two. This effect will extend out into the lattice to form a magnetic field around the electron. As the magnitude of the oscillations of the electron's dipoles near the poles is near zero there will be near zero magnetic field at the poles. The magnetic field direction will be tangential to the electrons surface but since the largest field is at or near the equator, the overall field direction will be parallel to the spin axis. If the electron is spinning, then the oscillations of the dipoles in the shell will couple with the spin to oscillate the dipoles in the lattice more in one direction than the other. This bias in the oscillation determines the direction of the magnetic field. The proton has a similar pattern of oscillating dipoles at its surface but because the radius of the proton is so small compared to that of the electron, the oscillating dipoles at its surface will be more restricted and will oscillate at a much higher frequency. It will not be able to oscillate the lattice dipoles with as big an amplitude as the electron as there will be very little coupling between them. This proposal for the structure of protons and electrons therefore predicts that the magnetic moment of the electron should be greater than that of the proton. That is in fact what measurements have shown.

The magnetic moment of the electron has been measured as $-9.28 \times 10^{-24} JT^{-1}$ and that of the proton as $1.41 \times 10^{-26} JT^{-1}$. Previous models for magnetic moment assumed it is a linear function of the radius of the particle, therefore the electron radius in those models would be 663 times that of the proton. In the section on the mass of particles it was shown that the electron radius is 12.21 times that of the proton so clearly the magnetic moment is not a function of radius. The frequency at which the dipoles in the shell of a proton or electron oscillate is determined by how restricted they are, which is a function of volume. The magnetic moment is therefore a function of volume. As volume is inversely proportional to mass that would mean that the magnetic moment of the electron would be 1836 times that of the proton. That would be the case if the electron was not so polarised. Most of its magnetic moment is produced near its equator and if we were to assume that roughly one third of its surface area contributed to producing the magnetic moment then its magnetic moment would be 612 times that of the proton as it is not nearly as polarised.

11. Electric Fields of Particles

As stated earlier an electric field is just where all the dipoles align with similar poles facing the same direction. At the pole of the electron there is no magnetic field so any dipoles that line up above the pole will not oscillate in such a manner as to contribute to the electron's magnet field. It therefore constitutes the strongest electric field line emanating from the electron. In a magnetic field, when the dipoles rotate to the midpoint of the oscillation the dipoles are in effect lined up as in an electric field and, as the dipoles move away from the midpoint the electric field gradually disappears. At the equator of the electron where the magnetic field is strongest the oscillations of the lattice dipoles is greatest and they therefore only line up as an electric field very briefly. There is therefore hardly any electric field emanating from the equator of the electron. The field progressively gets larger the nearer the oscillating dipole is to the poles. The electric field of the electron is therefore primarily concentrated around the poles falling off rapidly towards the equator. The electric field associated with the proton will have a similar structure with its strongest field around the poles but because it has such a small magnetic moment there is not much reduction in the electric field towards the equator. The electric field of the proton is therefore almost spherical. The total field strength from both particles will be the same but opposite in direction as they ultimately emanate from the monopoles inside. This is why the proton and the electron have the same magnitude of charge but different polarity.

12. The Neutron

As the dipoles in the shell of an electron are spaced similarly to that of the space lattice it is not unreasonable to expect that the much smaller proton with sufficient energy can penetrate it. The proton will lose most of the dipoles that form its structure as it penetrates the electron it will destroy the structural integrity of the shell. The pressure from the lattice outside will crush the remaining shell inwards until the positive ends of the dipoles on the inside of the shell get repelled by the positive ends of the dipoles surrounding the positive monopole of the proton. The tension in the lattice outside will therefore crush the shell inwards until opposing forces balance. As the neutron is known to be a bit heavier than the proton then the volume of the neutron must be a bit smaller than that of the proton. In this model this is possible as the proton lost some of its volume as it penetrated the electron shell and therefore only a “partial proton” made it inside. As the magnetic moment of a particle is due to the frequency of oscillation of the dipoles in the shell and therefore its ability to couple with the lattice this model predicts that the neutron will have a smaller magnetic moment than the proton as it is smaller in size, and its dipoles are more tightly constrained. It will also be negative as its shell was originally that of an electron. The actual measured magnetic moment of the neutron is $-1.9 \times 10^{-27} JT^{-1}$ while that of the proton is $1.41 \times 10^{-26} JT^{-1}$. This is less in magnitude than that of the proton and is also negative. The total external charge seen at a distance will be zero as there are now essentially a negative and positive monopole at its centre. However, near the surface it will still appear as an electron most of the time.

13. General Relativity

General Relativity[3] is often described as the theory of the very large and does not work at all at the atomic level. This is because for large objects i.e. large radii, the curvature of the lattice can be approximated to a continuously smooth curve but for protons and electrons there are discontinuities in the curvature due to the finite length of the lattice cells. There can thus be very abrupt changes in the curvature of the lattice around subatomic particles which is why General Relativity breaks down at these scales.

The stretching and tensioning of the space lattice as particles move through or stay stationary is ultimately what gives rise to the force of gravity. General Relativity beautifully describes the distortions in the space lattice in the presence of matter, but it does not describe what actually starts two bodies moving together. Two massive bodies like the sun and earth will produce a curvature/distortion in the space lattice like General Relativity describes but it will also cause a tension in the space lattice between them. As the lattice tries to reduce the tension it will pull the two bodies together. Gravity is therefore only an attractive force.

Space contraction occurs when a moving body compresses the lattice in front of it and since the dipoles on opposite side of a lattice cell are now closer together. The velocity of light will remain constant but as time is distance/velocity the time interval elapsed will be less than in non-compressed lattice cells and therefore to an outside observer time will appear to have slowed down.

Gravitational waves are produced by massive objects such as black holes as they rotate each other at high speed. As they push and compress the space lattice, they will cause both longitudinal and transverse waves in the lattice which will travel away at the speed of light.

14. Light

Light is an electromagnetic wave that propagates in one direction through the space lattice in response to the rotation of a dipole through 360^0. Figure 3a shows a section of lattice before it is disturbed. Dipole no 1 is the photon dipole. A dipole can rotate very slowly compared to the transmission of forces to neighbouring dipoles which occurs at the speed of light which is important for the next step. Assume red is positive and green is negative. I'm just going to concentrate on the central dipoles' behaviour for simplicity and so not complicate the diagram with other effects.

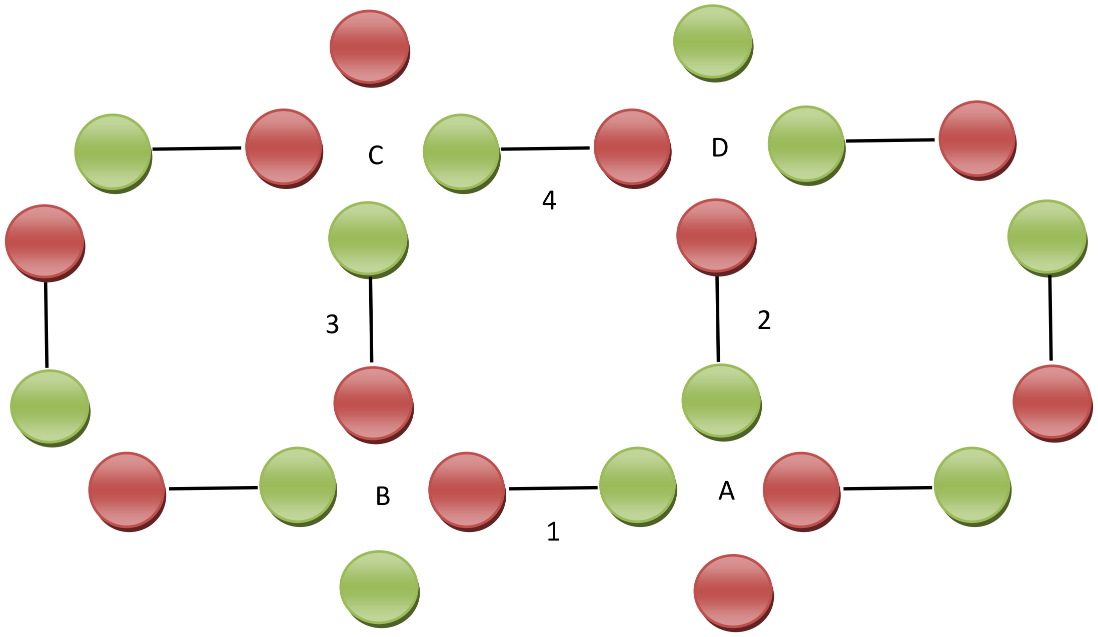


Figure 3a

When the photon dipole (No1) rotates through an angle of 30^0 as shown in figure 3b it will be as close as possible to the negative pole of dipole 2 in Node A. This will cause dipole 2 to rotate and its positive end in Node D will come as close as possible to the positive end of dipole 4. The positive end of dipole 2 will therefore repel the positive end of dipole 4 and also start to attract the negative end of dipole 4. This will cause dipole 4 to flip.

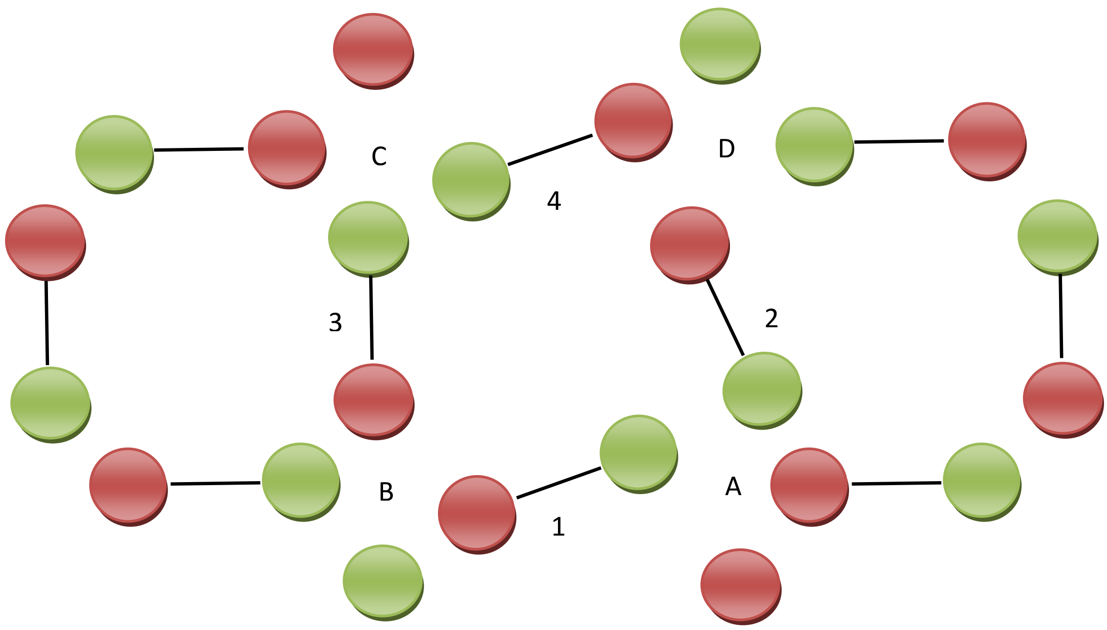


Figure 3b

The flipping of dipole 4 will be completed very quickly as the forces are transmitted at the speed of light through dipole 2, the positive end of which is very close to dipole 4. As dipole 1 slowly rotates past the 30^0 point, dipole 2 will start to return to its original position and dipole 4 will start to rotate in the same direction as dipole 1 as shown in figure 3c.

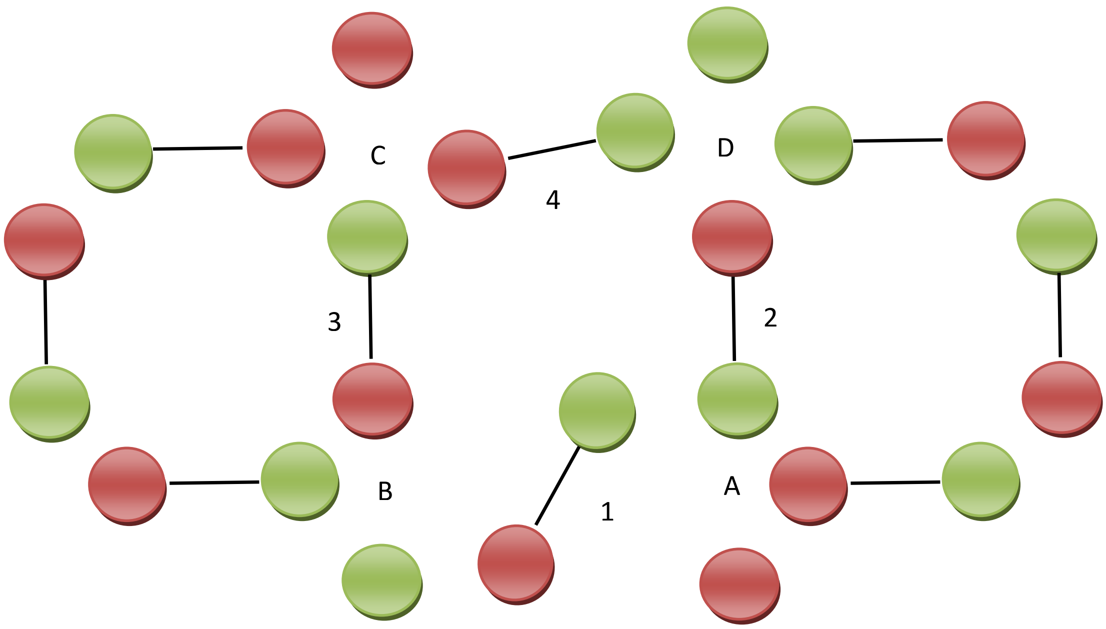


Figure 3c

The initial movement of dipole 1 therefore indirectly primes and positions dipole 4 well in advance of dipole 1 directly interacting with it. If dipole 4 were in the opposite orientation, then dipole 2 would just have held it in position. As dipole 1 continues to rotate, dipole 4 will also continue rotating and it will initiate the dipole in front of it to start rotating. In this manner the initial disturbance of dipole 1 will be transmitted through the lattice in a straight line through the transfer of momentum from one dipole to the next. As the dipoles are all orientated in the same direction when they start rotating (priming and positioning aside) they produce a sinusoidal electric and magnetic field in both space and time. This disturbance travels at the speed of light.

A single rotating dipole like in the description above does not constitute what we usually consider a photon. A photon packet will consist of vast numbers of adjacent dipoles rotating in sync with each other. These are capable of producing electric fields that we can detect. In a photon packet dipole 1 will be rotated trillions of times as the packet moves forward but the above priming and positioning of dipole 4 will only need to be done once. As the photon packet travels through the lattice the lead photon dipole(s) will be priming and positioning the dipoles just ahead of the photon packet.

An interesting consequence of this model is that the shortest wavelength that a photon can have is just greater than twice the lattice length as the priming and positioning would not take place quick enough otherwise. Recently a group detected gamma rays with a wavelength of 1.24 x 10^{-20}m so a dipole cannot be more than half this length.

It should also be noted that as the photon dipole, rotating for example around the z axis, approaches the dipole in front of it, it will not stay rotating in the xy plane but will instead be deflected either upwards or downwards in the z direction during the first 90^0 of its rotation. Because the neighbouring dipoles have started to rotate in unison with it the lattice nodes become net charged with an orientation that causes the photon dipole to return back down to rotating in the xy plane after it has rotated 180^0. For the remaining 180^0 it interacts with the preceding photon dipole to cause it first, to be deflected in the opposite z direction and then back to the xy plane on competition of the rotation. A photon therefore has two spin axes as opposed to only one for the electron, proton, and neutron. When "viewed" from the rear along the direction of travel, a photons plane of rotation will oscillate from side to side by 45^0 for a total rotation of 90^0. It therefore takes two full revolutions of the dipole for it to return to it original orientation which is why the photon is considered a spin 1 particle.

The figures above show the photon travelling along one of the axes of the lattice, but a photon can travel in any direction through the lattice. This representation just makes it easier to visualise. To follow its path is just a matter of getting the vector sum of the directions of all the dipoles involved in the x, y, and z directions. Unlike with a particle, such as an electron, there are no dipoles actually travelling through the lattice so the photon or photon packet will have no mass.

15. Atomic Structure of Hydrogen

The simplest atom is that of hydrogen ${}^1_1H$ which is just a proton attached to the shell of an electron. They are held together by the electrostatic force. As both particles are spheres, the dipoles in the shells of the surfaces have their inner poles closer together than the outer poles. As the positive end of a dipole in the protons surface aligns with the negative end of a dipole in the electrons surface, they will attract each other but as they get closer there will be a repulsion by the inner more closely packed poles. There will therefore be a distance where these two forces balance and the electron will orbit the proton at this distance. As the proton has 1836 time more mass than the electron, the electron orbits around the proton. There is no net force on the electron therefore it is not accelerating and therefore does not emit electromagnetic radiation as required by Maxwell's equations. If another proton penetrates the shell of the electron, the electron becomes a neutron as discussed earlier but the original proton stays attached and is now more strongly attracted to the displaced negative monopole inside because of its interaction with the proton inside. They both have roughly the same mass, so the proton-neutron pair rotate around their common centre. Another electron will then be captured by the proton, and it will orbit about the proton while the proton and neutron orbit each other. This is the structure of Deuterium $^{2}_{1}H$. This electron can also be converted to a neutron to create a Tritium $^{3}_{1}H$ nucleus which will then capture another electron. The shape of the tritium atom is therefore planer trigonal with a central proton surrounded by three electron shells albeit two of them are neutrons.

16. Nuclear Fusion

If two Deuterium nuclei collide head on with the two protons facing each other with sufficient energy, then the two neutron shells will start to form into two discs. The negative monopoles inside will now be much closer to the protons outside and will start to be attracted to them. There will be a stable point reached when the attractive force of the two external protons with the internal monopoles is matched by the repulsion force of the two negatively charged neutron shells. The two external protons will then orbit in the gap between the two neutron shells in a very stable manner. The electric field of the proton is slightly polarised so the orbiting protons' spin will align at random in a direction at right angles to the plane of the orbit. As the neutrons have a small magnetic moment, they will align their poles at the gap which will also try to align the magnetic spins of the orbiting protons. If both protons are spinning in the same direction, then they will drift to the same side and destabilise the structure. However, their own two magnetic fields will now interact and flip them in opposite directions, so the magnetic spins align in opposite directions. The plane of the proton orbit will therefore oscillate a little due to the oppositely aligned magnetic fields at a frequency the same as the proton orbit rotation rate. This is the structure of $^{4}_{2}He$. Because the two neutrons are now bound together by the force of attraction between the two orbiting protons and the negative monopoles inside there is a charge separation inside the neutron. The monopoles stay close to the outside protons while the internal protons are repelled away. The partial protons inside can now push back stronger on the shell and therefore increase the volume of the neutron. The mass of the neutrons therefore reduce as they produce less overall tension in the lattice than the two neutrons separately. There is therefore a huge amount of the tension in the space lattice released and this energy appears as kinetic energy of the $^{4}_{2}He$ nucleus. 0.645% of the mass is converted into kinetic energy when two deuterium nuclei fuse so this corresponds to a 0.645% increase in the volume of the proton which is an 0.86% increase in the radius.

There is another isotope of helium which is $^{3}_{2}He$ but only accounts for 0.000001%. This is formed in a similar manner to above, but the collision is between a proton and a Deuterium nucleus. If the proton approaches the Deuterium from the opposite side of its proton, then the neutron shell will pancake until the protons are attracted by the monopole inside. When there is a balance between this attraction and the repulsive force of the neutron shell dipoles the structure will be stable. This $^{3}_{2}He$ nucleus and the $^{1}_{1}H$ nucleus are the only two stable nuclei with more protons than neutrons. Neutrons therefore are required to stabilise different nuclei. Paired orbiting electrons do not contribute anything to the overall magnetic moment of the nucleus but there may be some magnetic moment produced by the neutrons. For a nucleus of which the numbers of protons and of neutrons are both even, magnetic moment is always zero. In cases with odd numbers of either or both protons and neutrons, the nucleus often has nonzero magnetic moment.

Only one collision was required to create both of these two isotopes of Helium from Deuterium which is why an abundance of Helium was created just after the big bang. All the other elemental nuclei are built from Helium nuclei, protons, and neutrons in successive steps inside stars where the frequency and energy of collisions make it inevitable.

$^{6}_{3}Li$ is created from $^{4}_{2}He$ by a collision with $^{2}_{1}H$. The proton on the outside of the Deuterium approaches the orbiting protons of the He nucleus with sufficient energy to overcome their repulsion and gets attracted by the monopoles inside the neutrons. An additional collision with another neutron will produce $^{7}_{3}Li$. This has two neutrons on each side and so is therefore more stable that $^{6}_{3}Li$ which is lobsided. Their relative abundance of 95.15% $^{7}_{3}Li$ to 4.85% $^{6}_{3}Li$ would bear this out.

All the other elements are created by successively adding more and more deuterium and additional neutrons for stability to end up with Uranium $^{238}_{92}U$ which will have 92 protons orbiting the gap between two hemispheres of 73 neutrons each. To get all the neutrons to fit together such that their internal monopoles can interact with the orbiting external protons the neutron shells will be very tightly packed together. Nuclei above Iron in the periodic table will have their neutrons so tightly packed that some will start to be compressed. These neutrons will therefore have more mass. Elements such as Uranium 235 will have so many of its neutrons compressed such that it will release energy when the nucleus splits in two and releases the tension on the neutrons.

17. Nuclear Fission

Uranium $^{238}_{92}U$ is not fissile when impacted by thermal neutrons probably because it is evenly balanced with the same number of neutrons in each hemisphere. Uranium $^{235}_{92}U$ however has 71 on one side and 72 on the other. When this nucleus is struck by a thermal neutron it disrupts the orbiting protons and destabilises the structure. The two neutron hemispheres will start to repel each other, each bringing about half the orbiting protons with them as the internal monopoles are still attracting them. When they are far enough apart the neutrons in each hemisphere will start to repel each other and they will fan out and create two new smaller hemispheres as they are all still anchored by the monopoles and orbiting protons. The orbiting protons will then arrange into a stable orbit between the two new smaller hemispheres. Some neutrons get lost in the process which can produce a vast array of different combinations of daughter nuclei. As the compression of the central neutrons in each hemisphere by their neighbours is released a large quantity of energy is released which appears mostly as kinetic energy of the daughter nuclei. It appears as kinetic energy because the tension in the lattice is relieved on one side of the neutron. This is on the outermost side of the neutron opposite the centre of the nucleus so the daughter nuclei are ejected in opposite directions away from the original location of the nucleus.

18. Electron Orbitals

When a nucleus is formed it will appear from a distance as positively charged and will attract electrons. As the first electron gets closer to the nucleus it will start to feel the repulsion from the surface of the large electron shells around the neutrons. The neutrons are arranged in two hemispheres either side of the orbiting protons. The electron will continue towards the nucleus until the attractive force from the protons is balanced by the negative force from the neutrons. This surface of zero potential will be approximately spherical over the two hemispheres with some undulations and will be somewhat closer to the nucleus in the plane of the proton orbit. The first electron will therefore primarily occupy this depression in the zero potential surface and orbit the nucleus. The second electron will also primarily occupy this depression and the pair will orbit together on opposite sides. In the nucleus the neutrons will have oriented themselves along their magnetic poles by having the neutrons in one hemisphere having their north poles point towards the centre of the orbiting protons while the other hemisphere points its south poles towards the centre in this fashion which also helps stabilise the nucleus. While there might be no net magnetic moment overall the electrons will feel a local but constantly changing field and align with it. Because the two electrons in the 1s orbital are on opposite sides mostly, they will experience opposite magnetic fields and therefore their spins will be opposite as well, all the time even though they are constantly changing. This is what is referred to as the 1s orbital.

The next electron that approaches will see a different surface of zero potential which will now be more spherical in shape overall but further away from the nucleus because of the two electrons below it. It wouldn't be stable for a third electron to occupy the 1s orbital as there would be collisions with the other two electrons as it can't pair its spin with both. There will be a raised ridge just above the proton orbit as the electrons in the 1s orbital are occupying that orbit most of the time. The third electron will therefore primarily occupy an orbit at right angles to the 1s orbit but further out from the nucleus. The fourth electron will pair up with the third electron and orbit as a pair with their spins opposite just as with the 1s orbital. This is known as the 2s orbital.

When a fifth electron is attracted to the nucleus it sees a complicated surface of zero potential because of the interactions of the 1s and 2s orbitals at right angles to each other. They produce dumbbell shaped regions of zero potential which are known as $2p_x$, $2p_y$ and $2p_z$. All the other orbitals fill this way with the zero potential surface for each orbit determined by the ones below it and the local magnetic fields ensuring that the spins of each pair are opposite.

As the electrons are all located at the zero potential for their orbital, they experience no net force and therefore are not accelerating. Accelerating electrons are known to lose energy so this solves the problem of why the electrons do not lose energy and fall into the nucleus.

The orbital angular momentum of the electrons is quantised because the orbital rotation of the electrons is coupled to the oscillations of the dipoles in its surface. The electron will have to make one revolution of the orbit for every one oscillation of the dipoles.

The quantisation of intrinsic spin direction comes about because the electric fields of both the proton and the electron are not radially symmetrical but are instead concentrated about the poles, more so for the electron than the proton. They therefore always align with an electric field but with the magnetic spin having a 50/50 chance about which direction it will align. Intrinsic and orbital momentum are therefore quantised because the rotation frequencies are coupled to the surface dipole oscillations.

19. Longitudinal Photon

When a photon of light enters a beam splitter the photon will encounter an electric field which will reflect it through 90^0 with a phase shift lag of 90^0. If we imagine that in Fig 3b that the second row of dipoles is a rigid electric field, then the rotating dipole will not be able to start it rotating as it is rigidly fixed in place. The central dipole of the photon together with its rotating neighbours will instead push the line of electric field dipoles forward in unison and at the same time be deflected up at 90^0 to its original rotation where it will commence to initiate the oscillation of a dipole which results in the photon being reflected at 90^0 with a phase shift lag introduced during the deflection upwards. The electric field line of dipoles will all rebound in unison staying parallel to each other just in time to nudge the original photon dipole during its last 90^0 of rotation. The electric field line longitudinal oscillation will propagate a longitudinal wave in the same direction of the original photon and will be of the same frequency and phase. It is therefore capable of interfering with the original photon if their paths cross again in a manner that would be the reverse of the process just described. This longitudinal photon is not detectable in its own right by any detectors currently except and only when it interferes with its own originating photon. This process of creating a longitudinal photon explains the outcomes of all single photon interference experiments using beam splitters. It dispenses with all the explanations requiring faster that light travel, backward causality and "many worlds" theories.

20. Emission of Radiation by Accelerating Charged Particles

When a charged particle is at rest or moving at constant velocity the oscillating dipoles in its shell will drive the dipoles in the lattice in phase with them. In the case of the electron the amplitude of the oscillations will be large and in the case of the proton the amplitude will be small. Suppose we have an electron moving in the +x direction spinning around the z axis, and we look at just one dipole on the equator of the electron pointing primarily in the y direction. As the electron is lattice stepping this oscillating dipole will move forward one lattice cell length just in time to continue the oscillation of the dipole in the next cell and so on. If the electron now slows down mid step the dipole in the electron will not be in the right place to be in phase with the lattice dipole as it oscillates back. It will instead, apply an extra torque to the lattice dipole and cause it to rotate 360^0. This is the initiation a photon which will propagate through the lattice as described earlier. As the electron applies a torque to the photon dipole the electron will be slowed down. A similar process will take place if the electron accelerates instead of decelerating as the dipole will again be in the wrong place to sustain the lattice dipole oscillations in phase and initiate a photon.

21. Photon Packet

An electron will not initiate just one single dipole photon when it accelerates. Instead, it will initiate photons primarily from a part of the surface area at right angles to the poles and left and right of the direction of motion. The electron will continue to do this for as long as it continues to accelerate so this packet of

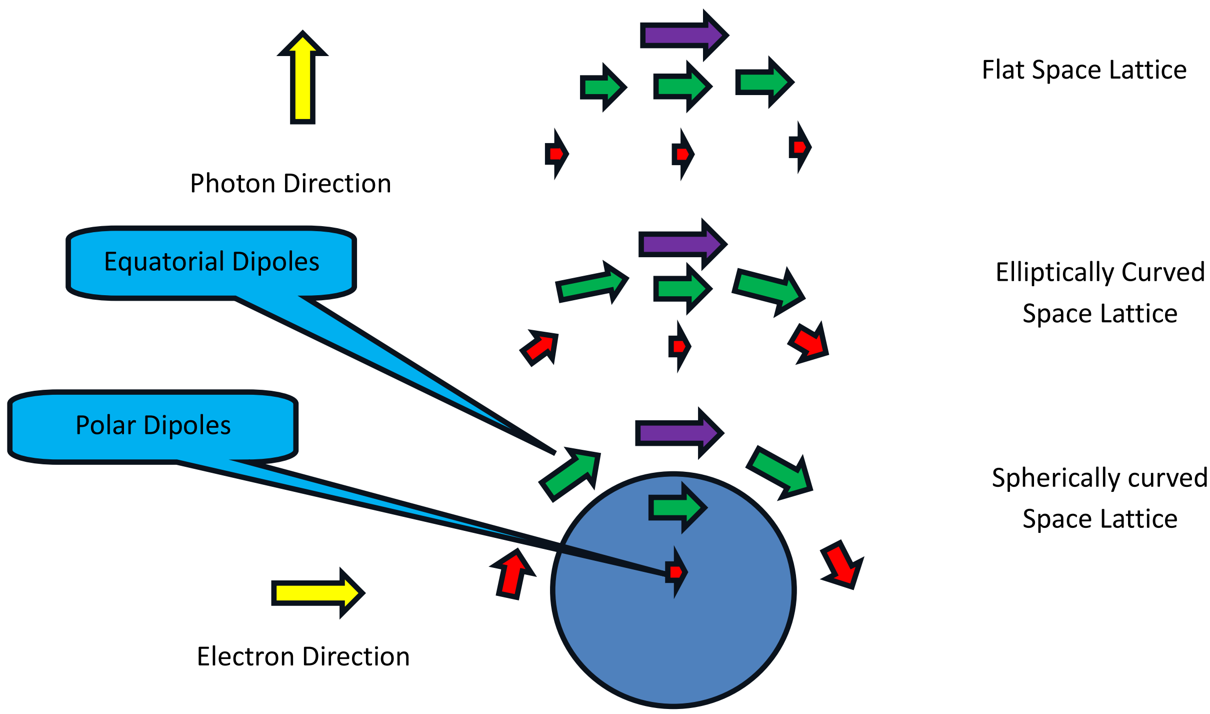


Figure 4

photons will extend in space along the path of the electron.

Figure 4 above is a view looking down on an electron moving to the right and decelerating. The largest impulse will be imparted to the dipoles at the equator, perpendicular to the direction of motion, shown as the violet photon. At the front and rear the impulse will be much less, as depicted by the red photon. There will be a gradual change in impulse, from maximum at the edge to zero at the front as depicted by the green photon. There will be a similar variation in impulse going from the equator up the side to the pole as depicted by the parallel red and green dipoles. The polarisation vector for each photon will be tangential to the surface of the electron where it was initiated (imagine the arrows in the diagram pointing upwards out of the page but tangential to the surface) so there will be a continuum of polarisation vectors all across the surface. As these photons propagate outwards the shape of the lattice will change from spherical to flat and this will cause all the photons to be collimated into a narrow circular beam about the same size as the diameter of the electron. This will also have the secondary effect of aligning all the polarisation vectors perpendicular to the spin axis of the electron. The above process will continue for the entire time the electron is decelerating. As the photons travel faster than the electron the overall shape of the photon packet will therefore be like a rugby ball, with a minor diameter about the same as the electron and a major diameter determined by the distance the electron travels.

The photon packet will be built up in slices as the electron lattice-steps in it's direction of motion. The photons in each slice will be initiated slightly later than the preceeding slice so their oscillation from side to side will slightly lag. Each additional slice will have the same lag to the preceeding slice all the way to the rear of the photon packet. The time averaged polarisation of each slice and therefore the entire photon packet will be parallel to the spin axis of the electron that produced it. In other words, the polarisation, or alternatively the spin, of the photon packet will remain fixed but the individual photons within it will oscillate. There will be a second photon emitted in the opposite direction not depicted in any of the figures.

22. Emission of Photons

If the photon packet is produced by and electron transitioning between orbitals in an atom, then one photon packet will be emitted radially outwards and the other radially inwards where it will be absorbed and dissipated by the nucleus. As the electron is being pulled into the lower orbit, it's orbital velocity will slow down as dictated by the shell dipole oscillations. This is the source of the deceleration which initiates the photon.

23. Absorption of Photons

Photons are absorbed in the reverse process as described in the last two sections. If a photon does not have a high enough frequency, then it will be unable to increase the orbital rotation rate of the electron to enable it to jump to the next level. This is the origins of the photoelectric effect.

24. Magnetic Field Around a Conducting Wire

When a potential difference is applied to a conducting wire aligned along e.g. the x axis of the lattice then the dipoles along the x axis that are not already aligned with this potential will be forcibly rotated 180^0 so that they do align. The alignment process will start at each end of the conductor and will proceed through the conductor at the speed of light, flipping dipoles as it goes. Electrons inside the conductor will start to precess around this electric field and eventually align their spin axes with the field as their own electric fields are highly concentrated at their poles. Depending on their initial orientation, half will be spinning clockwise relative to the electric field direction and half will be spinning anticlockwise. Any oscillation of the lattice dipoles around the wire by the clockwise spinning electrons will be cancelled out by the anticlockwise spinning electrons. The drift velocity of the electrons in the direction of the electric field will however impart an impulse to the lattice dipoles as the electrons lattice step through the conductor. The lattice dipoles will therefore oscillate around an axis tangential to the wire but perpendicular to the current direction. This will produce a circular magnetic field around the wire and the direction will be determined by the bias in the oscillations cause by the direction the electrons are moving. The formula for the magnetic field strength, B at a distance r from a wire carrying a current I, is given as

$$B = \frac{\mu_0 I}{2\pi r} \tag{12}$$

where μ_0 is the permeability of free space. The current I is the charge per unit time passing a point which is directly proportional to the drift velocity which is in line with the description above.

25. Magnetic Field of a Solenoid

When the conducting wire from the last section is wound into a solenoid the magnetic field B, produced inside the solenoid is given by the formula,

$$B = \mu_0 N I l \tag{13}$$

where μ_0 is the permeability of free space, I is the current, N is the number of turns and *l* is the length. From the last section we seen that the dipoles in the lattice around the wire oscillate around an axis perpendicular to the wire or current direction. If the solenoid were just a single loop, then the magnetic field at the centre produced by one side of the loop would be exactly cancelled by the field produced by the opposite side of the loop as the current would be going in opposite relative direction. In a solenoid however, the coils are helical and so there is a component of the magnetic field parallel to the solenoid axis pointing in the same direction regardless of which side of the loop the current is passing. These components all add together to produce a magnetic field inside the solenoid which is parallel to the axis of the solenoid. The other components cancel out. The helicity of the coils determines the magnitude of the component of the magnetic field parallel to the solenoid axis and therefore the total field strength. The formula above bears this out because if the helicity is increased by increasing the length, then the magnetic field strength is increased while keeping everything else constant.

26. Magnetic Field Around a Permanent Magnet

Ferromagnetic elements like nickel, cobalt and iron have two, three and four unpaired electrons respectively in their outer 3d electron orbitals which give rise to the magnetic properties of these elements. If we were to look at a row of iron atoms in a sample of iron they will be equally spaced because of the cubic centric structure of iron. The unpaired electrons will have their intrinsic spin axes at right angles to their orbital planes of rotation because the electric field of the electron is concentrated at the poles and therefore both poles are equally attracted to the central nucleus. As the unpaired electrons in neighbouring atoms orbit their respective nuclei, they will interact with each other so that their planes of rotation align with each other. A similar interaction between neighbouring rows will also cause the electrons' planes of rotation to align with each other. If an electron with an intrinsic spin direction which is opposite to its orbital spin direction is between two electrons that have all their spins aligned, then the greater magnetic moment of the two electrons combined will force the single electron to change spin direction. The electrons in the iron crystal do all this spontaneously to minimise their energy state and so create a structure where the unpaired electrons all have the same intrinsic spin direction, and all have parallel orbits of rotation. If our row of iron atoms is lined up in the x direction, then the unpaired electrons will be orbiting mostly in the yz plane in e.g. a clockwise direction and their intrinsic spins also in a clockwise direction. The orbital plane can tilt from side to side, but it will not exceed 180^0 causing the orbital direction to change as interaction with neighbouring atoms will prevent this. These aligned unpaired electrons will cause the lattice dipoles to oscillate around an axis parallel to our row of atoms and the oscillation will be biased in the direction of the spins. Because the orbital and intrinsic spins are coupled the magnetic field produced is as strong as is possible. In an actual iron crystal, the plane of rotation will be such that the energy of the unpaired electrons in the neighbouring planes will be minimised and the magnetic field will be at right angles to it. An unmagnetized sample of iron will be composed of small volumes, called domains, within which all the unpaired electrons' intrinsic and orbital spins are aligned. Each domain will have their own magnetisation direction at random. When placed in an external magnetic field, the oscillating dipoles of the lattice which constitute the external field will interact with the oscillating dipoles of the domain's magnetic field and force them to align with the external field which in turn will change the orbital plane of rotation of the unpaired electrons by rotating the iron crystal within the domain. If enough domains are changed in this way, then when the external magnetic field is removed the iron remains magnetised permanently.

27. Magnetic Attraction and Repulsion

In the solenoid described earlier I said that because the wire follows a helical path along the length of the solenoid the dipoles in the lattice which have their spin axes perpendicular to the wire will have a component parallel to the solenoid axis. The electric current in the wire will bias the lattice dipole oscillations in one direction so that the positive ends of the dipoles will spend more time facing one end of the solenoid than the other. The net positive end therefore becomes the North pole, and the net negative end becomes the South pole. When North and South poles from two different solenoids are brought together the positive ends of the dipoles at the North pole will attract the negative ends of the dipoles at the South pole and if two like poles are brought together, they will repel each other.

When a permanent magnet is made with a solenoid it will inherit the helicity of the coil and therefore its North and South poles will behave just as with the solenoid.

28. Electron Attraction

When two electrons approach each other with their spin axes parallel and spinning in opposite direction the two electrons can be attracted to each other. It has already been stated that the oscillating dipoles in the shell of an electron will oscillate the dipoles in the lattice thus creating a magnetic field around the electron, but primarily at the equator. Because the electron is also rotating this will tend to cause the dipoles in the lattice to oscillate a bit more to one side than the other. If a de Broglie wave were to interact with this magnetic field, then it would stop oscillating and the electric field that would result would always line up in a particular orientation with respect to the spin direction. If two electrons with the opposite spin direction approach each other along their equators, then de Broglie waves from both will cause electric fields to be created between the two electrons which will act in concert to attract the two electrons together. The two electrons will only stay together via this mechanism for as long as there is sufficient relative movement towards each other so that the de Broglie waves create the electric fields.

29. Cooper Pairs and the Meissner Effect

The Meissner effect is observed when a superconductor expels a magnetic field during the phase change to superconducting. I propose that this effect is due to cooper pairs which are attracted to each other via a different mechanism than that proposed in the last section. If the two electrons with the same spin get close enough together because of reduced thermal motion then, the de Broglie waves from each will cause an electric field to form around each but will be in opposite directions. If the amplitude is sufficiently large, then the two sets of lattice dipoles will line up parallel to each other but be in opposite directions. The poles of each set of dipoles on one side will be directly across from the opposite poles of the other set of dipoles and thus will be very strongly attracted to each other. This will stop the oscillations in the lattice and either stop or severely disrupt the oscillations in the electrons themselves. If this happens to all the conducting electrons, then an external magnetic field will be unable to penetrate very far below the surface. A very strong external magnetic field will be able to start the dipoles in the lattice or the electrons oscillating again thus breaking the bond between the electrons. This is what is observed experimentally.

30. Superconductivity

When a cooper pair form and the dipole oscillations stop, the lattice between the two electrons effectively becomes part of the structure and moves with it. As stated earlier in the section on inertial mass, whenever the tension in the lattice is reduced then the mass reduces. As the cooper pair together, put the lattice under less tension than the two electrons separately then the cooper pair has less mass. As the dipoles, primarily around the equator have stopped oscillating they have effectively created a circular electric field around each electron in the pair. These electric fields will attract cooper pairs together, if their relative orientations are correct, to form a train of cooper pairs. This train will get longer and longer and eventually meet its own tail to comprise a closed loop. If such a structure formed then it would be massless, at least in the direction of motion, and travel at the speed of light in a tube through the lattice of its own making. The electrical resistance of the material will have reduced to zero and the current will flow continuously as long as the temperature is low enough.

31. Superfluidity

Superfluidity is very closely related to superconductivity and has only been observed in Helium 3 and 4. He^4 is similar in structure to a cooper pair in that it consists of two electron shells attached together albeit there is a proton inside of each. Normally the proton inside is disturbing the dipoles in the electron shell and contributing to the mass of the neutron but at the very cold temperatures required for superconductivity these disturbed dipoles stay flipped at 180^0 long enough to be attracted to the electron shell of another neutron in another He^4 nucleus. The orbiting electrons of the helium atoms will not get in the way of the two neutrons joining because they orbit in the plane between the two neutrons in each of the individual nuclei. As nuclei join in this way there is a reduction in tension in the lattice and therefore in the total mass of the pair. Like in superconductivity, there is nothing to stop trains of He^4 atoms joining in this manner and creating loops thereby creating frictionless flow. The loss of mass allows for the flow up the sides of containers. As the dipole oscillations are not locked like in superconductivity there is no noticeable magnetic effect in superfluidity. A similar process happens with He^3 but since it only has one electron shell about the equator of which orbits the orbital electrons of the atom it is much more difficult to get close enough to another nucleus to bond as described for He^4. Superfluidity in He^3 therefore occurs at a much lower temperature than for He^4.

32. Youngs Slits with single photons

In a Young's Slits experiment with single photons the original wave explanation is largely correct as the central oscillating dipole of the photon sends out a wave of oscillation through the lattice. As no dipole in the expanding wave completes an oscillation they cannot be described as photons and will not be detected but the wave will have the same frequency as the original photon and therefore after passing through the second slit will be able to interfere with the original photon and change its direction after which it will be detected on a screen as a single photon. Any attempt to detect the photon before interference occurs will destroy the coherence of the waves. In a real experiment it will be a photon packet that will pass through the slit but the wave of disturbance that it creates in the lattice will be able to pass through the second slit and interfere with the packet and produce the familiar interference pattern.

31.Young's Slits with single particles

As described earlier a moving particle transmits what I will call a de Broglie longitudinal wave through the lattice in all directions. As this wave passes through the double slits it will interfere with itself. As the particle is continuously stopping and starting it is easy for its direction to be altered by the interfering waves. When two longitudinal waves interfere constructively, they will push the lattice in front of it in phase with the particles movement thereby making it easier for the particle to change direction to follow the peaks of the interference pattern. When two waves interfere destructively, they will tend to keep the lattice rigid, again forcing the particle to follow the peaks of the interference pattern.

32. Stern Gerlach Experiments

In the original Stern Gerlach experiment[5], silver atoms which have an unpaired electron were passed through an inhomogeneous magnetic field. It was originally expected that the atoms would be deflected by an amount that depended on the unpaired electrons magnetic moment direction. As this should be random, they expected to see an even spread from maximum deflection upwards to maximum deflection downward. What they got was two peaks at both extremes and nothing in between. This led them to conclude that spin was quantised. When they then passed one of the beams through another inhomogeneous magnetic field at right angles to the first, the beam was split in two again even though the spins were all in the same direction before entering the second device. There has been no explanation to date for this.

What is actually happening here is explained by referring back to the section on how the Lorentz force in a magnetic field comes about. As the electron travelling along the z axis enters the magnetic field along the y axis the de Broglie waves from the particle will create an electric field along the x axis. Stern and Gerlach modelled the unpaired electron as a tiny bar magnet only, but we cannot ignore its charge in this type of experiment. Because the electric field of the electron is mostly at the poles the electrons will align randomly with this electric field in the x direction with half having their magnetic spins pointing +x and half pointing -x. Because the electron is in a neutral atom there is no net electric force on the silver atom. At this point we have two sets of atoms with their unpaired electrons' spins aligned in the x direction but half spinning clockwise and the other half spinning anticlockwise. As the atoms proceed through the device in the z direction the de Broglie waves will interfere with the magnetic field around the unpaired electrons causing them to stop oscillating and thereby create an electric field around the equator of the electron. The de Broglie wave in front of the electron has about twice the frequency of the de Broglie wave behind it so the field in front will be about twice as strong. The direction of the resultant field will depend on the electron spin so half will have an electric field in the +y direction and half in the -y direction. Because the magnetic field, in the y direction, is inhomogeneous there will be a gradient in the electric field produced in the lattice by the de Broglie waves which will interact with the electric fields around the equator of the electrons to deflects all the electrons to either maximum or minimum deflection which is what Stern and Gerlach observed. There is no quantisation of spin. The measuring device just creates it.

In the second device one of the beams still travelling in the z direction is sent into the device with the magnetic field pointing along the x axis. The electrons will all have their magnetic spins along the +x axis and the de Broglie waves from the particle will create an electric field in the lattice in the y direction. None of the electrons will always be pointing exactly in the +x direction as they will be precessing and therefore, depending on their orientation just as they encounter the electric field, they will either have their magnetic spins aligned in the +y or -y directions in a 50/50 split. The magnetic field will then just deflect them to the maximum deflections as before.

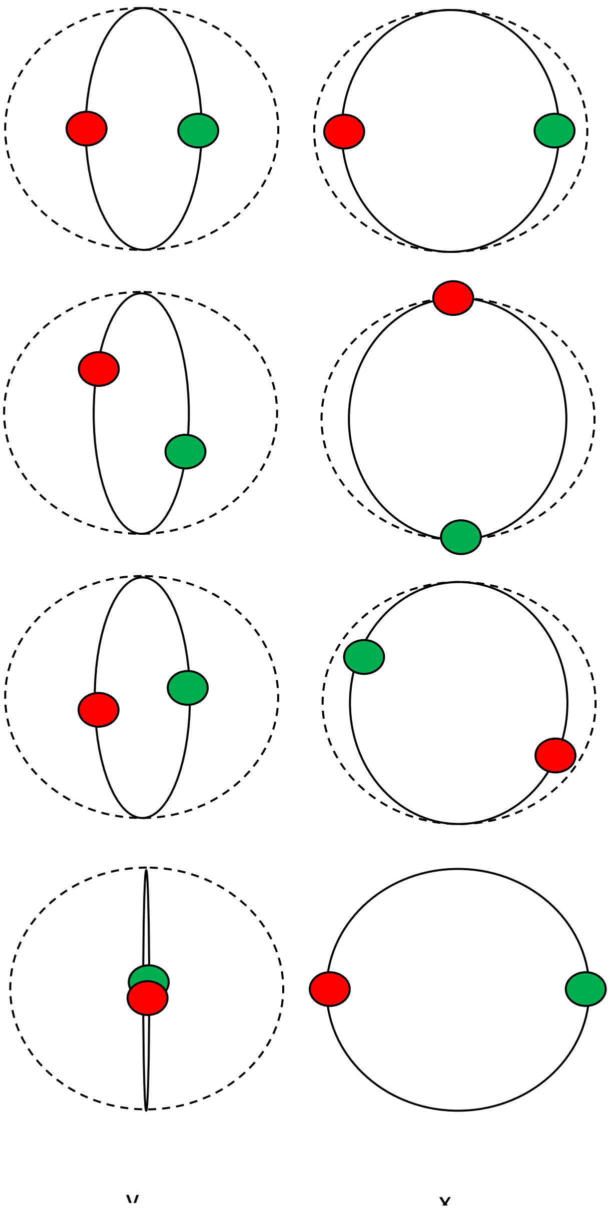
33.The Three Polariser Experiment

When two polarisers are placed at right angles to each other no photon can pass through but when a third polariser is placed at 45^0 between the two then 25% of the photons will pass through. To explain this, we need to refer back to the section on the photon packet where it describes how the direction of spin of a single photon dipole oscillates through an angle of 90^0, i.e. 45^0 left and right. A polariser is just a region of the lattice where there is an electric field. An electric field is where the dipoles are aligned in the same orientation with respect to the two monopoles. These lines of dipoles will be held more rigidly in place that those in the normal lattice. It is obvious from just this description that photons oscillating parallel to this field will not be able to pass through but photons oscillating at right angles will pass through easily. Depictions of photons in this document so far have just shown the photon aligned with an axis of the lattice, but photons can obviously travel in any direction. To analyse a photon packet, whose spin is at an angle to the grid we just need to look at the component vectors in the x, y, and z directions. To simplify it somewhat, let us look at a photon packet travelling in the z direction, at a spin angle $\theta < 45^0$ to the x axis through an electric field in the y direction. Before the photon packet reaches the electric field, i.e. polariser, it can be represented by dipoles oscillating in both the x and y directions, but instead of monopoles orbiting each other in circular orbits they will be orbiting in elliptical orbits. The closer the angle θ is to the x axis, the closer the orbit in the x direction will be to circular, i.e. the minor axis of the ellipse will approach the major axis and that in the y direction the minor axis of the ellipse will approach zero.

Because of the geometry of the interaction, the momentum will always be transferred from the elliptical orbit with the smaller minor axis to the elliptical orbit with the larger minor axis. In the example above all photons therefore with a θ less than 45^0 will be transmitted through the polariser and all those with a θ greater than 45^0 will be blocked and dissipated as heat eventually.

As the photon packet as described earlier progresses through the polariser, each slice will have the momentum in the y component of its dipoles transferred to the x component and the photon emerges polarised along the x direction.

When a photon packet passes through the first polariser at 90^0 to the table top the photon packet that emerges will have its polarisation at 90^0 to the table. As it approaches the second polariser at 45^0 only those photons that are oriented at 45^0 or less when they encounter it, will be able to pass. As they pass through,



Two dipoles in the x and y directions rotating clockwise in elliptical orbits which represents a photon travelling at an angle of less than 45^0 to the x axis.

The dipole rotating in the y direction encounters the electric field in the y direction and slows its rotation. The dipole in the x direction continues to rotate as normal.

As the dipole in the x direction continues to rotate, the dipole in the y direction has bounced off the electric field dipole and has reversed its direction and is now in an orientation to repel both monopoles of the dipole in the x direction which is now also tilting in the y axis, transferring

Before the dipole in the x direction completes its rotation, the dipole in the y direction will have transferred all its momentum to it and will have come to rest in the lattice. The dipole in the x direction now initiates a photon that is polarised in the x direction.

they will have their polarisation set at 45^0. Using Malus' law the percentage that get through is 50%. The same thing happens again at the third polariser which is at 0^0 so again 50% are able to pass. The total that pass is therefore 25%.

34.Lamb Shift

Lamb shift[6] refers to the difference between the energy levels of the 2s and 2p orbitals in a hydrogen atom. Contrary to theories at the time the 2p should be at a higher level but experiment showed it to be lower. First of all, there is no 2p orbital in a hydrogen atom as its structure depends on the 1s and 2s orbitals been fully populated as explained earlier. In the experiment performed by Lamb the 1s electron is promoted to the 2s orbital and then it relaxes to two possible slightly lower levels before relaxing to the 1s orbital.

This effect is purely a result of the fact that the electric fields of the electron and proton are not radially symmetrical. The proton is fairly symmetrical with a dip around the equator while the electrons field varies from zero at the equator to maximum at the poles. When the electron is orbiting the proton in the 1s orbital it will primarily be oriented such that the spin axes of both will be parallel and it will orbit primarily in the equatorial plane of the proton as this is the most stable configuration. This corresponds to the usual 1s orbital energy level. Lamb and Rutherford used microwaves in their 1947 experiment to stimulate transition to the 2s orbital and then waited for it to transition back to the 1s orbital. In some cases when the electron was transitioning back to its original orientation in the 1s orbital as described above it became oriented instead with one of its poles facing the proton at its equator. This is a very energetic and unstable orientation as the other pole will also be attracted to the proton. It eventually orients itself in the original orientation and emits a photon in the process with an energy less than that of the photon emitted during a direct transition from the 2s to the 1s orbital. In other cases when the electron transitions back to the 1s orbital it will encounter the proton away from the equator. This is also unstable and more energetic than its usual orientation as the poles of the electron will be attracted by different amounts due to the non-radially symmetric electric field of the proton. It won't be as energetic as the first case described and when it eventually transitions to the 1s orbital it will emit a photon with lower frequency that with the other case.

As both photons emitted during these two scenarios have frequencies a bit less than that emitted by a direct transition, Lamb and Rutherford[6] concluded that the electron first transitioned to the 2p orbital which was somehow lower than the 2s orbital and also split into two different energy levels before continuing the transition to the 1s orbital.

35. Quantum Tunnelling

In a typical quantum tunnelling event, an electron will appear to pass through a potential barrier for which it does not have sufficient energy to do so. We can model this as a moving electron trapped between two stationary electrons a few electron diameters apart. The moving electron will be continuously batted back and forth between the two stationary electrons at great speed. The monopole inside the electron will also be oscillating back and forth and on rare occasions the monopole will enter the shell of the electron. While in the shell it will be slowed down by the positive ends of the dipoles behind it and the negative ends of the dipoles in front. It will therefore be prevented from exiting the electron and will commence being pushed back inside. While the monopole is inside the shell there is nothing to support the shell and the tension in the lattice will crush it radially inwards to a tiny fraction of its original size. Its momentum will then carry it inside the stationary electron that is forming the barrier. There is no lattice inside the electron so nothing can have mass inside it. There is no concept of time either so the tunnelling electron can appear at the opposite end of the barrier electron immediately and exit. Once outside the monopole will continue its journey back inside the tunnelling electron where it balloons back out to its original size. The electron has thus tunnelled through the barrier almost instantaneously.

36.Bell Inequality Type Experiments

These types of experiments are supposed to be the definitive proof of Quantum Mechanics' validity. I think that John Bell's inequality formula[7] is incorrect because he made an incorrect assumption during its derivation. In his derivation he assumed that the results measured at detector B were independent of the settings of detector A. From my earlier description of how a photon packet passes through a polariser it is obvious that if the photon packet passes through detector A at whatever angle it is set at, then the probability of the entangled photon packet passing through detector B at whatever angle it is set at is just a variation of Malus' law, $I = I_0 \text{Cos}^2\theta$ where I is intensity and θ is the angle between the polariser's polarisation direction and the photon packet's polarisation direction.

It is absolutely the case that the coincidence results at detector B are dependent on the setting of detector A, so Bell's inequality formula is flawed. Coincidence counts are correlated with $\text{Cos}^2\theta$ which is exactly what these experiments show, and the extreme level of correlation is taken as iron clad proof of Quantum Mechanics' validity. These experiments do nothing more that confirm Malus' law for photon packets. I find it amazing that in Bell's original paper[7] he proposed the use of Stern Gerlach devices for measuring electron spin to validate his proposition. Stern Gerlach device behaviour cannot even be explained by Quantum Mechanics, yet it was proposed to be used to validate Quantum Mechanics.

37. Aharonov Bohm Effect

The Aharonov Bohm effect[8] describes the deflection of an electron by a magnetic field even though the electron never actually entered the field. This was demonstrated by passing a beam of electrons very close to a solenoid and observing the deflections. The solenoid has no magnetic field outside the coils so should have had no effect on the electron. Mathematicians developed the field of vector potentials which can simplify the mathematics involved with changing electric and magnetic vectors but understood that it was just a mathematical abstraction and was not real in itself. The Aharonov Bohm effect changed this distinction because the mathematicians concluded that if the magnetic field could not affect the electron, then it must have been the vector potential, in this case the magnetic potential, that caused the effect. This led them to believe that the magnetic vector potential actually described reality and not the actual magnetic field itself[8]. This is a bit like saying that complex numbers are actually real things because they better describe some phenomenon.

What is actually happening is that the de Broglie wave emitted by the particle interacts with the magnetic field and reflects off it. The reflected wave then interferes constructively and destructively with the original wave and changes the path of the electron.

38. Dark Energy

This is one of the biggest mysteries in cosmology today, but this model explains it very easily. At the edge of the universe the space grid finally comes to an end. The structure will not be as stable as in the interior as each dipole will not be surrounded symmetrically. Oscillations in the space lattice, caused by light and matter moving about everywhere in the interior, will propagate to the edge and then have nowhere to go. What happens is that some of the dipoles at the edge get slightly ejected into the void. They will be immediately attracted back to the lattice, but they will also attract the lattice towards them. The lattice therefore gradually expands. As this process is continually happening there will be a near constant force pulling the lattice and therefore the expansion will accelerate. Dark energy is just the lattices' way of dissipating all the energy of the oscillations in the lattice.

39. Dark Matter

Another big mystery in cosmology is the fact that most of the matter in the universe is dark. This matter reveals itself by its gravitational effects. For something to have a gravitational effect it just needs to distort the lattice. As I said earlier, most matter and antimatter were created during the inflation period just after the big bang. This enormously expanded the grid which contained the matter. As the antimatter started to annihilate with matter, Positrons and electrons came together as described earlier and fell apart. All the component dipoles reattach themselves to the lattice but there is not enough of them to create a cube big enough to hold an electron, so the lattice gets distorted in a concave manner. When the protons and antiprotons annihilate, they have to many dipoles to fit in a cube just big enough to hold a proton, so they bulge the lattice in a convex manner. A lot of total matter had to have been created so that we are left with the amount of matter we have today. The rest became dark matter.

40. Direction of Entropy

Entropy is often described as the measure of disorder in the universe, and it is always increasing. The direction of entropy is related to the expansion of the lattice by dark energy. At the beginning of the universe the lattice was very compact and highly ordered which is where the initial high entropy originates. As dark energy expands the lattice, the dipoles move further apart and can move more out of alignment with each other for longer which can be viewed as an increase in disorder or an increase in entropy. There will come a point when the dipoles are so far apart that they effectively behave independently of each other and thus achieve maximum disorder or entropy. The high entropy situation at the beginning of the universe corresponds to the high potential energy of the bonds between the dipoles which is gradually converted into kinetic energy of the dipoles as the energy of the big bang pulls the lattice apart via the mechanism of dark energy.

41. β^- Decay

In its most basic form β^- decay occurs when a neutron is converted to a proton within the nucleus with an electron and a neutrino being emitted. As described earlier a neutron is just an electron with a proton orbiting the negative monopole inside. This internal proton can gain energy in a number of different ways such as colliding with a neutrino or interacting with other neutrons in the nucleus. If it gains sufficient energy, then it will be able to break through the shell of dipoles surrounding the neutron. The neutron is now effectively an electron, and it will be repelled from the slightly negative neutrons around it and ejected as a β^- particle. The proton that has emerged from the neutron will be prevented from escaping the nucleus by the attraction of the negative monopoles inside the neutrons and it will eventually join the existing protons orbiting the centre of the nucleus. This process sometimes emits gamma or x rays. A neutrino is also emitted which is described in a later chapter.

42. β^+ Decay

β+ decay occurs very rarely naturally on earth and is almost always induced by cosmic rays which are composed of about 90% protons and 9% alpha particles. During β+ decay a proton in the nucleus is converted to a neutron and a positron and a neutrino are emitted. One mechanism to achieve this outcome is as follows. An energetic proton in a cosmic ray strikes a proton in the nucleus of an atom causing it to be injected into one of the orbiting electrons. This electron has therefore been converted to a neutron which now get pulled into the nucleus due to its surface negative charge being severely diminished. The cosmic ray proton loses its surrounding dipoles in the collision and now additional dipoles from the lattice surround it to form a positron. An alternative scenario is that the proton in the nucleus gets stripped of its dipoles during the collision and the cosmic ray proton gets captured by the orbiting electron. A neutrino is also produced as described later below.

43. α Decay

α decay typically occurs in the heaviest nuclides. In practice, this mode of decay has only been observed in nuclei considerably heavier than nickel, with the lightest known alpha emitter being the second lightest isotope of antimony. However, beryllium 8 is exceptional and decays to two alpha particles. As can be seen from the description of the nucleus earlier it is not hard to visualise what happens during α decay. Heavy nuclei have very distorted neutrons and if one neutron in a hemisphere gets bumped and displaced it will start to regain its spherical shape and thus reduce tension in the lattice. This release of tension will transfer kinetic energy to the neutron and then the neutron will drag two orbiting protons and a neutron from the other hemisphere out of the nucleus. As the other neutron regains its shape it will also gain in kinetic energy as the lattice tension releases and therefore propel the newly constituted alpha particle out of the atom and the material.

44. γ Decay

I have already discussed how a particle emits a photon so there is no need to discuss it again other than to add that accelerating protons tend to emit γ rays as the dipole oscillations in the proton shell are relatively stiff compared to those in electrons so they tend to give a high frequency impulse to lattice dipoles when accelerating.

45. Neutrinos

Neutrinos are generally accepted to be neutral particles that come in three “flavours” some of which are near massless and one which is possibly massless. They are produced in nuclear reactions but interact very weakly with matter. During Beta decay for example a neutron is converted to a proton with the emission of an electron and a neutrino. As described in the section on β^- decay the proton internal to the neutron gains sufficient energy to penetrate the shell thereby converting the neutron to an electron which is then ejected as a β^- particle and the proton is captured and joins the existing orbiting protons. As the proton penetrates the shell of the neutron it will propel a number of dipoles in the shell, out into the lattice. These dipoles will no longer be part of the electron and instead will arrange themselves into a cylindrical cluster with pairs of dipoles attracted to opposite ends of each other. It will just be a matter of chance how may dipoles will be in a cluster. Each dipole is overall electrically neutral but when arranged in this manner each end of the cluster will also be effectively neutral but at very close range to an individual monopole it will be slightly attractive or repulsive depending on the situation. This is the structure of a neutrino.

This neutrino will have two distinct rotation modes, one parallel to the axis of the cylindrical structure and one perpendicular to it. If the neutrino is travelling in e.g. the +x direction and the cylinder is rotating around the x axis, then the neutrino will have very little interaction with the lattice structure, and this corresponds to the lightest or perhaps massless neutrino. If the neutrino is rotating perpendicular to the cylinder axis in the yz plane, then there is greater chance for interaction with the lattice which will slow the neutrino and thereby give this neutrino rotation mode the greatest mass. If the neutrino is rotating perpendicular to the cylinder axis in the xz or xy planes then it will interact with the lattice somewhat less than the previous example and therefore have an intermediate mass. These rotation modes can all be active simultaneously but interactions with the lattice will cause some modes to dominate temporally which explains why neutrinos appear to oscillate between flavours. Whichever mode is dominating at the instant of a collision with a proton will determine the outcome of the collision. Neutrinos are also either left or right-handed which is just determined by the direction of spin relative to the chirality of the lattice.

46. The Gravity of Black Holes

As stated earlier the force of gravity between objects such as the sun and the earth is due to the tension in the lattice pulling the two objects together as the lattice tries to reduce the tension. With a black hole the gravity is enhanced with an entirely different mechanism. As matter falls into a black hole the electrons are eventually crushed into anti protons. As the volume of an electron far exceeds the volume of lattice that the dipoles of an electron can create, the lattice itself also collapses inwards. At the very centre of the black hole the protons and anti-protons will also disintegrate and form into a very tightly spaced lattice just like what was probably present before the big bang. In effect a black hole is like a mini big bang in reverse, with the lattice and the matter within it being crushed into a tightly spaced lattice. If a black hole stops feeding then it will remain as is but only temporarily. As Dark energy expands the lattice, the gravity holding the black hole together will reduce and the black hole will expand outwards again. It is conceivable that after all the matter in the universe is consumed by black holes that these black holes would eventually merge into one. This process of creating and merging black holes would counteract dark energy and so the entire lattice would also be consumed into a single massive black hole. This is what I think existed before the big bang. There is nothing inside the black hole except a very tightly packed lattice of dipoles and all that is required to initiate a big bang is for a pair on monopoles to get separated from each other.

47. James Webb Space Telescope Anomalies

In the short few years since the launch of the JWST so many anomalies have been discovered[9] that do not fit with current theories. Anomalies such as galaxies and black holes being much larger and more mature for the locations they are found in. In some cases, black holes have been discovered that are apparently older than the universe[9].

In this paper so far, I have described the structure of space as a cubic lattice of dipoles, and this is effectively the case in a local region of space. If the universe expanded from a single point, then the lattice will actually be spherical with one side of a lattice cell being a bit larger than the other, as one moves away from the centre. This will mean that as light travels towards the centre it will follow the path of least resistance i.e. high permeability. This means that light will not travel in straight lines and will be deflected by an amount that depends on how close to the centre it passes. An observer on earth, looking in one direction will therefore see light that could have originated from anywhere in the universe. This is why the universe looks much the same in all directions and the microwave background is almost uniform. This also explains many of the anomalies discovered by JWST. E.g. an observer may observe two galaxies side by side at the edge of the known universe and one may appear very young and small as expected but the other might be large and mature. This is because the second galaxy is not where the observer sees it but might be on the other side of the universe. It might even be the Milky Way a few hundred million years ago as we have no way of knowing what path the light took to reach the observer.

If space does consist of a spherical lattice of dipoles, then the Universe is probably much smaller than we think as light traverses curved paths to reach us. It also contains much less matter than we think as we are counting the same galaxies multiple times.

48. The Speed of Light

We know from Maxwell's equations that the speed of light, c, is given by the expression,

$$c = {}^{1}/_{\sqrt{\epsilon_0}\sqrt{\mu_0}} \quad (14)$$

Where

- μ_0 is permeability of free space.
- ε_0 is the permittivity of free space.

As stated earlier, μ_0 is a measure of how easy it is to oscillate the dipoles in the lattice so as to produce a magnetic field and ε_0 is a measure of how easy it is to pull dipoles apart. In a region of space where the lattice cells are smaller than they are here then the dipoles will be closer together and therefore are more strongly attracted to each other. This will have the effect of decreasing ε_0 as it will be harder to pull the dipoles apart. According to General Relativity the speed of light is constant everywhere so, for the above expression to remain true then μ_0 will have to increase accordingly. This would seem logical as it would now be more difficult to oscillate the dipoles to create a magnetic field. As the lattice cells increase in size due to the expansion caused by dark energy the value of ε_0 will increase and the value of μ_0 will decrease to maintain a constant speed of light, c.

49. The Fine Structure Constant

The fine structure constant, α, is a dimensionless quantity given by the expression,

$$\alpha = \frac{e^2}{4\pi\varepsilon_0 \hbar c} = 0.0072973525693 \quad (15)$$

where

- e is the elementary charge,
- ħ is the reduced Planck constant,
- c is the speed of light,
- ε_0 is the permittivity of free space,

If we assume that the length of a dipole is r and that the distance to the neighbouring dipole is also r then we can multiply the above equation by r/r and split into two fractions to give

$$\alpha = \frac{e^2}{4\pi\varepsilon_0\, r} \cdot \frac{r}{\hbar c} \qquad (16)$$

The first part of the expression is the potential energy of a charge e, a distance r, from another charge e, and has units of Joules or energy. In the case of a dipole in the lattice this expression would be doubled. The second term is the inverse of the rotational kinetic energy of a dipole rotating about its own centre at velocity c, with a radius of r/2, and is also in units of Joules or energy. If we write this second fraction using Planck's constant instead of the reduced Planck's constant, then the kinetic energy E is,

$$E = \frac{hc}{2\pi r} = hf \quad \text{as} \quad \frac{c}{2\pi r} \text{ is the frequency of rotation.} \qquad (17)$$

This is the expression for the energy of a photon which as I stated earlier is just a rotating dipole.

The fine structure constant therefore represents the ratio of the potential energy of a dipole to its rotational kinetic energy. It is also a measure of how rigid the lattice is and with a value of 0.00729 it is therefore not very rigid as it is very easy to rotate the dipoles.

If we multiply the original expression for α x $1\text{x}10^{-7}$ /$1\text{x}10^{-7}$ then we can rewrite the expression to include μ_0,

$$\alpha = \frac{e^2\, x\, 10^{-7}}{4\pi\, x\, 10^{-7}\varepsilon_0\, \hbar c} = \frac{e^2\, x\, 10^{-7}}{\mu_0\varepsilon_0\, \hbar c} = \frac{c^2 e^2\, x\, 10^{-7}}{\hbar c} = \frac{ce^2\, x\, 10^{-7}}{\hbar} \qquad (18)$$

We have already shown that the velocity of light is constant and as the monopoles are not changing then e is also constant. ħ has units of Joule seconds (Js) but equation 17 above shows that as the dipole gets larger the frequency of the rotation will reduce and therefore its energy must decrease. ħ is therefore constant. This is actually a description of Red Shift. All the parameters in the Fine Structure Constant expression are intrinsic properties of the dipole so the ratio of potential energy to kinetic energy of the dipoles remains constant as the lattice expands but they each reduce at the same rate with the energy being dissipated as dark energy.

50. The Standard Model of Particle Physics

The Standard Model of Particle Physics (SM) is paraded as the most successful theory in physics, mainly because of its prediction of

a) Quarks
b) The Anomalous Magnetic Moment of the electron
c) The Higgs Boson

In what follows I will show that none of the three predictions are definitive proof of the validity of the Standard Model of Particle Physics.

Quarks

When Murray Gell-Mann and George Zweig in 1964 independently proposed the quark model with its fractional charges, the physics community was horrified and rightly so. Many years were spent looking for particles with fractional charges but none were found. In the early 70's an experiment was carried out involving high energy annihilation of electrons and positrons. The annihilations produced muon-antimuon pairs and hadrons, i.e. protons and anti-protons. The results are shown below in figure 6.

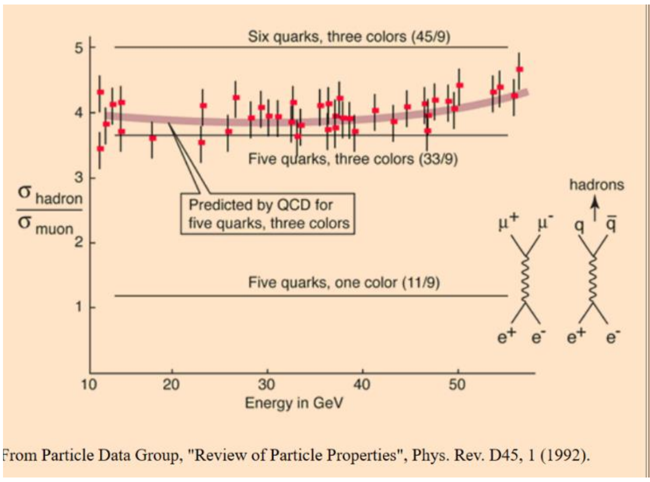


Figure 6

The Physics education website, HyperPhysics[10] explains very simply the quark model approach to explaining the results.

The models which are evoked to explain the experimental results in figure 6 involve the calculated cross-sections for the scattering events. It is helpful that the same type of scattering events, e.g., electron-positron scattering, can yield either two muons (leptons) or a variety of hadron products, any one of which suggests the creation of quarks. The experimental handle is then the relative frequency of the hadron events compared to the muon events. The calculated ratio of the products of the scattering process is the ratio of the cross-sections, and the cross-section σ for each product is proportional to the square of its charge. Therefore the ratio of the products R depends upon the ratio of the squares of the electric charges of the products. The calculated ratio then depends upon the number of types of quark-antiquark pairs which can be produced. So it has the form

$$R = \frac{\sigma_{hadrons}}{\sigma_{muons}} = \frac{\sum \sigma_{qq}}{\sigma_{muons}} = \sum \left(\frac{q_q}{e}\right)\left(\frac{q_q}{e}\right) \qquad (19)$$

If we use the five quarks which would be available in this energy regime, the u, d, s, c and b quarks, then we get

$$R \approx \frac{4}{9}+\frac{1}{9}+\frac{1}{9}+\frac{4}{9}+\frac{1}{9} = \frac{11}{9} = 1.22 \qquad (20)$$

The fractions come from the squares of the fractional charges of the proposed quarks i.e. 2/3 and -1/3. From the results of the experiment R is about 4 at low energies and increases with increasing energy so this predicted result was clearly wrong. To make the model fit the results better they proposed that each quark came in three different colours so now R = 33/9 or 3.66. A whole new property of matter was invented so as to make the original flawed hypothesis of fractional charged quarks fit the data.

In 1961, Ernest Sternglass, while working with Richard Feynman proposed a structure[11] for the Pion which consisted of an electron and a positron orbiting each other at relativistic speeds. He calculated its mass at 134.7MeV which compares well with the measured value of 134.97MeV. His model for the Muon was an electron in orbit around a Pion and that for the anti-muon was a positron in orbit around the Pion. His calculated mass for the muon and anti-muon was 105.8MeV which compared very favourably with the measured mass of 105.65MeV.

When a positron and an electron collide at high energy the shells are destroyed but the two monopoles will be separated by large distances most of the time. Dipoles from the shell will therefore surround the monopoles to form a proton and an antiproton. When a positron and an electron approach each other very closely without colliding then they will form a Pion. Another interaction like this will create a Muon or an Antimuon. As Muons are three body particles and require two separate interactions to form and two hadrons are created from each destructive collision of electrons and positrons, their will naturally be many more hadrons created than Muons. A very simplified analysis of the collision cross section of electrons, positrons and Muons in a beam give an R value of about 3.6 which increases with increasing energy as more of the Muons are destroyed again by the higher energy positrons and electrons. There is therefore no need for coloured quarks with their fractional charges to explain the above results in figure 6.

In the SM the electrons and Muons are elementary particles that are not made of quarks. The SM does not show how particles that are not made of quarks actually produce quarks in a collision which then form the hadrons. If it is just the energy of the electrons and the positrons that is supposed to create the quarks, then it does not explain either how energy actually gets converted into matter which then gains mass. In my model, supported by Sternglass' model, there are no such complications.

The Anomalous Magnetic Moment Of The Electron

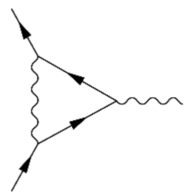
The prediction of the anomalous magnetic moment of the electron to more than 10 significant figures is paraded as one of the most accurately verified predictions in the history of physics.

From Wikipedia[12] , *In quantum electrodynamics, the anomalous magnetic moment of a particle is a contribution of effects of quantum mechanics, expressed by Feynman diagrams with loops, to the magnetic moment of that particle. The magnetic moment, also called magnetic dipole moment, is a measure of the strength of a magnetic source.*

The "Dirac" magnetic moment, corresponding to tree-level Feynman diagrams (which can be thought of as the classical result), can be calculated from the Dirac equation. It is usually expressed in terms of the g-factor; the Dirac equation predicts g=2. For particles such as the electron, this classical result differs from the observed value by a small fraction of a percent. The difference is the anomalous magnetic moment, denoted a_e and defined as

$$a_e = \frac{g-2}{g} \qquad (21)$$

The one-loop contribution to the anomalous magnetic moment—corresponding to the first and largest quantum mechanical correction—of the electron is found by calculating the vertex function shown in the adjacent diagram. The calculation is relatively straightforward and the one-loop result is:



$$a_e = \frac{\alpha}{2\pi} \approx 0.0011614 \qquad (22)$$

Where α is the fine-structure constant. This result was first found by Julian Schwinger in 1948.

Additional corrections have been made to this expression by adding terms which are successively higher in powers of α. To calculate these terms requires analysing many multiples of Feynman diagrams with thousands of calculations per diagram e.g. the α^4 term requires 891 Feynman diagrams with the number exponentially with higher powers.

$$a_e = \frac{\alpha}{2\pi} + c_1\frac{\alpha^2}{2\pi} + c_2\frac{\alpha^3}{2\pi} + c_3\frac{\alpha^4}{2\pi} + \ldots \qquad (23)$$

The quantity a_e is an experimentally measured value which is dependent on the magnetic moment of the electron, which in turn is dependent on the magnetic moment of the dipoles in the electron shell. The fine structure constant, α, is a function of ħ which is the proportionality constant relating the energy of a rotating/oscillating dipole to its rotation frequency. It therefore is also a function of the magnetic moment of the dipole, M_d. The expression in equations 22 and 23 are therefore self-referencing and equating M_d with itself. The above equation at 22 could be written,

$$f(M_d) = g(M_d) \qquad (24)$$

All that is being done in evaluating the terms in equation 23 is confirming that the function f is equal to the function g. When the terms of equation 23 are being evaluated there are many couplings between the particles in the Feynman diagrams that have to be determined. Some come from the SM, some are measured, and some are estimated. There is therefore a huge scope to change the coupling values and goal seek the value of the terms in equation 23 to get them to agree with the latest measurement of a_e. This is not Physics but a pointless exercise in mathematics to reconcile a measured value with itself.

I should point out here that the value of the Muon's and other particle's anomalous magnetic moments do not agree with the measured value as well as the electron anomalous magnetic moment does.

Muon	Predicted	$a_\mu = 0.00116591804$	Measured	$a_\mu = 0.0011659209$
Tau	Predicted	$a_\tau = 0.00117721$	Measured bound	$-0.052 < a_\tau < +0.013$
Neutron	Predicted	$a_p = 0$	Measured	$a_p = -0.9$

The predicted value of 0 for the Neutron shows how little the standard model actually understands about the fundamental nature of particles.

The Higgs Boson

The Higgs Field was first proposed in 1964 to solve another problem with the SM, namely that there was no mechanism to give mass to the particles. The Higgs field has an associated boson called the Higgs boson with a predicted mass of 125.18 GeV. A particle in the range 125-127GeV was eventually found in 2012 and in 2013 it was announced that the Higgs boson had eventually been found and the SM was vindicated.

Earlier I showed how Ernest Sternglass' model for the Muon did away with the need for quarks. His model can also be extended to use protons and antiprotons. In the book, Goodbye Quarks, by Ray Fleming he calculated that a proton in orbit around a negatively charged Pion would have a mass of approximately

123.52Gev. This is very close to that of the Higgs Boson. This maybe all that was discovered. Even if this is not the correct model for the Higgs boson there are a multitude of other orbiting systems that can be imagined just from the four fundamental particles.

51.Time and Direction of Time

In any two lattice cells of different size the maximum frequency of the rotating dipoles will be greater in the smaller cell. The unit of Frequency is Hz or s^{-1} therefore the inverse of frequency is the rate at which time flows so the rate at which time flows at a location or at a point in the future is directly related to the inverse of the maximum frequency of the rotating dipoles at that location. Some of the properties of electrons and other particles are directly related to this frequency so our perception and measurement of time will be related to this frequency also. This can be observed with cosmic rays, which are mostly just protons travelling at relativistic speeds. When they strike the Earth's atmosphere they collide with atoms and generate a lot of relativistic neutrons and muons. The half-life of these muons is greater than muons that are created in labs with non-relativistic speeds. As the cosmic ray neutrons are travelling at high speed, they compress a region of the space lattice in front of them before they travel through it. The maximum rotation frequency of lattice dipoles in this region will increase and therefore the rate of time flow will decrease. The oscillation frequency of dipoles in the muon's electron shell will also change and therefore some of the properties of the muons will change. The muons will therefore experience a slower rate of time compared to slow lab muons and so their half-life will be longer. Before the big bang the dipoles were packed together as tightly as possible, so the rate of time flow was zero or near zero. As the universe expands and the lattice expands with it, the rate of time flow is constantly increasing so the direction of time is from a point where it was stationary towards increasing rate of flow.

52. The Casimir Effect

I started this paper by mentioning the Casimir Effect[1] and so will therefore complete it by explaining it. As I wrote earlier, the Casimir effect is the attraction experienced between two parallel conducting plates placed very close together. Casimir proposed that fluctuations of different wavelengths of the vacuum energy were being excluded from the gap between the plates, thereby reducing the pressure inside the gap and causing the plates to move towards each other. These fluctuations consisted of virtual particle-antiparticle pairs of different wavelengths.

His proposal was correct in some ways but the wavelengths that are being excluded from the space between the plates are of those waves of oscillation in the space lattice that cannot fit integer number of half wavelengths between the plates. As I have shown throughout this paper, waves in the lattice are caused by photons, electrons, protons, planets, stars, and black holes etc so there is a continuum of wavelengths of oscillations in the lattice, which eventually become dark energy. When some of these are excluded from the space between the plates the extra pressure outside pushes the plates together.

53. Suggestions for Further Study

Everything I have written in this paper is derived from my own intuition, logic, and knowledge of physics. I am not a mathematician and therefore do not have the necessary skills to provide rigorous mathematical proofs to back up the concepts put forward here. These simple concepts have been able to explain every phenomenon in physics that I have analysed, and I therefore am extremely confident that any mathematical analysis will confirm the validity of these concepts.

I suspect that a mathematical analysis will be able to identify the length of a dipole and the unit size of a lattice cell in our locality and others and with that knowledge be able to extend General Relativity to cover the full range of scales in the universe. It should also be possible then to compute the magnetic moments of the particles and their masses.

It may be possible for AI systems to analyse images of all the galaxies in the universe and identify which images are actually of the same galaxies and thereby give us a more accurate measure of the actual matter in the universe.

As for the origin of the dipole and its electric charge from which everything else naturally follows I will leave for others to discover.

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