

# A Modern Aether

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## Abstract

A re-appraisal of the classical Aether is appropriate to incorporate some of the more recent concepts and properties of the vacuum and to evaluate how a dynamic, non-static Aether could be adopted as a physical model consistent with all known phenomena in particle physics and astrophysics.

## Introduction

A revised Aether model is proposed which holds up as a pedagogical tool in explaining all known phenomena in particle physics and astrophysics and allows a unified theory eliminating the supposed incompatibility of General Relativity and Quantum Theory.

Einstein wrote in a 1919 letter to Lorentz:

*"It would have been more correct if I had limited myself, in my earlier publications, to emphasizing only the non-existence of an ether velocity, instead of arguing the total non-existence of the ether, for I can see that with the word ether we say nothing else than that space has to be viewed as a carrier of physical qualities."*

Einstein's comments on his Special Relativity Theory:

*"In 1905 I was of the opinion that I was no longer allowed to speak about the ether in physics. This opinion, however, was too radical, as we will see later when we discuss the general theory of relativity..... once again 'empty' space appears as endowed with physical properties, i.e. no longer as physically empty, as seemed to be the case according to special relativity. One can thus say that the ether is resurrected in the general theory of relativity.... Since the new theory, metric facts can no longer be separated from true physical facts the concepts of space and ether have merged together." (Ludwig Kostro: Einstein and the Ether, 2000)*

Einstein's comments on his General Relativity Theory:

*"According to the general theory of relativity space is endowed with physical quantities. In a sense therefore there exists an ether. According to the general theory of relativity space without ether is unthinkable, for in such space there would not only be no propagation of light but also no possibility of existence for standards of space and time measuring-rods and clocks nor therefore any space-time intervals in the physical sense." (Ether and the Theory of Relativity, Leiden, 5.5.1920)*

It is generally accepted that something exists in the vacuum of space. Such as –

1. The Aether of classical science that filled space and acted as the carrier for electromagnetic waves
2. Vacuum Energy comprising pairs of particles that annihilate one another such as a sea of quark/anti-quark pairs
3. Cosmic foam
4. Quantum fields
5. The Higgs Field with its associated Higgs Boson particles
6. Dark Energy and Dark Matter
7. Granular Space-Time
8. Branes

The following proposed Aether model of the vacuum has the advantage of being a simple conceptual model that can help us understand concepts that would otherwise be difficult to comprehend by more conventional but more convoluted theories. It elegantly explains puzzling phenomena and provides a consistent model that holds true in explaining the following –

1. Michelson-Morley experiment
2. Gravitational bending of light
3. Gravitational time dilation
4. Kinematic time dilation
5. Twin paradox
6. Wave/particle duality
7. Young's twin slit anomaly
8. Vacuum energy
9. Inflationary period of universe expansion
10. Dark energy (Accelerating expansion of the universe)
11. Dark matter (Anomaly of rotational speed of stars in a galaxy)
12. Quantum spin
13. Stern-Gerlach Experiment
14. Quantum entanglement (Instantaneous action at a distance through empty space)
15. Electron Orbitals
16. Heisenberg Uncertainty Principle
17. Quantisation
18. Speed of light
19. Warped space-time
20. Frame-dragging (Lense-Thirring Effect)
21. Planck's constant
22. Higgs field
23. Theory of Everything (Unifying General Relativity and Quantum Field Theory)

## 1 Modern Aether Hypotheses

The idea of the classical luminiferous Aether being a static substance throughout space has been discredited primarily due to the Michelson-Morley experiment that failed to detect an Aether wind. However, the vacuum medium that carries the photon's electromagnetic wave could be a dynamic Aether-like substance existing throughout space which is hidden until particles (fermions or bosons) interact with it and give it detectable physical properties. Matter particles could be the means by which the Aether manifests itself in proportion to the surrounding gravitational field strength.

Imagine particles travelling through space, inducing jelly like properties into the surrounding Aether as they pass, with the Aether transforming back to its invisible undetectable form after the atoms have passed. Another analogy would be a very cold ball of ice travelling through water and creating a slushy region around itself.

It is important to note in this paradigm, that the thickened Aether exists and appears to move in the frame of reference of the particles that create it and not in a fixed absolute frame of reference. This helps explain the failure to detect the classical Aether in the Michelson-Morley experiment. The **observable** properties of the Aether do not exist in a static fixed reference frame! The Aether wind could not be detected as the thickened observable properties of the Aether always travel along with the particles that induce the transformation of the Aether, which in the case of the Michelson-Morley experiment would have been the particles constituting the planet Earth and the influences of other objects in our solar system.

This Aether could either be composed of discrete particles or it could be a continuous medium. However it would be reasonable to first assume that it is composed of discrete particles as all other scientific observations conform to the hypothesis of everything being quantised. Assuming this paradigm, a model can be constructed that can be used to help explain and be compatible with all of the experimental observations.

The principles of this Aether model are as follows –

1. Space is filled with a fluid consisting of tiny Aether particles possibly separated by a distance related to the Planck length. (The Planck length currently being the lowest common denominator of any known physical dimension in the Universe)
2. There is a delay related to the Planck time associated with moving between each of these Aether particles.
3. The speed that we travel through this medium is bounded by the number of lossless delays travelling between each particle. This slowing down would apply to everything from the speed of light to the speed of atomic clock vibration frequencies. Note therefore that the speed of light in a vacuum will remain the same when referenced to an atomic clock moving in the same reference frame (and in the same gravitational field) irrespective of the absolute speed through the Aether.
4. The Aether is not like a static frame in space but like a soup whose properties only become apparent in the presence and influence of fermions or bosons.
5. Aether particles are created dynamically from this soup with a particle density proportional to the gravitational field produced by nearby particles having mass. It would be these Aether particles that interact with all other particles. The density of these Aether particles would determine the velocity that other particles can travel through space. It would be the quantity of interactions with the Aether particles that would determine the delays and hence their velocity. If it is considered that it takes a fixed time to travel from one Aether particle to the next, then the more Aether particles per unit distance, then the longer it would take to travel a specified distance.
6. Aether particles could have mass-like properties of their own induced by the surrounding gravitational field.

Particles with mass would thus induce a gravitational field in the surrounding Aether. This property of the Aether has more recently been likened to the Higgs field. This gravitational field would cause Aether particles (with Higgs Boson like properties) to be formed in proportion to the gravitational field density. i.e. the Aether would be denser near more massive bodies.

*(Note: The gravitational field and gravitons could be likened to the Aether field and Aether particles)*

Particles with no mass like photons and gluons interact with each of these Aether particles and are delayed in their travel by each Aether particle. It is almost as if each photon had to travel around each Aether particle, causing the photon to take a longer route through space and effectively travelling more slowly from A to B. Or it could be an Aether field surrounding each Aether particle that causes drag on the photon. It follows therefore that the higher the density of Aether particles, then the more slowly light travels. (See Section 2.18 for the evidence of how the vacuum speed of light can vary.)

This is in agreement with observations of light near massive bodies where the light travels more slowly. Taken to the extreme, near a black hole, light comes to a standstill.

It also explains the bending of light near massive bodies where the Aether particles are denser. This is similar to light bending as it moves from air into more dense mediums such as glass.

Note that the interaction with Aether particles would necessarily be frictionless. In the extreme case of a photon with zero mass, it would travel at the speed of light at the background Aether particle density of space.

If you think about it, why is the speed of light constrained from travelling infinitely fast? Why is it 299,792,458 m/s and not 299,792,450 m/s? Something must be constraining it – the Aether! It is the permittivity and permeability properties of the Aether that determine the viscosity and determine the speed of light waves and particles.

The speed of light in a vacuum  $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$

where  $\mu_0$  = permeability in a vacuum in free space =  $1.25663706212(19) \times 10^{-6}$  H/m

and  $\epsilon_0$  = permittivity in a vacuum in free space =  $8.8541878128(13) \times 10^{-12}$  F/m

The impedance of free space  $Z_0 = \sqrt{\frac{\mu_0}{\epsilon_0}} = |E|/|H| = 376.730313668(57) \Omega$

where  $|E|$  is the electric field strength and  $|H|$  is the magnetic field strength.

i.e. the permeability and permittivity of the vacuum are what impede the speed of light.

The Aether particles could have a mass of their own induced by the gravitational field of nearby matter. This would account for the dark matter in the universe which would be proportional to Aether density. This would explain the dark matter in galaxies which is in proportion to the mass of the galaxy and explains why stars on the edge of galaxies do not fly off into space despite their high speed.

This Aether paradigm is also helpful in explaining wave/particle duality, special relativity, general relativity and many more theories in physical terms. Consider the following for example –

The puzzling concept that light is either a particle or a wave is easily explained if it is assumed that the photon is the particle and the wave is the effect this photon has on the Aether it is travelling through.

Einstein's Special Theory of Relativity was based on Lorentz's discovery of time dilation and length contraction while travelling closer to the speed of light. This offers no physical explanation. However this could be simply explained by, and would be in agreement with, an Aether that slows down travel by having to interact with more Aether particles per unit time. This would be similar to a car experiencing more drag the faster it moves due to the air it is travelling through. Therefore time would slow down due to this drag as everything including atomic clock frequencies used to measure time would slow down.

In Einstein's General Theory of Relativity, the concept of space-time being warped near a massive body can be more simply explained by the speed of light being slower in the more dense Aether surrounding a massive body. This has the effect of slowing down time and so taking longer to travel a given distance. **Therefore only time is actually warped.** Space remains physically the same. It only appears to have changed size! Space-time is just a mental construct. It does not necessarily mean that curved space-time is the cause of the apparent force of gravity; it only means that it describes it geometrically and enables us to make calculations and predictions that align with other observations.

*(Note: Time is not a dimension. Just because it can be measured does not make it a dimension. Just the same as heat is not a dimension just because it can be measured.)*

Time and space are just like scenes on a roll of film as everything is predetermined by the laws of physics, chemistry and biology. A mind bending thought is the fact that a photon, born near the start of the universe will reach the end of the universe in zero time from its perspective. i.e. time is stationary when observed from the photons reference frame. This is according to Einstein's special relativity theory, where the faster that something travels relative to our reference frame then the slower time passes for that object. It will age more slowly relative to us. When the speed of light is reached by an object then time would appear to stand still for it when observed from our reference frame. It follows therefore that time would appear to stand still for a photon which is travelling at the speed of light in a vacuum viewed from our reference frame.

## 2 Evidential Analysis

The following is a list of the evidence compatible with the existence of a dynamic Aether.

### 2.1 Michelson-Morley experiment

The Michelson-Morley experiment attempted to detect the presence of the Aether by setting up an experiment that fired a beam of light which was split into two mutually perpendicular paths before being reflected back and recombined. It was anticipated that any drag produced by the Aether as the apparatus moved through space would cause a difference in the time taken by the light travelling parallel and perpendicular to the earth's movement causing an interference pattern due to the phase difference in the two light beams. The apparatus was arranged so that it could be rotated horizontally which should have produced a varying interference pattern as it was rotated in the Aether wind. However no varying phase difference was observed with the resulting conclusion that there was no evidence of an Aether wind.

However, Lorentz showed that moving objects are subject to length contraction (and time dilation) by

a factor  $\sqrt{1 - \frac{v^2}{c^2}}$

$$\text{i.e. } L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$$

where  $L$  is the contracted length,  $L_0$  is the stationary length,  $v$  is the speed of the object and  $c$  is the speed of light. (Note: As  $v$  approaches the speed of light, the length approaches 0)

This Lorentz contraction cancels out exactly any expected differences in the transverse and longitudinal paths of the light beams. Lorentz used this to explain why the Michelson-Morley experiment did not find an Aether wind. Einstein then used the Lorentz contraction formula as part of his special relativity theory. Einstein did not rule out the existence of Aether but just said it was not necessary to explain his special relativity theory.

Even if this explanation was invalid, the Aether wind could never have been detected as the observable detectable properties of the Aether do not exist in a fixed reference frame! The thickened observable properties of the Aether always travel along with matter particles. The Earth would create its own Aether wind travelling along with it as would our solar system, the galaxies and the expanding universe.

### 2.2 Gravitational Bending of Light

Gravity increasing the density of the Aether is the alternative to Einstein's theory of General Relativity which expounded the idea that space is compressed near massive bodies. If space is composed of Aether then the Aether is similarly compressed.

This explains why light can be observed to bend towards large stellar masses. It is being bent by the denser Aether. It is actually being refracted in the same way as light travelling through air and meeting denser glass would be refracted towards the denser medium. Note however that there are no absorption frequency peaks in the Aether particles like there are in the atoms of materials like glass or diamond. Therefore there is no diffusion of the light spectrum due to variations in the refraction angle associated with the different frequencies of light.

The refractive index of light  $n = \sqrt{\mu\epsilon}$  where  $\mu$  is the permeability and  $\epsilon$  is the permittivity

We saw earlier that the speed of light  $c = \frac{1}{\sqrt{\mu\epsilon}}$

i.e.  $c = 1/n$

Therefore  $\frac{n_g}{n_0} = \frac{c_0}{c_g}$

Where  $n_g$  and  $n_0$  are the refractive indices in a gravitational field and in free space respectively and where  $c_g$  and  $c_0$  represent the speed of light in a gravitational field and in free space respectively.

Therefore the refractive index in gravity  $n_g = \frac{n_0 c_0}{c_g} = \frac{c_0}{c_g}$

As the speed of light is less in a higher gravity frame (see section 2.18) then the refractive index in the gravitational field is greater than 1 and explains the bending of light as it moves into a gravitational field.

### 2.3 Gravitational Time Dilation

The Gravitational Time Dilation formula is –

$$T = \frac{T_0}{\sqrt{1 - \frac{2GM}{Rc^2}}}$$

Where:

$T$  = Time measured inside the gravitational field.

$T_0$  = Time measured outside the gravitational field.

$M$  = The mass causing the gravitational field.

$R$  = The distance from the centre of the gravitational field.

$c$  = The speed of light in a vacuum.

$G$  = The gravitational constant  $6.6742 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$

On the Earth's surface  $g = \frac{GM_E}{(R_E)^2}$

Where  $M_E$  = Earth's mass and  $R_E$  = Earth's radius

i.e.  $\frac{GM_E}{R_E} = gR_E$

$\therefore T = \frac{T_E}{\sqrt{1 - \frac{2gR_E}{c^2}}}$

For small changes in gravitational field associated with changes in altitude above the earth, the approximate time dilation expression when expanded in a binomial expansion is –

$$T \approx T_E \left( 1 + \frac{gR_E}{c^2} \right) \text{ or } T - T_E \approx \frac{gR_E}{c^2} T_E$$

Where  $T_E$  is the time measured at the Earth's surface.

i.e. clocks run slower in higher gravity. (We age slower in higher gravity)

This can be explained by the Aether being denser in a higher gravitational field causing everything to run slower including time as measured by clocks.

Electrons will travel more slowly in their orbitals. All atoms and particles move slower, therefore clocks run slower (including the Caesium reference standard for time measurement) and chemical processes run slower, thus slowing aging. Blood will move more slowly round our bodies; nerve signals to and from our brain will be slower and neural signal transmissions will be slowed so that our brains will perceive time as passing at the same speed.

## 2.4 Kinematic Time Dilation

The Kinematic Time Dilation formula is –

$$T = \frac{T_0}{\sqrt{1 - \frac{v^2}{c^2}}} \text{ where } T_0 \text{ is the 'proper time', the time measured in the rest frame of the event.}$$

When this is expanded in a binomial expansion, then for small velocities it becomes

$$T \approx T_0 \left( 1 + \frac{v^2}{2c^2} \right)$$

i.e. clocks run slower (we also age slower) when moving faster as the apparent Aether density is effectively increased. This is similar to the effect of diving into water at 100 mph compared to 5 mph. The water is effectively a lot harder at the higher speed (i.e. the water appears more dense at higher speed). It could also be likened to the effect that air has in slowing down a car when driven fast but the minimal effect it has when driving slowly. The air appears denser when driving faster.

This is why someone leaving the Earth in a spaceship and travelling fast into space would find when they returned to Earth that they had aged less than someone who had remained behind on Earth.

Another example of this was verified by various experiments such as the Hafele-Keating experiment where a plane carrying Caesium clocks was flown eastwards and westwards and the clocks compared with a clock on the ground. It was found that the clock flying eastwards (with the additional speed of the Earth rotating eastwards) was slower than the clock on the ground which in turn was slower than the clock flying westwards.

*Note: In the relativity description of this effect it is considered necessary to measure the time differences from an observer in an inertial (non-accelerating) reference frame which in the case of the Earth would be a point at the centre of the Earth rather than at a point on the surface of the Earth which is rotating in space. In this case the clock on the ground would be moving eastward relative to the centre of the Earth and its velocity would be less than the clock on the plane flying eastward. Conversely the clock on the ground would be moving eastward relative to the centre of the Earth and its velocity would be greater than the clock on the plane flying westward and so the time dilation would be explained solely by the clock velocities.*

A similar effect occurs due to rotational frame-dragging (the Lense–Thirring effect) which appears in the general principle of relativity and similar theories in the vicinity of rotating massive objects. Relativity theory describes massive rotating bodies distorting and dragging space-time similar to spinning an object in water causing the water to whirl around it. This is consistent with the idea of there being an Aether which acts like a liquid being dragged around by the rotating mass. Again, clocks would run slower (we would also age slower) when moving against the flow of the Aether being dragged by the rotating mass as the apparent Aether density is effectively increased travelling through more Aether particles per unit time. The frame-dragging (Lense-Thirring effect) is described more fully in section 2.20.

## **2.5 Twin Paradox**

The increased interaction with Aether particles when travelling faster also explains the twin paradox. According to Einstein's relativity theory it would predict that someone travelling faster than someone else would see the other person's clock running faster. However according to this relativity theory the stationary person should also see the fast moving person's clock running faster as the stationary person is effectively moving away fast relative to the moving person. However, this is not the case. What happens is that the faster moving person actually ages less and his clock actually runs slower than the stationary person. If you accept that Aether particles fill space then this can be explained by the fact that the stationary person is moving at a certain speed through the surrounding Aether particle density, however the moving person is travelling faster through the surrounding Aether particles and experiences more interactions with them, thus slowing down time for the moving person.

## **2.6 Wave/Particle Duality**

From Einstein's special relativity theory, the faster that something travels relative to our reference frame then the slower that time will pass for that object. It will appear to age more slowly relative to us. When the speed of light is reached by an object then time would appear to stand still for it when observed from our reference frame. It follows therefore that time would appear to stand still for a photon which is travelling at the speed of light in a vacuum viewed from our reference frame.

Therefore the photon itself must be unchanging electromagnetically as time will stand still for the photon when observed from our reference frame. The logical conclusion is that the time varying electromagnetic field cannot be a property of the photon but must instead be a property of the space surrounding the photon. Therefore the wave nature of light is not in the photon but is in the space surrounding it.

The specific frequency associated with a photon must be induced into the Aether by the photon. As time stands still for the photon itself, it must therefore mean that somehow the photon's fixed shape as it travels is responsible for the associated frequency induced in the Aether, perhaps producing a ripple in the Aether as it rotates in its travel.

Why is it that an electromagnetic wave is only generated when an electron accelerates and not when moving at constant velocity?

Why is it that electrons moving back and forth in a radio transmitter aerial produce an electromagnetic wave but electrons moving in a constant direction in a coil of wire do not?

If you imagine an oar propelling a rower as it pushes through the water it can be seen that a wave is produced at the end of the stroke when the oar stops moving rather than while it is moving at a constant speed through the water. The wave detaches from the oar at the end of the stroke. This is similar to what happens when the electron in the aerial transmitter stops moving and the electromagnetic wave detaches and travels through the air. The electron and its field set the Aether in motion and launch a rippling wave that propagates through space as an electromagnetic wave.

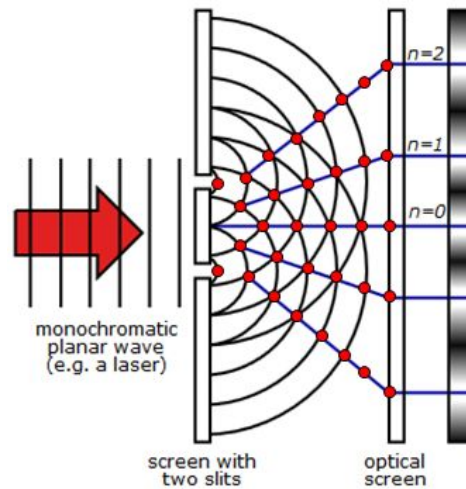
The photon is like an energy pressure pulse in the Aether. This pulse is what is described as the particle. The electromagnetic wave is the effect of this pressure pulse on the surrounding Aether. Light can therefore be considered as both a particle and a wave at the same time. The photon is the particle and the wave is the effect this photon has on the Aether it is travelling through.

This provides a simple explanation for the wave/particle duality. The wave nature is a property of the Aether and the particle nature is a property of the photon.



## 2.7 Young's (De Broglie's) Twin Slit Anomaly

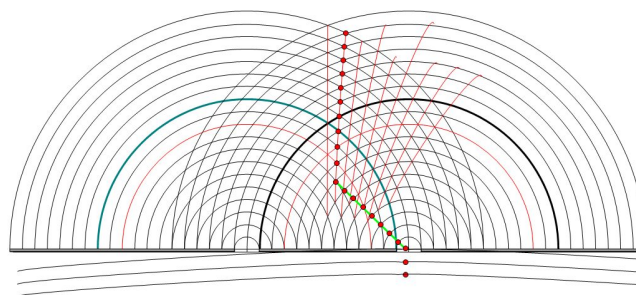
If we look at Young's twin slit experiment, an interference pattern of bright and dark lines appears on a target screen when light is shone through twin slits. This suggests that light is behaving like a wave causing destructive and constructive interference after passing through both slits. However, sending individual photons through the slits results in a build up of particles hitting the target at positions that create the same bright and dark line pattern.



As seen in the previous section on Wave/Particle Duality, the photon is the particle and the wave is induced in the Aether surrounding the particle. This suggests the pilot wave interpretation of the Young's twin slit experiment where the time invariant photon is guided by the wave created in the space surrounding the photon as it travels through the medium of the vacuum.

In the De Broglie–Bohm theory (Pilot Wave theory), the wave function travels through both slits, but each particle has a well-defined trajectory and passes through exactly one of the slits. The final position of the particle on the detector screen and the slit through which the particle passes is determined by the initial position of the particle. The initial position is not controllable by the experimenter, so there is an appearance of randomness in the pattern of detection. The wave function interferes with itself and guides the particles in such a way that the particles avoid the regions in which the interference is destructive and are attracted to the regions in which the interference is constructive, giving rise to the interference pattern on the detector screen.

Particles moving through the Aether create ripples which form an interference pattern of moving peaks and troughs after passing through both slits. These moving peaks and troughs cause the particles to be restricted to certain paths where the waves from the two slits cancel or reinforce. The particles are pushed along in the peaks of the interfering waves (as shown in the diagram below) forming the well known pattern on the target. This is analogous to a beach ball being driven along by interfering waves going through a sea wall.



It is therefore not necessary to consider a quantum mechanical paradigm as the explanation for this experiment when it can be described by this classical mechanical model. There is no need for an unlikely quantum theory explanation that the photon exists in multiple places at once and only resolves to a single point based on a probability wave when it hits the target screen!

## 2.8 Vacuum Energy

Free space is considered to be filled with vacuum energy. This is simply a manifestation of the Aether by another name. The Aether exists throughout space but its effect only becomes apparent in the presence of matter/light. Similarly vacuum energy is considered as an underlying background energy that exists in space even when devoid of matter (known as free space).

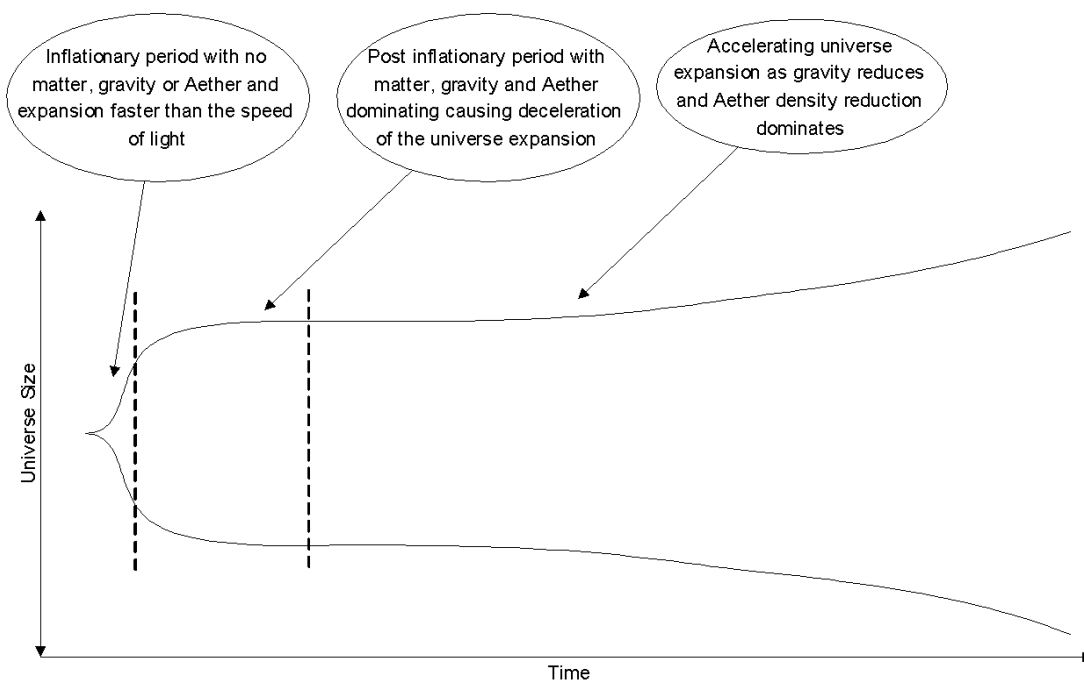
The vacuum energy is deduced from the concept of virtual particles, which are themselves derived from the energy-time uncertainty principle. These virtual particles are conceptually the same as Aether particles. Its effects can be observed in various phenomena such as spontaneous emission, the Casimir effect, the van der Waals bonds, or the Lamb shift, and it is thought to have consequences for the behaviour of the Universe on cosmological scales. The energy of a cubic centimetre of empty space has been calculated to be one trillionth of an erg based on the upper limit of the cosmological constant.

## 2.9 Inflationary Period of Universe Expansion

At the initial singularity and during the inflationary period, the universe was so dense and compact that only boson-like energy particles that can occupy the same space could exist. Fermions such as protons, neutrons and electrons could not exist and so matter and thus gravity did not exist. If gravity did not exist then under the proposed theory then the Aether density would have been zero. Therefore if it is considered that the Aether limits the speed at which anything can travel, then during the inflationary period the universe could expand faster than the speed of light.

Even if some Aether existed during this inflationary period then as the Aether particles became further apart as the universe expanded then this would have allowed expansion faster than the speed of light as the Aether itself can expand faster than the speed of light.

After this initial expansion faster than the speed of light then the gravitational forces due to the appearance of matter would start to have a dominating effect causing the expansion to decelerate. Eventually the continuing expansion would have caused the gravitational fields and thus the Aether density to reduce to such an extent that particles could move faster through the Aether resulting in the universe expansion to start accelerating again. (See below)



## **2.10 Dark Energy (Accelerating Expansion of Universe)**

It has been assumed that the universe's accelerating expansion is due to some mysterious undiscovered repulsive force such as dark energy. However it is perhaps more plausible that the drag on the universe's expansion is reducing as the vacuum of space thins out, resulting in an acceleration of particles travelling through it. This drag in the vacuum of space could be due to the quark/anti-quark pair vacuum energy or the Higgs field or the Aether or whatever is considered to constitute the vacuum of space.

As the universe expands, the Aether would become less dense allowing matter/light to travel even faster. Doubling the diameter of the universe doubles the Aether particle spacing which halves the Aether drag and therefore doubles the expansion speed of the universe. So, if the universe doubled once in diameter then the speed of expansion would be twice as fast. If it doubled in size again then it would be 4 times faster in total etc. etc. i.e. an accelerating expansion.

Consider a universe of dimension  $r$ , with Aether drag factor  $d$  and a universe gravitational attraction factor  $g$ .

Aether density is inversely proportional to  $r$  and therefore the Aether drag is also inversely proportional to  $r$ .

Gravitational attraction is inversely proportional to the distance squared ( $1/r^2$ ).

Therefore the resultant drag would be  $d/r + g/r^2$ .

When  $r$  is very large then  $g/r^2$  tends to zero and the resultant drag approximates to  $d/r$ .

The expansion speed is inversely proportional to drag and therefore approximately proportional to its size  $r$  which is in accordance with the measured expansion of the universe where galaxies are receding at a velocity = Hubble's Constant x distance. i.e.  $v = Hd$ .

This is a much simpler explanation for the accelerating expansion of the universe. It is therefore not necessary to have a mysterious repulsive force (dark energy) to cause this effect. Dark energy does not exist!

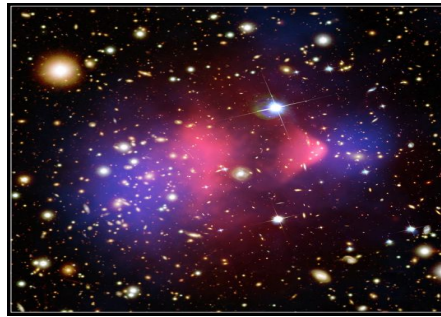
## **2.11 Dark Matter**

It has been observed that stars rotate faster around galaxies than calculations would predict. A hidden gravitational force must therefore be present to prevent the stars flying off into space. Dark matter was conceived as an explanation for the hidden mass which must be present in a galaxy to provide this extra gravitational attraction.

The extra gravitational force could however be attributed to the effects of the Aether. The Aether can be considered to be like a fluid whose density (and perhaps mass-like property) is proportional to the strength of the gravitational field and is therefore denser around massive bodies. Therefore the Aether is denser in galaxies and could account for the hidden mass which allows the stars to rotate faster around the galaxies than calculations would predict, and prevents them flying off into space.

In the case of the colliding galaxies in the Bullet Cluster (see below after the galaxies have collided and passed through one another) the normal baryonic matter (shown in pink) trails the matter measured by gravitational lensing which is essentially dark matter (depicted in blue). During the collision the normal baryonic matter was slowed down by the collision whereas the dark matter continued on ahead. This could be attributed to the surrounding dense Aether which is being dragged along by the galaxies, flowing on after the collision of the baryonic matter, much like two boats colliding and their waves flowing on past each other.

### Bullet Cluster after Colliding



The contradictory example of the Abell 520 galaxy cluster collision (see below) where the normal baryonic matter (in pink) appears to have left the dark matter (in blue) behind is hard for scientists to explain however this cluster may not have been a head-on collision of the three galaxies and perhaps was a glancing collision with the galaxies accelerating together leaving their Aethereal dark matter behind in the centre as they swirled around each other before flying apart.

### Abell 520 Cluster after Colliding



## **2.12 Quantum Spin**

It is suggested that particle spin is not a physical spin as an electron for example is a point particle with no volume and therefore cannot have an actual angular momentum, only an intrinsic angular momentum. If the electron was considered to be a ball shaped charge then its angular velocity would have to exceed the speed of light to achieve the magnetic dipole moment.

However everything points to the electron actually having a physical spin as evidenced by the electron's magnetic dipole moment.

One possibility would be if the electron was ball shaped and excluded any Aether then as we have seen before it could spin faster than the speed of light as the speed of light is only limited by the speed that particles can move through the Aether. As the electron is not travelling through the Aether then it could spin faster than the speed of light!

Alternatively, the spin could be a product of a larger electromagnetic vortex in the Aether surrounding the spinning electron.

The reason that positive and negative spin electrons pair in each orbital can be explained by the fact that if two electrons had positive spin then their north poles and south poles would repel each other. This would force them to take up opposite orientations. This would also prevent more than 2 electrons occupying the same orbital.

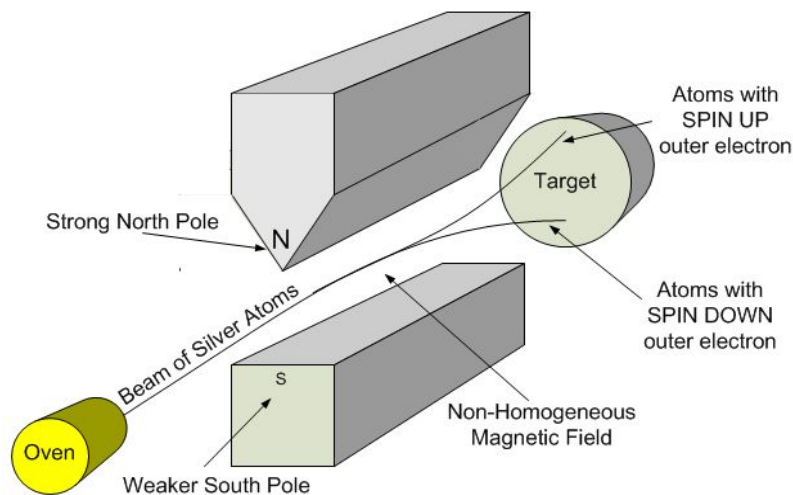
## **2.13 Stern-Gerlach Experiment**

The Stern-Gerlach experiment appeared to show that electron spin was a quantum property of electrons and that the spatial orientation of angular momentum is quantized.

The experiment sent silver atoms through a non-uniform magnetic field, which deflected them before they struck a detector screen. A non-uniform magnetic field with a stronger north pole was necessary to prevent the electron's magnetic dipole being equally attracted to the north and south pole. The silver atoms were used because these atoms have a single unpaired outer electron with zero average orbital angular momentum as it is in a spherical S orbital where the electron orbit has no preferred orientation. All the other electrons are paired which neutralises their spin-up and spin-down magnetic moments. The 46 inner electrons also shield the magnetic moments of the 47 protons in the nucleus.

It was expected that the magnetic dipole produced by the outer electron spin would be randomly oriented and would therefore create a spread of electrons randomly deflected over an area of the detector screen. However it turned out that the electrons were deflected in 2 defined bands, one above and one below the initial trajectory. It was deduced therefore that the electron spin was a quantum property of the electron; half having negative spin and half having positive spin and was not due to the electron physically spinning.

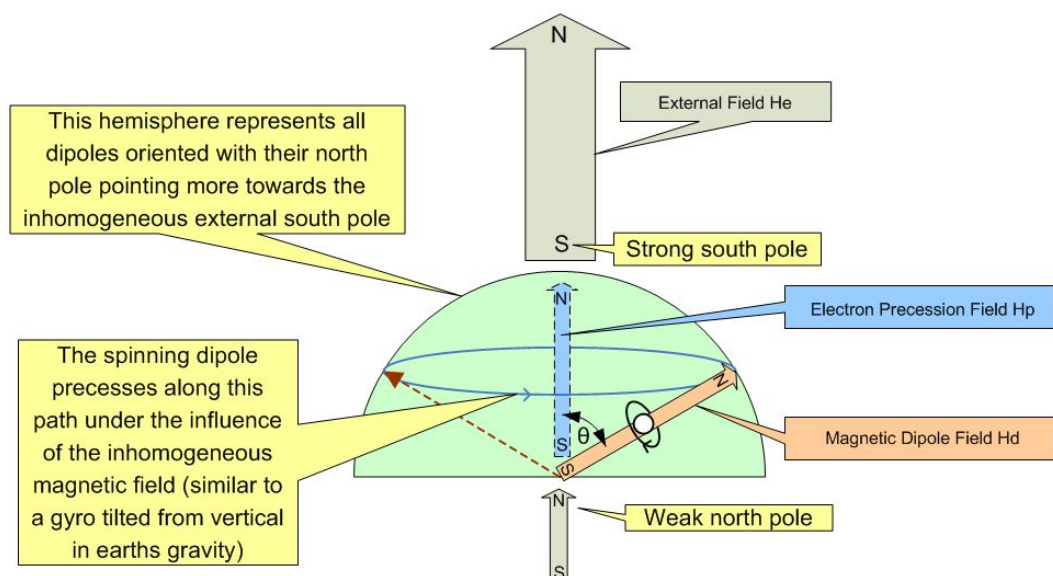
### Stern-Gerlach Experiment



However if the electron was actually physically spinning then the result of the Stern-Gerlach experiment could be explained as follows -

A spinning electron would generate a magnetic dipole with a magnetic field  $H_d$ . The magnetic dipole would experience precession in the non-homogeneous magnetic field as shown in the diagram below. This precessing of the magnetic dipole would itself generate a magnetic field  $H_p$ .

### Precessing Electron Dipoles in a Non-homogeneous Magnetic Field





The **precession** field  $H_p = H_d * \sin(\theta)$

(Where  $\theta$  = the angle between the **external** field  $H_e$  and the **dipole** field  $H_d$ )

Deflection force due to the precession field =  $F_p = H_e * H_p$

Therefore –

Deflection force due to the precession field =  $F_p = H_e * H_d * \sin(\theta)$

The deflection force due to the dipole field =  $F_d = H_e * H_d * \cos(\theta)$

Therefore the total deflection force  $F_t = F_d + F_p$

i.e.  $F_t = H_e * H_d * \cos(\theta) + H_e * H_d * \sin(\theta)$

i.e.  $F_t = H_e * H_d * [\cos(\theta) + \sin(\theta)]$

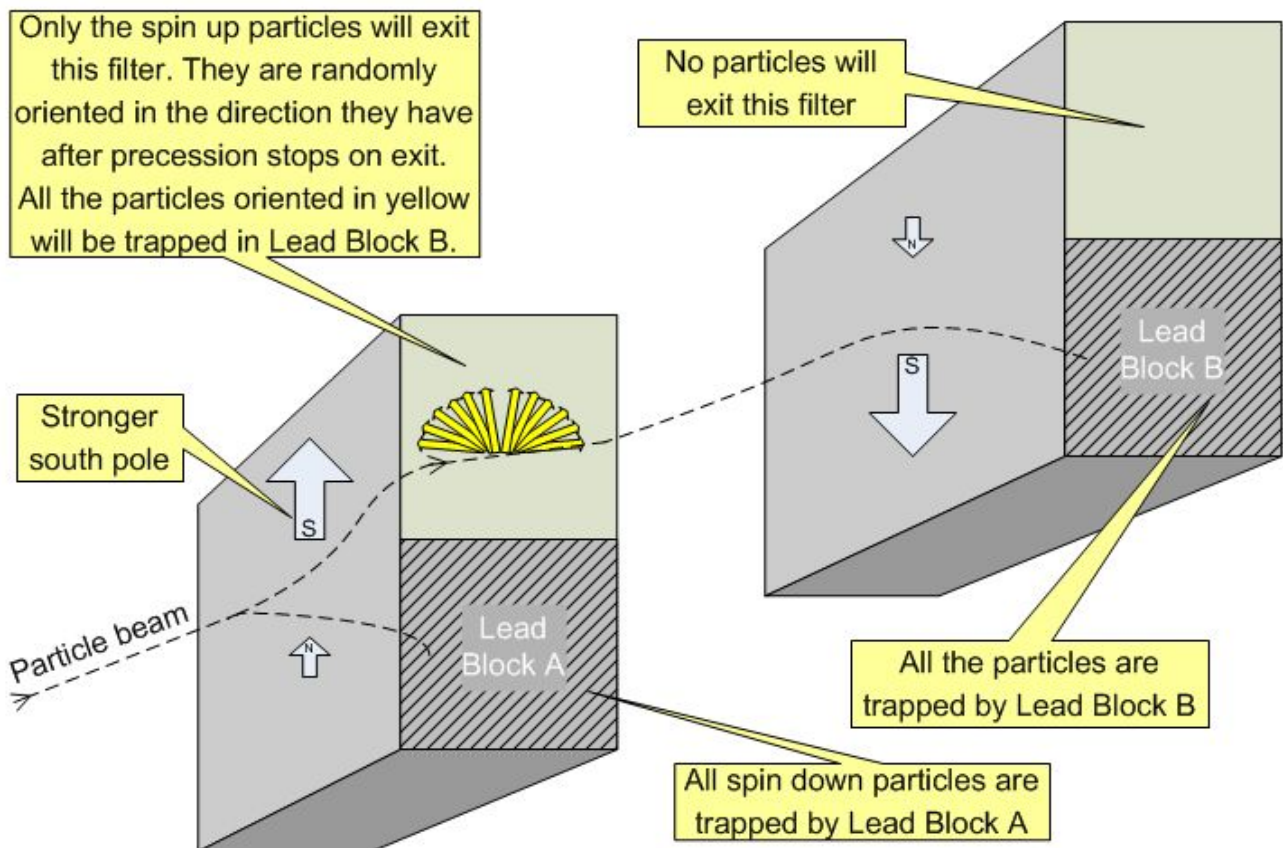
i.e.  $F_t = H_e * H_d$

**Therefore the deflection force for any angle of dipole is constant!**

This means that the particles will deflect by a fixed amount upwards and downwards in the Stern-Gerlach experiment and can be as the result of a physical spinning of the electron.

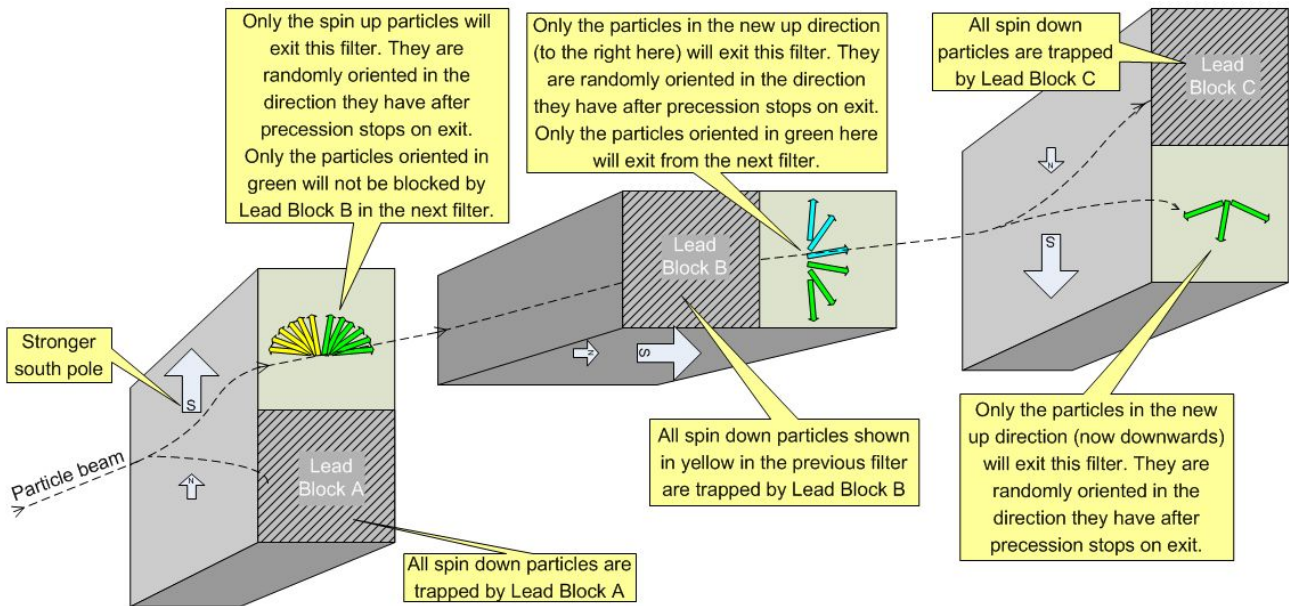
It was also found that by blocking the spin down particles by trapping them in a lead block and only allowing the spin up electrons to pass through the filter apparatus that the spin up electrons would then be blocked completely when passed through a similar apparatus which was inverted relative to the first as shown below. This can be explained as follows –

### Spin Up Particles Blocked Completely By Inverted Magnetic Field



However when a third filter apparatus is placed at 90 degrees between the two apparatus that were inverted relative to one another, then a quarter of the atoms exiting the first apparatus will exit the final apparatus -

### Spin Up Particles Unblocked By Having An Intermediate 90 Degree Field



This can be explained by the fact that the atoms depicted in green pointing in the up direction on entering the intermediate apparatus will precess in various directions pointing to the right when exiting the intermediate apparatus. When these atoms leave the intermediate apparatus they will retain their final precessional orientation in hemispherical directions pointing to the right as shown in green and blue. The atoms that are then pointing downwards when entering the final apparatus will then be deflected downwards allowing them to exit this final apparatus. They will all then be oriented in a downward hemispherical direction.

It would seem therefore that electron spin is compatible with a true physical spinning of the electron!

## **2.14 Quantum Entanglement**

The existence of the Aether explains how entangled particles of opposite spin separated by a distance are in fact still connected via the Aether and can instantly have an effect on each other. It is not a hard concept to understand that particles can be connected across large distances in space by the Aether as we readily accept that gravitational and magnetic fields extend for very large distances through space.

To understand how an entangled particle can instantly affect the other, faster than the speed of light would allow, one has to understand that nothing needs to actually move through space from one entangled particle to the other for this to occur. What could happen in fact is that the entangled particles could still be connected via the field lines stretching through space connected by the Aether particles and therefore nothing has to move through the Aether.

Imagine a rod connecting the entangled particles. If you move one entangled particle the other instantly moves also as they are connected by the rod, they are not dependent on the domino like movement from Aether particle to Aether particle which is limited to the speed of light. The rod joining the entangled particles could for example be the magnetic field lines joining the magnetic dipoles produced by each of the particle spins. If one particle has its north pole pointing in the up direction then the other particle would be aligned to have its north pole pointing in the down direction. If one of the particles changes its spin direction then the other could immediately turn to align in the opposite direction to its entangled partner. This does not involve any movement through space from one entangled particle to the other. If space consisted of Aether particles then the magnetic field

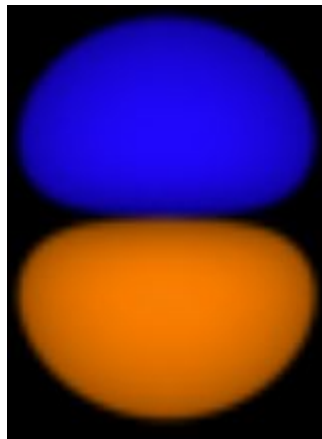
joining the entangled particles would simply rotate on the axis joining the two particles without any need for anything to be affected by the speed of light delays due to movement through the Aether particles.

When we observe one of the entangled particles spin direction, this immediately causes the particles to become disentangled and the magnetic link between the two particles to be broken resulting in the other particle having the opposite spin direction existing at the time the link is broken. This fact eliminates the supposed incompatibility between Quantum Mechanics and Special Relativity. Nothing has to travel faster than the speed of light!

## **2.15 Electron Orbitals**

It is suggested that Bohr's planetary model of electrons circulating in orbits around the nucleus would not be possible as the electrons would experience acceleration due to the angular change of direction which would normally cause photons to be emitted and thus would cause the electrons to lose energy and fall into the centre of the atom. However it is possible that electrons orbiting within an atom build up nodal vibrations in the surrounding Aether. These are the s, p, d, f electron orbitals (not to be confused with electron orbits) which have an Aether probability density distribution defined by the wave function as expressed in the Schrödinger wave equation. These vibrating nodes create the orbital shapes in a similar manner to those seen on a metal plate driven by a sinusoidal source from a loudspeaker creating standing waves, except in 3D.

### **2p Orbital**



The electron's path could therefore be guided by this Aether wave function probability distribution and could also restrain the photons thus preventing their emission.

Another possible reason for the photons not being emitted could be due to the bending of the photon's path in the fields of the nucleus so that it does not have the ability to depart from the electron path.

## **2.16 Heisenberg Uncertainty Principle**

The electron's orbital speed would be determined by the Aether it is travelling through and would create standing waves in the Aether surrounding the nucleus. The orbital's density probability distribution creates the uncertainty in predicting the position of the electron and its momentum at any one time. The electrons within an atom are moving so fast that they are effectively everywhere within their atomic orbital at once which helps explain the Heisenberg uncertainty principle. The probability of finding an electron at any point in the atom would therefore be determined by the Aether wave density distribution.



## 2.17 Quantisation

If the Aether particles within the atom were spaced by the Planck length then the orbiting electrons would create standing waves having discrete energy levels based on multiples of Planck's constant and would thus explain quantisation. The standing waves would intrinsically be limited to multiples of a wave length. Electrons move in paths around the nucleus of an atom creating standing waves in the Aether that can only exist in discrete energy levels; distances from the nucleus; wavelengths; and frequencies. The electron quantisation levels that exist are created by those electron paths that allow non-destructive interference from the inward and outward waves created by the electrons moving through the Aether surrounding the nucleus.

## 2.18 Speed of Light

Light travels more slowly in more dense mediums. For example, light travels slower in glass when compared to the less dense medium of air. This is due to the light taking more time as it travels through the denser medium as the photon's wave front has to pass through and interact with the electromagnetic fields of more atoms thus increasing its propagation delay and in turn slowing the propagation of the photon itself.

We know that light travelling through glass will regain the speed on leaving the glass that it had on entering the glass. Therefore no energy has been lost in travelling through the glass if no glass atoms have emitted photons as a result of being excited by the light.

If the vacuum of free space was considered to consist of an Aethereal medium rather than nothing, then the perceived speed of light would similarly depend on the density of this Aether. The movement of photons through space would be restricted by the Aether particles in the same way. The more dense the Aether, the slower the photon could travel.

Einstein derived the following relationship for the variable speed of light in a non-inertial (i.e. accelerating) gravitational field –

$$c_r = c_0 + 2\phi/c_0$$
$$c_t = c_0 + \phi/c_0$$

$c_r$  is the radial speed of light with respect to the gravitational field.

$c_t$  is the tangential speed of light with respect to the gravitational field.

$c_0$  is the speed of light with no gravitational field.

$\phi$  is the gravitational potential relative to the point where the speed of light  $c_0$  is measured.

(e.g.  $\phi = -m/r$  at a distance  $r$  from a planet of mass  $m$ )

i.e. The relative speed of light is slower in stronger gravitational fields.

The absolute speed of light would therefore be slower in the more dense Aether surrounding a star for example produced by its gravitational field compressing the Aether. Time would also pass more slowly in this compressed Aether as even the electrons in an atom and Caesium clocks would move more slowly and so the locally measured speed of light, although slower, would still be measured as the same constant value. Speed equals distance over time and so, although the light has slowed down in the compressed Aether, the measurement of time has also slowed down locally by the same amount and so we end up with the same resultant local measurement for the speed of light.

Therefore for a local observer, the speed of light would remain the same. This is in agreement with current scientific understanding. For an observer distant from a black hole for example, light appears to go slower and slower as it approaches a black hole until the speed of light is zero at the boundary between the inside and outside of a black hole. It would similarly follow that as space is getting less

and less dense as the universe expands, then the speed of light is actually increasing although it still measures the same with reference to our clocks.

It is a common misconception that the speed of light in a vacuum cannot change. It is true that the speed of light will always measure the same locally however it can be physically slower in high gravity for example when compared to the speed of light in low gravity.

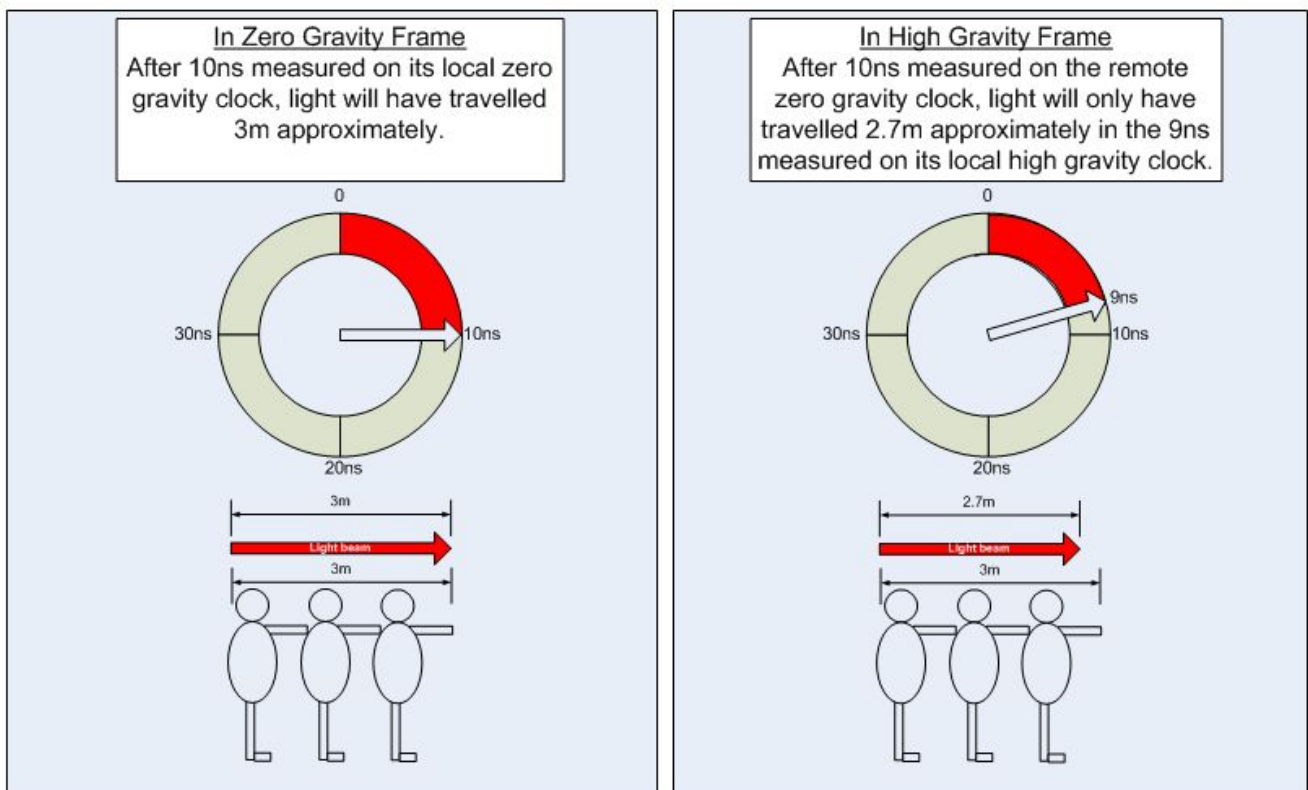
Consider the evidence -

1. We know for a fact that time goes slower in higher gravity. (A clock moved into higher gravity and then returned to low gravity will have physically gone slower than a clock remaining in low gravity.)
2. We know for a fact that the speed of light is the same when measured locally in high or low gravity.
3. We know for a fact that lengths measured on a measuring stick are the same when measured locally in high or low gravity.

Therefore if distance and speed of light are measured as being the same in higher gravity and the clocks have physically slowed down then as distances are still measured the same then the physical speed of light must be physically slower to measure the same on the physically slower clock!

In the examples below we can see that in zero gravity in the vacuum of space that the speed of light is 299,792,458 m/s, i.e. approximately 3m in 10ns. However as time is slower in high gravity, then the slower local high gravity clock will show just 9ns elapsed say compared to 10ns on the zero gravity clock and light will only have travelled 2.7m approximately as light still travels 3m in 10ns in its local frame measured in its own local high gravity clock. Therefore light speed is slower compared to the zero gravity frame as it has only travelled 2.7m locally in the 10ns elapsed time on the zero gravity clock but it will still travel 3m in 10ns when measured on its own local high gravity clock. i.e. the speed of light is always the same when measured locally but slower in high gravity compared with in low gravity.

Note that time does not just **appear** to be slower in higher gravity; it **is** actually slower as a twin living in higher gravity will have aged less when returning to where the other twin is living in lower gravity.



The speed of light in a vacuum is therefore not constant; it varies under the influence of gravity and the associated matter density in the universe. However, the locally measured speed of light will be the same wherever and whenever it is measured.

It must be remembered that the speed of light can only be measured with reference to our standards for time which are based on the frequency of emissions from the Caesium atom for instance. If the Aether was denser in a different part of the universe, then the Caesium atom would have a lower frequency there due to the particles in the atom moving more slowly. The speed that light travels in that denser region of space would also appear to be slower than in our region of space. However, if we measured the speed of light while in that denser region of space it would not appear to be reduced as it would be measured with respect to the local frequency of the Caesium atom.

If the vacuum of free space was considered to consist of an Aether medium rather than nothing, then the perceived speed of light would similarly depend on the density of this Aether and would explain Einstein's General Theory of Relativity where time slows down near massive bodies and light is bent.

Consider a spaceship with a Caesium clock on board travelling fast through space and shining a light ahead of it. The photons in the light beam would encounter more Aether particles per second than if it were stationary which would slow the photons down and thus cause the speed of light to slow down through the Aether. However the Caesium clock and its electrons would also slow down by the same amount as they passed through the increased amount of Aether particles. As a result the speed of light as measured with reference to the spaceship's Caesium clock would appear to be unaltered.

It is important to note, however, that the movement of photons through the Aether would have to be an essentially frictionless and lossless process. It would therefore mean that there is no net energy passed from the photon and its associated wave to the surrounding Aether. All of the photon's energy travels with the moving photon and its associated wave.

## ***2.19 Warped Space-Time***

Einstein's model of a warped space-time is just that; a model. His 4-dimensional space-time is a mathematical model of what happens in reality but it does not invalidate any other model of what we observe and lacks the simplicity of a 3-dimensional model of space that we are used to in everyday life. A 4-dimensional space-time can be a suitable tool for a mathematician but even for a mathematician is hard to visualise as we are used to seeing everything in 3-dimensional space.

If air and water were completely invisible a mathematician could similarly model a person diving into water, and being slowed down in the more dense water, as being due to 4-dimensional warped space-time when a better model would be of a 3-dimensional model of space with a more dense medium slowing down the travel through the water.

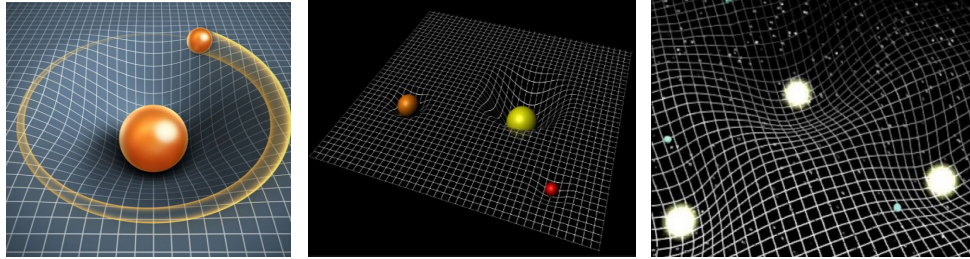
From Einstein's theory of General Relativity, mass warps the fabric of space-time, compressing space around it and giving rise to what we recognise as the effect of gravity. The density of this space reduces with distance from the mass.

If Aether was the constituent of this free space then we would expect that light would travel more slowly when closer to massive objects where the gravitational field is higher and the Aether is more compressed. This is in agreement with current scientific understanding. For example, light goes slower and slower as we approach a black hole until the speed of light is zero at the boundary between the inside and outside of the black hole. It would similarly follow that as the universe expands, then the Aether density is reduced and the speed of light is increased. The speed of light in a vacuum is therefore not constant; it varies under the influence of gravity and the associated density of matter in the universe. However it always has the same locally measured value!

As shown in the previous section on the speed of light - The relative speed of light appears to be slower in stronger gravitational fields.

Also, according to Einstein's General Theory of Relativity, gravity is not a force as there is no force acting on a body when falling freely in gravity but the same would apply to a negative charge accelerating towards a positive charge! Would charges also warp space so that they move towards each other? It seems illogical.

Einstein described gravitational attraction as being due to masses moving straight ahead in a curved spacetime caused by the uneven distribution of mass. These are the typical misleading models used to represent space-time being warped causing gravitational attraction -



What actually happens is that only the Aether is actually warped and thus space indirectly by making the Aether or space denser. Distances appear to be warped but what is actually happening is that distances only appear to change as everything is moving slower and so it takes longer to travel over a distance in the dilated time.

It may even be that the Aether is elastic and can be compressed or pulled in from surrounding space by any massive object. This would mean that the Aether is stretched thinner than normal in surrounding space. Two massive objects in space could therefore be pulled together by this stretched Aether between the two objects. The Aether could be like an invisible stretchy jelly and be the cause of gravitational attraction forces.

The Aether is therefore acting like an invisible medium comprised of invisible particles that can be compressed under the influence of gravity. This can be likened to the Earth's atmosphere being denser near the earth's surface.

Note that it is actually just space that appears to be warped near a massive body, not space-time being warped as suggested in Einstein's theory of General Relativity. The warping of time is actually due to the slower speed of light in that more dense Aether.

The bending of light towards massive objects in space is similar to the mechanism causing refraction of light that occurs when travelling from air to more dense glass. The higher Aether density near the massive object refracts the light towards the denser Aether region close to the massive object.

The Aether is the means by which photons or electromagnetic waves can be transmitted through the vacuum of space. The denser the Aether then the slower the photons or electromagnetic waves travel and the more compressed the light waves become. This is what causes the wavelength of the light to be shorter in the higher density Aether when light approaches closer to massive objects.

## **2.20 Frame-dragging (Lense-Thirring Effect)**

Rotational frame-dragging (the Lense-Thirring effect) appears in the general principle of relativity and similar theories in the vicinity of rotating massive objects. In Einstein's relativity theory it describes massive rotating bodies distorting and dragging space-time similar to spinning an object in water causing the surrounding water to spin around it. This is consistent with the idea of there being an Aether which acts like a liquid being dragged around by the rotating mass.

Under the Lense-Thirring effect, the frame of reference in which a clock ticks the fastest is one which is revolving around the object as viewed by a distant observer. This also means that light travelling in the direction of rotation of the object will move past the massive object faster than light moving

against the rotation, as seen by a distant observer. It is now a well established effect, partly thanks to the Gravity Probe B experiment.

Also, an inner region is dragged more than an outer region. This produces interesting locally-rotating frames. For example, imagine that an ice skater, in orbit over the equator of a black hole and rotationally at rest with respect to the stars, extends her arms. The arm extended toward the black hole will be turned in the direction of spin. The arm extended away from the black hole will be turned in the direction opposite to the spinning black hole due to the Aether being dragged less the further away it is from the massive body. The skater will therefore be rotationally sped up, in a counter-rotating sense to the black hole.

It is important to note that the increased drag caused by a denser Aether is a lossless mechanism. i.e. the light does not slow more and more the further it travels through a uniformly dense Aether. The Aether just limits the maximum speed that it can travel as if the light travelled through a series of Aether particles taking the same time to travel from Aether particle to Aether particle. A more dense Aether would therefore take longer for light to travel through as it would intercept more Aether particles in its path. Similarly light going in the same direction as the frame-dragging Aether wind would result in fewer interactions with the Aether particles and thus the light would travel faster than if it were travelling against the Aether wind.

## **2.21 Planck's Constant**

Planck's constant could arise as a result of the spacing of Planck size Aether particles. Aether could be considered as being composed of particles linked by a spring-like force. A photon is confined to vibrating at a multiple of the resonant frequency of this spring-like force which leads to the discrete quantum energy levels of electrons in an atom that are multiples of Planck's constant.

## **2.22 Higgs Field**

The Higgs field permeates the vacuum of space and causes a drag on particles that interact with it which is the same as saying that it can impart mass on particles. The Higgs field is thus another name for the Aether that permeates all space and similarly can produce a drag on particles moving through it giving them mass.

It is considered that photons and gluons have zero mass and do not interact with the Higgs field. However, it could be considered that photons are limited to the speed of light by the Higgs/Aether field. Without the Aether, photons would travel at infinite speed. The denser the Aether, the slower the speed of light as occurs near massively heavy bodies.

The Higgs Boson can be considered as a dense spot in the Higgs field. This can similarly be considered as a dense spot in the Aether like a drop of water in water vapour or perhaps a bubble or ice particle in water.

Mass is really just a property of the Aether as it requires something to restrict the acceleration of particles otherwise they would have no mass and no inertia. i.e. the Higgs Field is a property of the Aether. Particles with low mass have less interaction with the Aether. Photons have the least interaction, only restricted to the speed of light by totally elastic interaction with the Aether as it weaves its way through the Aether particles.

The Higgs Field permeates the whole of the Universe now. It was zero at the big bang. It is now thinning out due to the Aether getting thinner in the vacuum of space. Therefore the universe expansion is accelerating as there is less drag from the Aether.

## 2.23 Theory of Everything

A 'Theory of Everything' needs to unify the two theories upon which all modern physics now rests. These are Einstein's General Relativity theory describing physics at the very large scale of the universe and Quantum Theory describing physics at the very small scale of particles. General Relativity is a theoretical framework that only focuses on gravity for understanding the universe in regions of both large scale and high mass whereas Quantum Theory is a theoretical framework that only focuses on the three non-gravitational electromagnetic, strong and weak nuclear forces for understanding the universe in regions of both small scale and low mass subatomic particles, atoms, and molecules.

The supposed incompatibility between General Relativity and Quantum Theory is only considered an issue at the very small Planck scale when gravity is thought to be extremely large such as in a black hole or during the beginning stages of the universe (i.e. the moment immediately following the Big Bang).

The idea that Einstein's General Relativity theory is not universal due to it breaking down in extreme gravity is negated however as gravity was not infinite when the universe was reduced to a singularity at the Big Bang. As explained earlier in section 2.9 (Inflationary Period of Universe Expansion), gravity was effectively zero at the big bang as matter was still to be created and so gravity did not exist! Likewise gravity is self limiting in black holes due to matter becoming so compressed that fermions (protons, neutrons and electrons etc.) are converted to energy and so gravity which is dependent on matter does not become infinite. Matter and therefore gravity does not exist in singularities where only boson-like energy particles can occupy the same space.

It is also suggested that the General Relativity theory and Quantum Field Theory are not compatible, and that they cannot both be right, as General Relativity says that objects' behaviours can be predicted exactly, whereas quantum theory says all you can ascertain is the probability of how they will behave. There is no incompatibility however if you consider that it is just that we lack the tools to predict the particles behaviour. It is like having a camera with limited resolution. If you zoom in, you end up with an out of focus image where an object is smeared over a region.

In the framework of quantum theory, particles are considered to have neither definite positions nor definite velocities unless and until an observer measures those quantities. However they actually do have specific positions and velocities. It is just that we cannot measure it as the observation tools we have are limited. An electron in an atom for example would be moving so fast that it appears to be in more than one place at a time.

It is also considered necessary for gravity to be quantised to have a universal theory of everything and that gravitons could be the gravitational particles. Gravitons would need to have no mass and travel at the speed of light. Unfortunately, gravitons have yet to be detected. However these properties of the graviton are the exact same properties of the proposed Aether. Gravitational waves would ripple through space as a compression wave in the Aether at the speed of light. The proposed Aether paradigm suggests that the Aether particle density is set by the gravitational field strength and that the Aether particles are effectively the quanta of gravity.

Any 'Theory of Everything' also needs to include an explanation of dark matter and dark energy. The proposed new Aether model (outlined in sections 2.10 and 2.11) offers a suitable explanation. The new Aether model also merges the physics of the very small - like particle/wave duality and quantisation, as well as the physics of the very large - like gravitation, bending of light near massive objects, time dilation and length contraction.

And finally the incompatibility of Einstein's Special Relativity theory where nothing can travel faster than the speed of light, and the instant action at a distance of quantum entanglement can be resolved by recognising that particles can be connected through space by the Aether particles carrying the field lines. So nothing has to travel through the speed limiting Aether as the entangled particles are connected directly via the Aether particles.

### 3 Summary

A new Aether paradigm has been presented which gives simple and elegant solutions to phenomena that are difficult to comprehend by other pedagogical methods and by Occam's razor provides more likely solutions. It holds true in explaining the following -

1. **Michelson-Morley experiment** - It was believed that this experiment showed that the Aether did not exist as no Aether wind was detected; but it only showed that the Aether did not exist in a fixed reference frame. However the proposed Aether could exist if it was dynamic in nature with the observable properties of the Aether always travelling along with matter particles. The Earth would create its own Aether wind travelling along with it as would our solar system, the galaxies and the expanding universe.
2. **Gravitational bending of light**- The denser Aether surrounding large stellar masses causes the light to bend towards them. It is actually being refracted exactly the same way as light travelling through air and meeting denser glass would be refracted towards the denser medium.
3. **Gravitational time dilation** - This can be explained by the Aether being denser in a higher gravitational field causing more interactions with the Aether particles and therefore causing everything to run slower. This includes time as measured by clocks to run slower. Electrons will travel more slowly in their orbitals. All atoms and particles move slower, therefore clocks run slower (including the Caesium reference standard for time measurement) and chemical processes run slower, thus slowing aging.
4. **Kinematic time dilation** – This can be explained by the fact that with increasing speed through the Aether then the number of interactions per unit time with the Aether results in an effective increase in the Aether density and time running slower.
5. **Twin paradox** - If Aether particles fill space, then this can be explained by the fact that the stationary person is moving at a certain speed through the surrounding Aether particle density; however the moving person is travelling faster through the surrounding Aether particles and experiences more interactions with them, thus slowing down time for the moving person.
6. **Wave/particle duality** - The photon must be unchanging electromagnetically as time will stand still for the photon when observed from our reference frame. The logical conclusion is that the time varying electromagnetic field cannot be a property of the photon but must instead be a property of the space surrounding the photon. Therefore the wave nature of light is not in the photon but is in the space surrounding it.
7. **Young's twin slit anomaly** – The particle goes through one of the slits but the wave goes through both slits and guides the particle to its position on the detector screen giving rise to the observed interference pattern.
8. **Vacuum energy** – This is simply a manifestation of the Aether by another name. The Aether exists throughout space but its effect only becomes apparent in the presence of matter/light.
9. **Inflationary period of universe expansion** – The universe expanding faster than the speed of light was possible as matter did not exist during this period and thus gravity was zero. If gravity was zero then under the proposed theory then the Aether density would have been zero. Therefore if it is considered that the Aether limits the speed at which anything can travel, then there was no limit to the speed of expansion during the inflationary period.
10. **Dark energy** – The accelerating expansion of the universe can be explained by the fact that as the universe expands, the Aether becomes less dense allowing matter/light to travel even faster resulting in the accelerating expansion.
11. **Dark matter** - The Aether can be considered to be like a fluid whose density (and perhaps mass-like property) is proportional to the strength of the gravitational field and is therefore denser around massive bodies. Therefore the Aether is denser in galaxies and could account for the hidden mass which allows the stars to rotate faster around the galaxies than calculations would predict, thus preventing them flying off into space.
12. **Quantum spin** – If the electron was considered to be ball shaped then its angular velocity would have to exceed the speed of light for its spinning charge to create a sufficiently large magnetic dipole moment. However if the electron was ball shaped and excluded any Aether then, as we have seen before, it could spin faster than the speed of light as the speed of light is only limited by the speed that particles can move through the Aether. As the electron is not travelling through the Aether then it could spin faster than the speed of light!



13. **Stern-Gerlach Experiment** – This was said to show that the spatial orientation of an electron's spin angular momentum is quantized and that the spin was an intrinsic quantum property and not physical. However it has been shown here that the two defined bands that the particles were split into in the experiment could be explained by the fact that the sum of the particle's dipole field and precessional field in the external magnetic field is constant and so the deflection force for any angle of dipole is constant.
14. **Quantum entanglement** – The existence of the Aether explains how entangled particles can instantly affect one another at a distance faster than the speed of light as nothing has to move through the speed limiting Aether to affect the other particle if they are connected by the field lines carried by the Aether particles.
15. **Electron Orbitals** – These are the standing waves in the Aether produced by the electron's motion in the atom that guide the photons thus preventing them from being emitted as a result of their acceleration due to the electron's angular change of direction.
16. **Heisenberg Uncertainty Principle** – The uncertainty in knowing the position and momentum of an electron in its orbital is due to the fact that the electron is moving so fast that its position is effectively smeared over a region determined by the Aether wave density distribution. As we do not have the tools to determine its position and momentum with sufficient resolution then position and momentum become uncertain.
17. **Quantisation** – Electrons in atomic orbitals create standing waves in the Aether and their energy levels are quantised in multiples of the Planck constant due to the Aether particles being spaced by the Planck length.
18. **Speed of light** – The speed of light in a vacuum is determined by the Aether density which is proportional to the background gravitational field of space. The speed that photons move through the Aether is determined by the time it takes to travel from one Aether particle to the next.
19. **Warped space-time** – Space-time is not warped. It is just time being dilated due to the Aether being compressed near massive bodies due to gravity. This causes distances to appear to be longer as everything is slowed down in higher gravity.
20. **Frame-dragging** – Frame dragging has been shown to be a measurable effect where light travelling in the direction of rotation of a massive object will be faster than light moving against the direction of rotation. This is due to the Aether which acts like a liquid being dragged along by the rotating body.
21. **Planck's constant** – This could be explained by the spacing of Planck size Aether particles which results in the discrete quantum energy levels of electrons in an atom.
22. **Higgs field** – The Higgs field permeates the vacuum of space and causes a drag on particles that interact with it which is the same as saying that it can impart mass on particles. The Higgs field is thus another name for a property of the Aether that permeates all space and similarly can produce a drag on particles moving through it giving them mass.
23. **Theory of Everything** – The problem with unifying General Relativity's gravity and Quantum Theory's non-gravitational electromagnetic, strong and weak nuclear forces is related to the infinities at the singularities under extreme gravity at the Big Bang and at the centre of black holes. However, this can be resolved by understanding that at the Big Bang matter had not yet been created and so gravity was zero and therefore the Aether was also non-existent. Similarly gravity is self limiting at the centre of black holes as matter is so compressed that fermions are converted to energy and therefore gravity which is dependent on matter does not become infinite. Also the incompatibility of Einstein's Special Relativity theory where nothing can travel faster than the speed of light, and the instant action at a distance of quantum entanglement can be resolved by recognising that particles can be connected through space by the Aether particles carrying the field lines. So nothing has to travel through the speed limiting Aether as the entangled particles are connected directly via the Aether particles.

General Relativity, Special Relativity, Quantum Entanglement and Quantum Theory can therefore be unified in a Modern Aether Theory of Everything.

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