

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/antiquark pairs
3. Superfluid vacuum theory (SVT)
4. Cosmic foam
5. Quantum fields
6. The Higgs Field with its associated Higgs Boson particles
7. Dark Energy and Dark Matter
8. Granular Space-Time
9. 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. Shapiro effect
22. Sagnac effect
23. Planck's constant
24. Higgs field
25. 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 matter 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 particles 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 gravitational field 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 universal fixed reference frame! The Aether wind could not be detected as the thickened observable properties of the Aether always travel along with the gravitational field of 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. The speed that photons travel at is simply determined by the permeability and permittivity of their surrounding environment, which in the case of the vacuum of space is the influence of the properties of the Aether.

It should also be understood in this Aether model that the Aether does not physically push or pull photons and so nullifies stellar aberration observations that are quoted as proof of the non-existence of

a partially dragged Aether. It merely delays their travel in proportion to the number of interactions with the Aether particles.

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 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 Aether 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. Time slows down when travelling faster as a result of atomic particles within every atom slowing down due to an increased interaction per unit time with the Aether medium.
7. Time slows down in a higher gravitational field as a result of atomic particles within every atom slowing down due to an increased interaction with the higher density Aether medium.
8. The Aether is not physically pushing or pulling particles such as photons in a different direction as if by an Aether wind. It is only the particle's speed that is varied due to the number of interactions with Aether particles.
9. 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 rest mass like photons and gluons interact with each of these Aether particles and are also 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 more likely it could be an Aether field surrounding each Aether particle that causes delays in the travel of 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 rest 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 vacuum speed of light constrained from travelling infinitely fast? Why is it 299,792,458 m/s and not 300,000,000 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 μ_0 = permeability in a vacuum in free space = $1.25663706212(19) \times 10^{-6}$ H/m

and ϵ_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.

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 everything down 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 electrons in atoms and 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 Aether density being proportional to the surrounding gravitational field. This would increase the interaction with Aether particles in higher gravity, causing everything to slow down including time as measured by clocks. A clock transported to a higher gravity location will run slower relative to a clock remaining in the lower gravity location. Transporting the clock back to the lower gravity location and comparing the clock times will verify that the returning clock will have run slower but also show that the clock has not changed in size. **Therefore only time has actually warped!** Space would not have to physically change dimensionally. Space-time is just a mathematical 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 can provide a geometric visual aid to help understand the predictions and calculations that align with our 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 of our time from its perspective. i.e. time is stationary in the photons reference frame. This is in accordance with 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.

Aether also obviates the need for a mysterious dark energy and dark matter to exist.

Dark energy can be more simply explained by the Aether thinning out causing less drag as the universe expands resulting in an accelerating expansion.

Similarly there is no need for the extra gravitational force of dark matter preventing a galaxy's rotating stars from flying off into space when it can be more simply explained by circular frame dragging adding to the rotational speed of the stars. This would be consistent with an Aether in the vacuum of space being dragged like a galactic rotating fluid that allows the stars circular motion to speed up without adding to the centrifugal force (due to the star's inertial straight line motion) that balances the gravitational pull of the galaxy and determines the stars orbit.

The Aether particles could have a mass-like property 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 the Aether density. This would explain the dark matter in galaxies which is in proportion to the mass of the galaxy and would be an alternative explanation for stars on the edge of galaxies not flying off into space despite their high speed.

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

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 in the direction of motion 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 the gravitational field of 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.

In the proposed model, it is important to note that the Aether is not pushing or pulling light particles through space.

It is often stated that stellar aberration is evidential proof that the Aether does not exist as it negates the theory of Aether drag due to the Earth moving through space. However, this is not true, as it only shows that the Aether does not physically push or pull photons in a different direction. It does not negate the existence of an Aether that affects the speed of photons due to the number of interactions with Aether particles. The fact that stellar aberration requires a telescope to be tilted to observe the light from an immediately overhead star merely confirms that there is no evidence of Aether dragging light particles to the side along with the rotation of the Earth.

There is evidence that could be attributed to a physical drag on an Aether caused by the rotation of a massive body as exemplified by the frame dragging Lens-Thirring effect (see section 2.20). This drag induced on Aether particles would not push or pull photons; it would merely result in more time delays being induced due to interacting with more Aether particles when moving against the Aether flow and thus slowing the photon's speed. This frame dragging has been demonstrated by the well established results of the Gravity Probe B experiment and could be attributed to electrons also slowing down in atoms as they interact with more Aether particles per unit time and thus slowing down the measurement of time itself. The photon's direction of travel would not be affected by the Aether, only the speed at which it travels.

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 could be considered to be similarly compressed.

This would explain why light is 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 μ is the permeability and ϵ 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 c_g is less than c_0 and the refractive index in the gravitational field n_g 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. $\frac{GM_E}{R_E} = gR_E$

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

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

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 –

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

Therefore 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 ageing. 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.

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

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

Therefore clocks run slower (we also age slower) when moving faster.

This is why someone leaving the Earth in a spaceship and travelling fast into space (excluding the effects of the Earth's gravitational field) would find when they returned to Earth that they had aged less than someone who had remained behind on Earth.

Examples of this were 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.

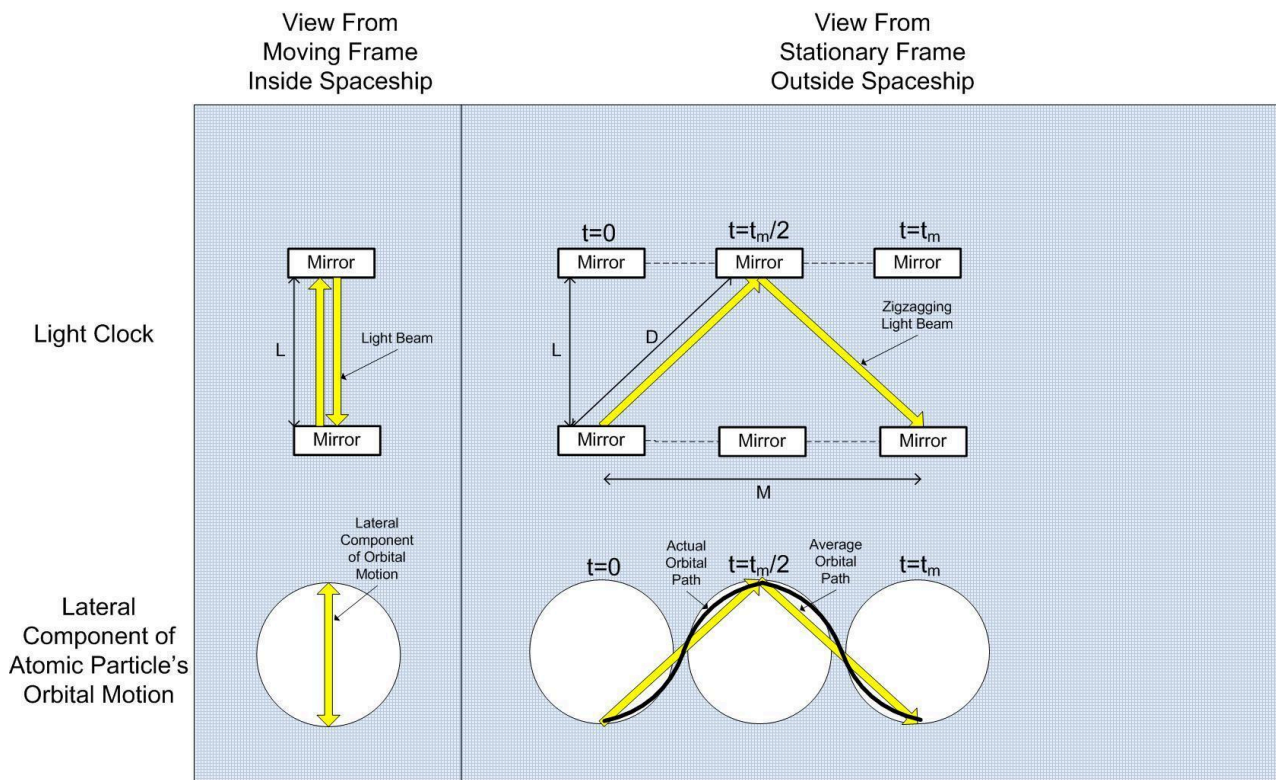
As we shall see, this slowing down of time can be explained by the atomic particles having to travel further through an increased number of Aether particles per unit time as they zigzag in their orbitals when an object moves faster. The extra delays introduced by interacting with more Aether particles per unit time slows down the motion of every atom including the Caesium atoms in a Caesium clock and thus slows time itself. Interacting with more Aether particles per unit time gives a physical explanation why time slows down when moving faster. Travelling faster through the Aether can be looked at as effectively increasing the apparent Aether density as there are more interactions with the Aether per unit time.

A similar second order 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.

2.4.1 Transverse Light Clock Thought Experiment

The well known light clock thought experiment is useful in explaining why, and by how much, time slows down for a moving object.



In the light clock diagram above, a spaceship is moving horizontally to the right with a velocity V in the vacuum of space and a light pulse is emitted perpendicular to the motion of the spaceship. The light beam travels back and forth between a pair of mirrors attached to the outside of the spaceship a distance L apart and a sensor at one of the mirrors detects every arrival of the pulse and represents this by a corresponding tick of the clock.

Note that it is necessary to use the same sensor for the time measurements due to the difficulties in synchronising clocks a distance apart.

It can be seen that for an observer in the reference frame of the moving spaceship, that the mirrors appear stationary and light travels a distance L to and from each mirror. The time between each tick t_s is the distance $2L$ divided by the speed of light.

i.e.

$$t_s = 2L/c \quad (1)$$

In the reference frame of a stationary observer outside the spaceship, the light beam appears to travel a distance D to and from each mirror as the spaceship moves with a velocity V through space.

As the speed of light is still c , the time between each tick t_m is the distance $2D$ divided by the speed of light c .

i.e.

$$t_m = 2D/c \quad (2)$$

and

$$V = M/t_m \quad (3)$$

Also

$$D^2 = L^2 + (M/2)^2 \quad (4)$$

The lengths L , D and M can be eliminated from the above equations as follows:

From Eq. (1)

$$L = (c t_s)/2 \quad (5)$$

From Eq. (2)

$$D = (c t_m)/2 \quad (6)$$

From Eq. (3)

$$M = V t_m \quad (7)$$

Substituting D, L and M in Eq. (4) gives

$$[(c t_m)/2]^2 = [(c t_s)/2]^2 + [(V t_m)/2]^2 \quad (8)$$

Multiplying by $4/c^2$ gives

$$t_m^2 = t_s^2 + (V^2 t_m^2)/c^2 \quad (9)$$

Therefore

$$t_m^2(1 - V^2/c^2) = t_s^2 \quad (10)$$

i.e.

$$t_m = \frac{t_s}{\sqrt{1 - \frac{V^2}{c^2}}}$$

This is the standard kinematic time dilation formula and would also apply equally to the lateral components of an atomic particle's orbital motion (assuming light speed for the orbital motion) as shown in the diagram above. This gives a physical explanation for why a Caesium atomic clock, or any other mechanical clock, will appear to slow down in accordance with the time dilation formula due to the lateral vibrations of their atomic particles. This also explains why you would age slower while moving faster as every atomic particle such as electrons in the atoms of your body would physically slow down as they would interact with more Aether particles on a zigzag path through the Aether as shown in the diagram.

Note: In the light clock diagram above, the light beam from the moving spaceship is still moving at the speed of light c . However the electrons in a clock on the moving spaceship would be travelling faster and over a longer distance through the vacuum in a zigzag path than when stationary. The clock will therefore experience time dilation and run slower. However the light beam itself will not as it is still travelling at the same speed of light c .

2.4.2 Longitudinal Light Clock Thought Experiment

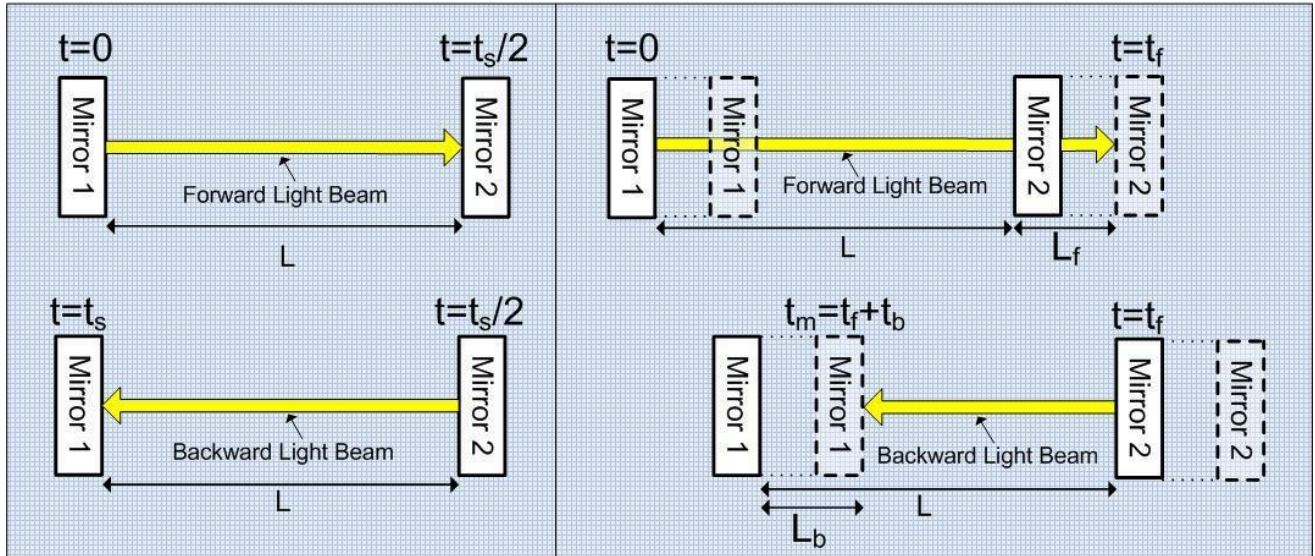
A light clock thought experiment with the mirrors placed in line with the direction of motion does not seem to have been examined in the literature and appears to reveal a surprising result.

The generally accepted theory for the speed of light is that it is determined solely by the medium it is travelling through and not the ballistic theory of light propagation whereby the speed of light is the vector sum of the emitting object and the speed of light determined by the medium it is travelling through. On this basis we can determine the time dilation in the longitudinal direction of travel whereby a light pulse emitted from the moving object would have the same speed as a light pulse emitted from a stationary object. The speed of light would not be added to the speed of the emitting object as would be the case with a moving person throwing a ball. The photon's speed would be purely determined by the permeability and permittivity properties of the surrounding medium in which it finds itself when emitted.

In the light diagram below, the spaceship is moving horizontally with a velocity V in the vacuum of space and a light pulse is emitted in the direction of motion of the spaceship. The light beam travels right and then left between 2 mirrors a distance L apart and a sensor at Mirror 1 detects every arrival of the pulse and represents this by a corresponding tick of the clock.

View From Moving Frame Inside Spaceship

View From Stationary Frame Outside Spaceship



2.4.2.1 Moving Reference Frame Calculation

It can be seen that in the reference frame of the moving spaceship, the mirrors appear stationary and light travels a distance L to and from each mirror. The time between each tick t_s is the distance $2L$ divided by the speed of light.

$$\text{i.e. } t_s = 2L/c \quad (11)$$

2.4.2.2 Stationary Reference Frame Calculation (For non-ballistic theory of light)

On the basis that the speed of the photon relative to Mirror 2 is $c-V$ while travelling forward and the speed of the photon relative to Mirror 1 is $c+V$ travelling backward then –

$$t_f = L/(c-V) \text{ and } t_b = L/(c+V)$$

Therefore the total time to travel to and from the mirror (t_f+t_b) would be

$$t_m = [L/(c-V)] + [L/(c+V)]$$

Arranging with a common denominator this becomes

$$t_m = [L(c+V) + L(c-V)] / [(c-V)(c+V)]$$

$$\text{i.e. } t_m = 2Lc / (c^2 - V^2) \quad (12)$$

$$\text{From Eq. (11)} \quad L = c t_s / 2$$

$$\text{Therefore substituting for } L \text{ in Eq. (12) gives } t_m = c^2 t_s / (c^2 - V^2)$$

i.e.

$$t_m = \frac{t_s}{\left(1 - \frac{V^2}{c^2}\right)}$$

This disagrees with the standard kinematic time dilation formula which is –

$$t_m = \frac{t_s}{\sqrt{1 - \frac{V^2}{c^2}}}$$

It could be construed that the length L in the longitudinal direction is subject to length contraction.

i.e. from equation 11, L is actually $\frac{ct_s}{2} \sqrt{1 - \frac{V^2}{c^2}}$ or $\frac{t_s \sqrt{c^2 - V^2}}{2}$ and not $c t_s/2$
 Substituting this in equation 12 we get –

$$t_m = t_s \frac{\sqrt{c^2 - V^2}}{c} \cdot \frac{c}{(c^2 - V^2)}$$

i.e.

$$t_m = \frac{t_s}{\sqrt{1 - \frac{V^2}{c^2}}}$$

This is again the standard formula for time dilation.

However length contraction as we shall see later is only an artefact of time dilation (an apparent length contraction not a real length contraction).

2.4.2.3 Stationary Reference Frame Calculation (For ballistic theory of light)

If we were to examine the ballistic theory of light propagation whereby the speed of light is the vector sum of the emitting object and the speed of light determined by the medium it is travelling through then we get the following analysis for the longitudinal time dilation in the direction of travel –

In the forward direction the relative speed of the photon to mirror 2 is the photon speed (c+V) minus mirror 2 speed (V)
 i.e. (c+V) – (V) = c

In the reverse direction the relative speed of the photon to mirror 1 would be the photon speed (c-V) minus mirror 1 speed (-V)
 i.e. (c-V) - (-V) = c

Therefore $t_m = t_f + t_b = L/c + L/c = 2L/c = t_s$

Therefore the time measured by an observer in the moving frame is the same as the time measured in the stationary frame and therefore there is no time dilation due to the longitudinal component of the light beam for the light clock oriented in the direction of travel!

Therefore the overall time dilation would be solely due to the transverse motion of the light wave and is still –

$$t_m = \frac{t_s}{\sqrt{1 - \frac{V^2}{c^2}}}$$

However we know that the overall speed of light propagation is not ballistic due to the experimental observations of distant binary star systems where the light from the approaching star would be expected to travel faster than light from its receding companion, and overtake it with a resulting scrambled image. This is not the case and so the overall speed of light propagation cannot be ballistic! However if we replaced the photon with an atom (that is ballistic) when fired longitudinally between the mirrors in the light clock experiment then we would see that time dilation is solely due to its

transverse motion. This would therefore be a better example to illustrate the time dilation mechanism rather than using a photon.

2.4.2.4 Kinematic Time Dilation of Atoms (For orbital ballistic theory of atoms)

It seems logical that the physical cause of time dilation where clocks run slower and people age slower in a faster moving reference frame must be due to atomic particles actually moving slower. So the light clock thought experiment explaining time dilation in a faster moving frame can only be applicable to atomic particles moving in a ballistic manner and not to photons travelling non-ballistically through the relatively stationary vacuum.

If we consider particles in an atom such as an electron, instead of a photon, it will experience a ballistic movement back and forth in any longitudinal component of the electron's orbital motion. As shown above for ballistic longitudinal motion, this would explain why the longitudinal component of motion does not affect the kinematic time dilation formula. Only any transverse motion of the electron as shown in the diagram above (Lateral Component of Atomic Particle's Orbital Motion in Section 2.4.1) would contribute to the kinematic time dilation formula.

Therefore kinematic time dilation appears to be purely due to the transverse motion of atomic particles!

2.4.3 Constant Speed of Light Analysis for Kinematic Time Dilation

When a light beam is emitted perpendicular to a moving spaceship you would think that measuring the speed of light over the same measured distance on a ruler on the spaceship but with its slower clock would mean that light still travelling at its same speed c could travel further in that extended time and thus appear to be travelling faster.

However it can be seen that the light beam in the transverse light clock thought experiment is travelling over a longer zigzag path through the Aether by the same amount that time has slowed down. Therefore the measured speed of light on the moving spaceship will still remain as c .

Again we might wonder why with time running slower in a faster moving frame, then how is the speed of light still measured as c when emitted in the longitudinal direction from a moving spaceship. It is not now moving in a longer zigzag path.

The answer is that the non-ballistic light beam is in a relatively faster time frame. Therefore the light beam will travel less distance in its time frame relative to the spaceship's time frame in the same proportion as the clock is running slower on the spaceship.

We know that the speed of light emitted from a star in our galaxy and measured on Earth would be the standard speed of light c irrespective of whether the star is moving away from us or towards us or even in a lateral direction.

In the analysis above for light emitted from a moving object, we know that light is still moving through the vacuum at the standard speed of light c so that if the light speed was measured by the observer in its local stationary frame it would also measure the speed of light to be c .

This agrees with the idea that the speed of light is solely due to the permittivity and permeability of the space it is travelling through.

If we now consider Doppler shifts in light frequencies from moving stars in our galaxy we find that there are **Relativistic** Doppler redshifts with a Lorentz time dilation factor in the faster moving frame of the star. These are separate from the non-relativistic Doppler red or blue shift that is similar to the effect of Doppler shift of sound waves changing the frequency of the received wave.

The **Time Dilation** redshift is irrespective of the direction that the light beam has been emitted and is purely due to the time dilation effect of the object and light in the moving frame.

This can be explained by the fact that the light beam in the moving frame is still moving at the same speed as in the stationary frame (assuming the same permittivity and permeability of the vacuum and ignoring gravitational effects). However the frequency of the light wave will be lower and have a longer wavelength. This could be due to the relative slowing down of an electron emitting the photon due to time dilation with a resulting lower electron energy. As the frequency of a light beam is proportional to energy ($E=hf$ where h is constant) then the frequency would also be reduced. However

as the speed of light is still c then the wavelength of the photon must increase by a similar amount that the frequency has gone down by and so the photon speed c would be unchanged as $c=f\lambda$.

2.5 *Twin Paradox*

The increased interaction with Aether particles when travelling faster, as explained above, 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 a person travelling faster through the surrounding Aether particles will experience more interactions with them, thus slowing down time for the faster moving person. There is therefore no paradox.

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 relative to 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.

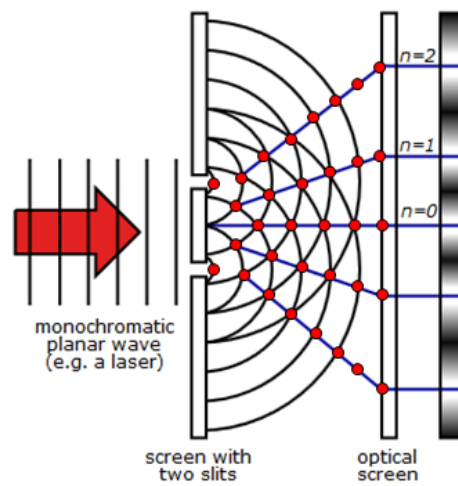
The specific frequency associated with a photon must be induced into the Aether by the photon. Individual Aether particles are not moving along with the photon or at the speed of the photon. They are simply moving locally in the same way as individual atoms in a vibrating string or water molecules in a wave are not moving from the source to the destination of the travelling 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*

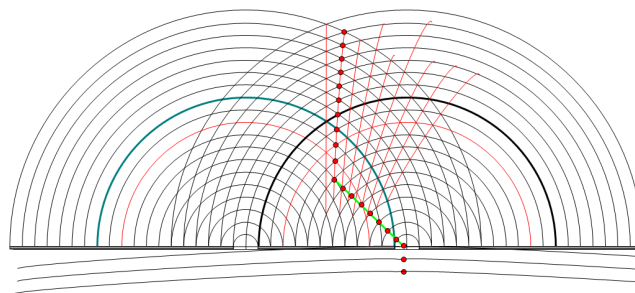
If we look at Young's twin slit experiment, an interference pattern of bright and dark lines appears on a target screen when light is shone through twin slits. This suggests that light is behaving like a wave causing destructive and constructive interference after passing through both slits. However, 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.

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 instantly resolves, faster than the speed of light, 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).

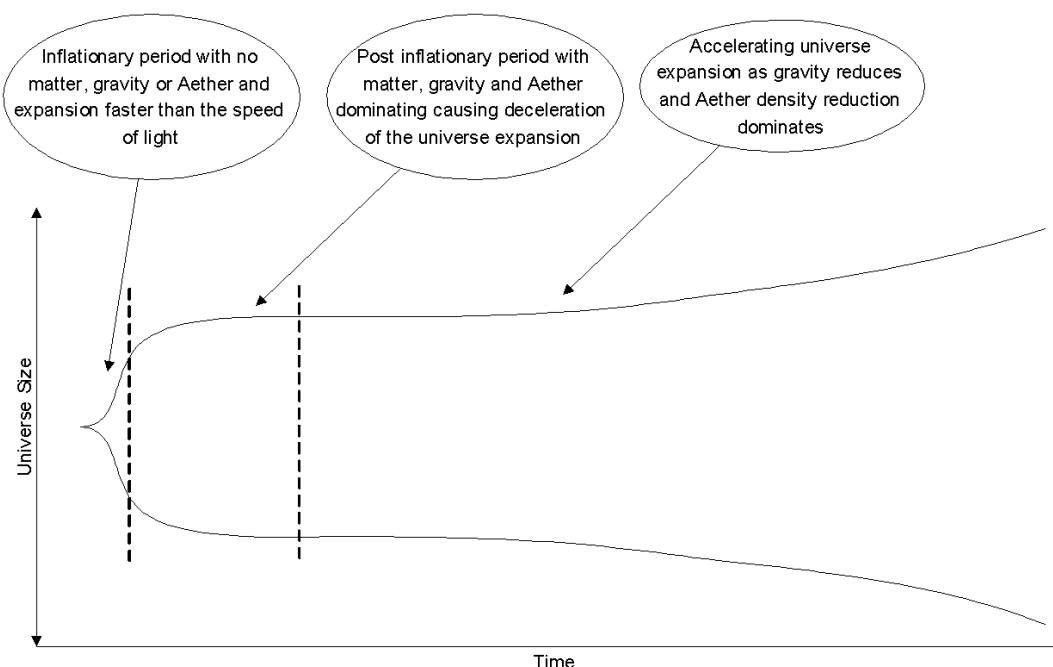
The vacuum energy is deduced from the concept of virtual particles, which are themselves derived from the energy-time uncertainty principle. These virtual particles are conceptually the same as Aether particles. Its effects can be observed in various phenomena such as spontaneous emission, the Casimir 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, according to the Pauli Exclusion Principle, only boson-like energy particles could exist that can simultaneously occupy the same location. 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, where the Aether density is proportional to the gravitational field strength, 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, 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 (just as light accelerates when moving from glass to air) 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 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. This is similar to the mechanism whereby light travels faster when moving from a denser medium like glass to air. 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 drag d is inversely proportional to r and therefore its effect on velocity through the Aether is proportional to r .

Gravitational deceleration g is inversely proportional to the distance squared ($1/r^2$) and therefore the gravitational expansion velocity is proportional to $-1/r$.

Therefore the resultant expansion velocity would be $r - 1/r$.

When r is very large then $-1/r$ tends to zero and the resultant velocity approximates to r .

Therefore the resultant expansion velocity is currently approximately proportional to the universe radius r which is in accordance with the measured expansion of the universe where galaxies are receding at a velocity $v = H_0 * r$ where H_0 is the current Hubble constant.

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 nearer the outer reaches of galaxies than calculations would predict. A hidden gravitational like force was therefore assumed to be present that prevents the stars from 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.

However, this may not be due to a hidden gravitational force at all, but due to frame dragging as described by the Lense-Thirring Effect. Frame dragging can be attributed to Aether being dragged around rotating massive bodies as described in section 2.20. The rotating mass of the rest of the galaxy would contribute to frame dragging of an individual star in a **circumferential** motion about the centre of gravity of the galaxy. As it is a circumferential drag, it would not contribute to the centrifugal force caused by the inertial motion of a moving object travelling in a straight line that counterbalances the galaxy's gravitational pull and determines the star's orbit. This frame dragging would have a more significant effect at the outer reaches of the galaxy where the gravitational pull on a star would be less dominant and lead to a flattening of the rotational speeds of those stars.

Alternatively, if there actually was a hidden extra gravitational force, it could also be attributed to the effects of the Aether. The Aether can be considered to be like a fluid, with perhaps a mass-like property, and whose density is proportional to the strength of the gravitational field and is therefore denser around massive bodies. Therefore as the Aether is denser in galaxies, it could account for the hidden mass which allows the stars to rotate faster around the galaxies than calculations would predict, and prevents them from 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 physics 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 its 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 an extremely small ball shaped object 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. This larger effective diameter would thus allow a larger angular momentum to be obtained without having to spin faster than the speed of light

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 tend to repel each other. This would force them to take up opposite orientations while staying in the same orbital. This would also prevent more than 2 electrons occupying the same orbital.

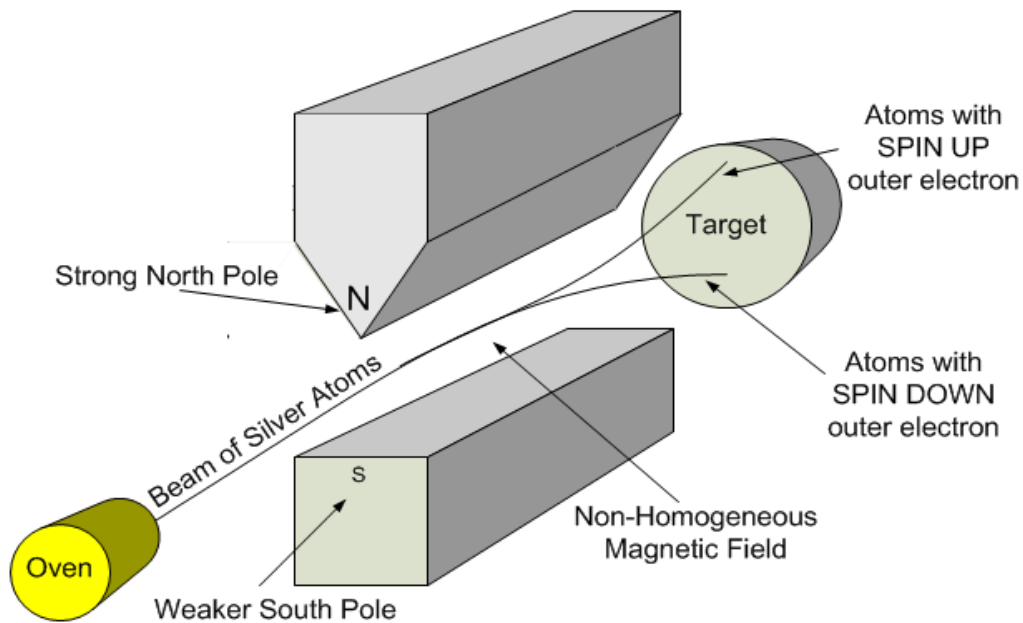
2.13 Stern-Gerlach Experiment

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.

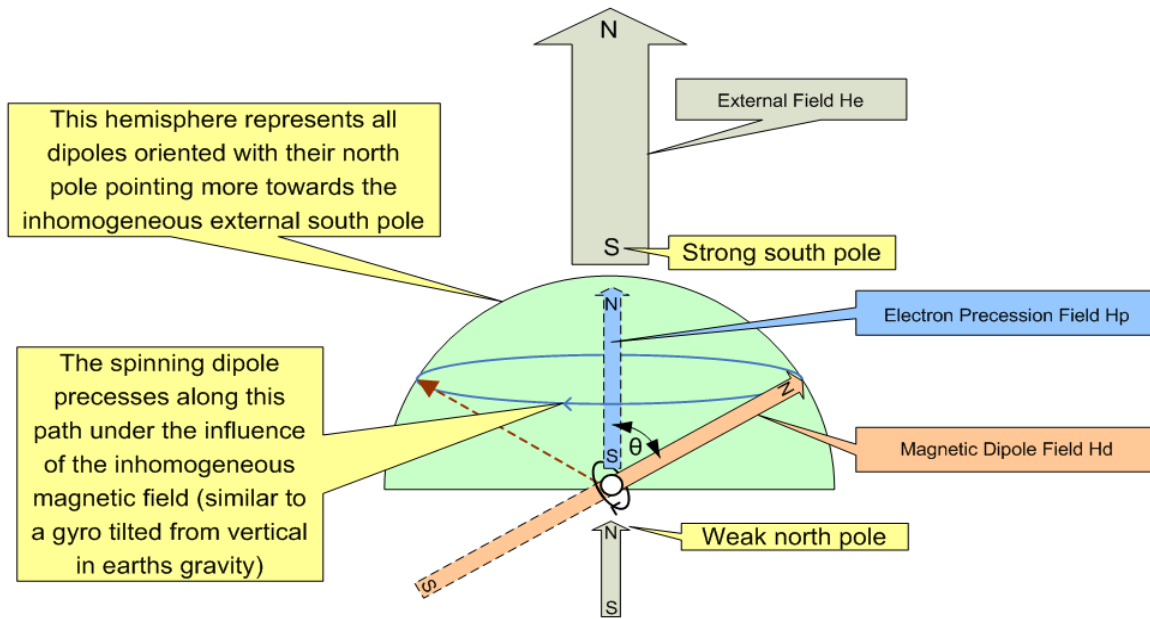
Stern-Gerlach Experiment



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 θ = 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. $F_t = H_e * H_d * [1.2 +/- 0.2]$ in the range $\theta = 0$ to 90 degrees.

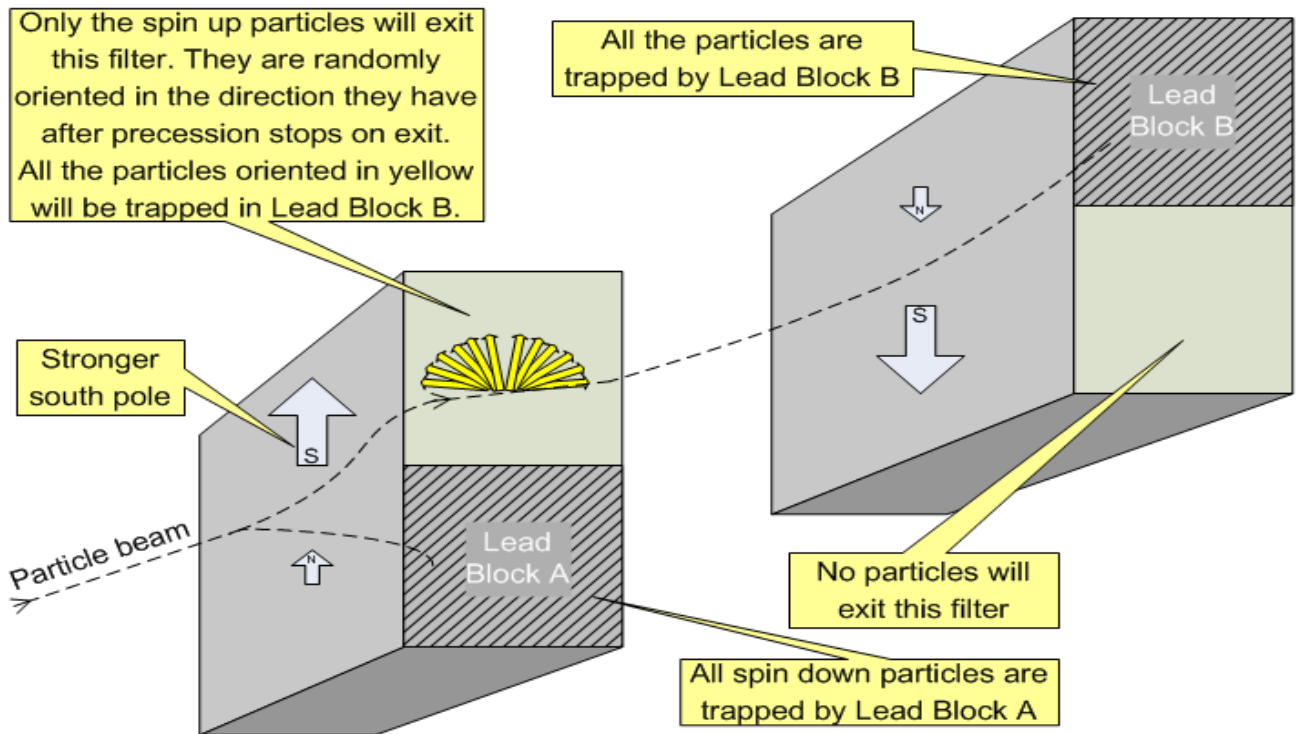
Therefore the deflection force for any angle of dipole is within 16.6%!

This means that the particles will deflect by a fixed amount (within 16.6%) 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.

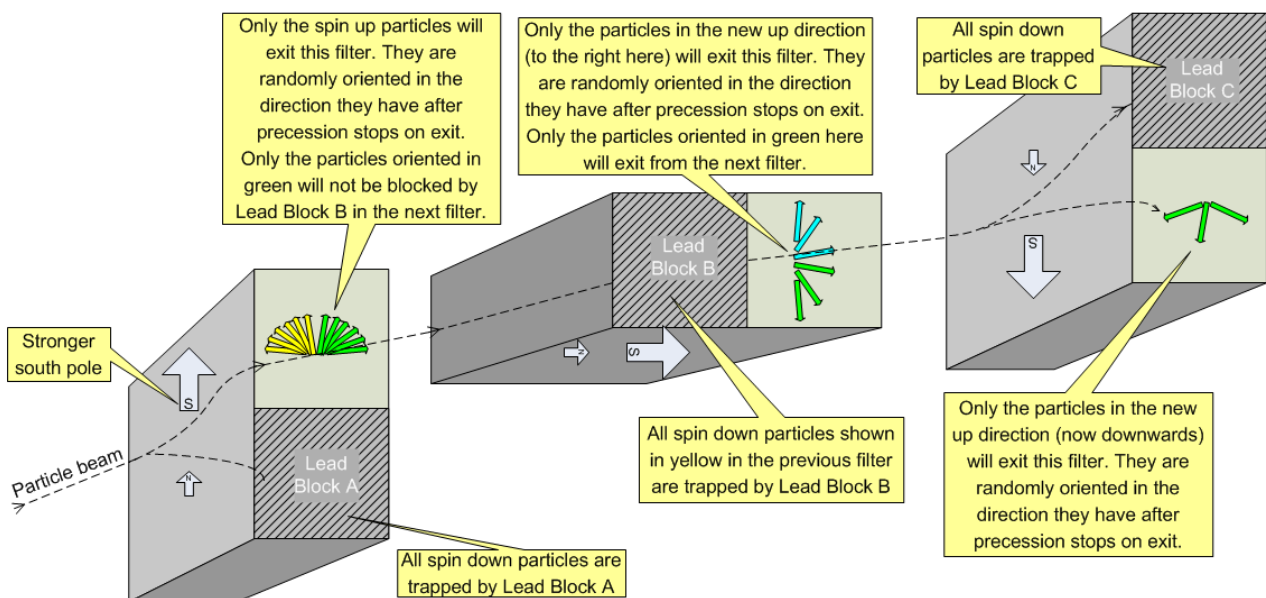
This can be explained as follows –

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. The quarter remaining particles 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.

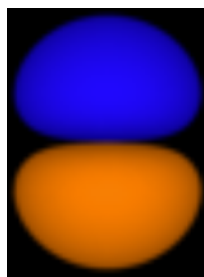
Imagine a rod connecting the entangled particles. If you move one entangled particle the other instantly moves also as they are connected by the rod, they are not dependent on the domino-like movement from Aether particle to Aether particle which is limited to the speed of light. The rod joining the 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 the spin direction of one of the entangled particles, this immediately causes the particles to become disentangled and the 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. Therefore there is nothing 'spooky' about action at a distance that troubled Einstein. 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.

Qubits in quantum computing can be understood to be a '1' or a '0' or both in any combination of probabilities in between at the same time. However what is more likely to be happening again is that the state is uncertain as it is changing between these states so fast during the computation that it is effectively all of these states at the same time.

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 and the amount of interaction with it. 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.

ϕ 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 relatively 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 in absolute terms to measure the same on the physically slower clock!

Note that time does not just **appear** to be slower in higher gravity/ It **is** actually slower, as a clock in higher gravity will have run slower than that in lower gravity. Similarly a twin living in higher gravity will have aged less than the other twin living in lower gravity.

The same cannot be said for length contraction. A ruler in higher gravity when returned to lower gravity cannot be proved to have physically shrunk in higher gravity and then stretched back to normal size in lower gravity. Length contraction can be considered as an artefact of time dilation as distances seem shorter due to it taking less time as measured on the slower clock to travel over any distance.

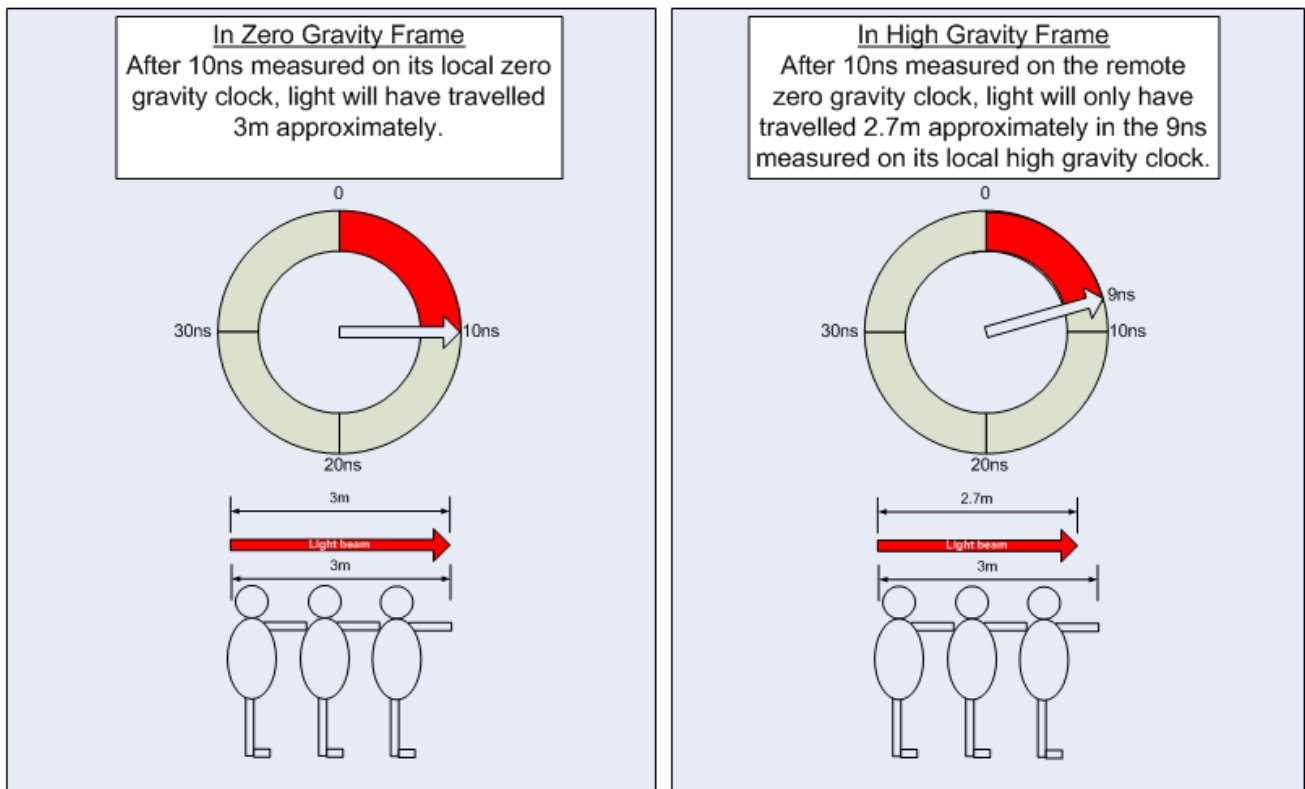
Near a black hole it is said that time slows to a standstill and distances stretch infinitely. However it is difficult to imagine distances physically increasing infinitely near a black hole. It is more logical that time can slow in a similar way to what happens while travelling through water compared to air as it takes longer to travel the same distance in water. It is this that makes distances seem to stretch as it takes longer to travel over the same unchanged physical distance.

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.

The variable speed of light has been observed experimentally when investigating the Shapiro effect (See section 2.21). Experiments showed that sending a radar signal from Earth and bouncing it off Venus or Mercury with the signal passing near the high gravity of the Sun, introduced a delay in the reception of the signal back on Earth due to the Sun's gravitational field. The speed of the radar signal's photons, and by implication also the speed of light, must have been slowed down when observed from the Earth. Note that this delay cannot be accounted for by changes in the path length due to the gravitational bending of light. This is another example of the Aether slowing down light that can be attributed to the Aether being denser in a high gravitational field and resulting in more interactions with Aether particles in its travel.

In the examples below we can see that in near 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.



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.

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.

It is well understood that time slows down the faster something travels according to Einstein's Special Theory of Relativity. This can be accounted for by everything slowing down, including clocks, due to the interaction with the increased number of Aether particles passed through per unit time.

Consider a spaceship with a Caesium clock on board travelling fast through space and shining a light. Time would be relatively slower for the spaceship while travelling faster and we also know that the speed of light measured locally on the spaceship would be the same as that measured locally on a slower moving object.

If a light was shone perpendicular to the direction of travel of the spaceship (to avoid any confusion with the apparent length contraction in the direction of travel) then the distance light travelled in a given time could be measured by a fixed length measuring stick perpendicular to the direction of travel.

Accepting that time slows down while moving faster then why is the speed of light calculated to be the same when measured over the same distance travelled by light with a slower clock than when using a faster clock?

The mechanism for this can be explained by examining the well known analysis of the light clock as shown earlier in section 2.4 (Kinematic Time Dilation).

From that light clock diagram it can be seen that light travelling perpendicular to the direction of travel of the moving clock will have to travel further through space and therefore through more Aether particles. Therefore time and distance travelled will be longer when measuring the transverse speed of light in the faster moving frame resulting in the same locally measured speed of light.

The speed of light through the Aether will always be c , independent of the speed of the object emitting the light and solely determined by the local permeability and permittivity of the vacuum of space.

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 it 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 denser medium slowing down 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.

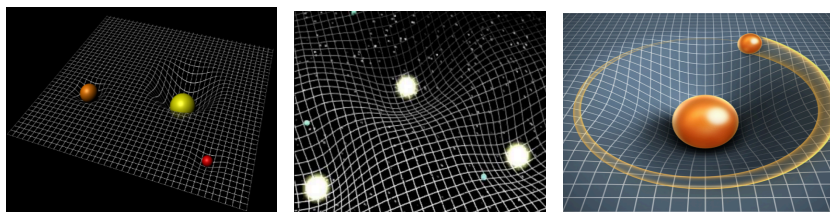
If Aether was the constituent of this free space then we would expect that light would travel more slowly when closer to massive objects where the gravitational field is higher and the Aether is more compressed. This is in agreement with current scientific understanding. For example, light goes slower 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 vacuum 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, some interpret Einstein's General Theory of Relativity as describing gravity as not being 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? Would the attraction between a north and south pole of a pair of magnets be due to warped space? It doesn't seem logical.

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 specific 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 composed 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 space just 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 slowing down of particles such as electrons, protons and neutrons in atoms 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. 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 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 an Aether being dragged like a liquid as the alternative to space-time being dragged around by the rotating mass in Einstein's paradigm.

Under the Lense-Thirring effect, the frame of reference in which a clock ticks the fastest is one which is revolving in the same direction as the rotation of the massive object as viewed 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 locally-rotating frames. For example, imagine someone in space extending their arms when over the equator of a black hole and rotationally at rest with respect to the stars. 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 person 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 atomic particles and photons do not slow more and more the further they travel through a uniformly dense Aether. The Aether just limits the maximum speed that they can travel through a series of Aether particles, taking the same time to travel from Aether particle to Aether particle. Travelling in the opposite direction to the rotating massive object and the dragged Aether leads to more interactions per unit time with the Aether and thus an effective increase in the Aether density. This would therefore slow time and the ageing of atoms and also take longer for photons to travel through it due to it intercepting more Aether particles in their path. Similarly particles going in the same direction as the frame-dragged Aether would result in fewer interactions with the Aether particles and thus the ageing of atoms would be decreased and light would travel faster than if it were travelling against the dragged Aether. This apparent drag on photons is not due to the Aether physically dragging photons by pushing or pulling them but due to the time delays induced by interacting with less or more Aether particles.

2.21 Shapiro Effect

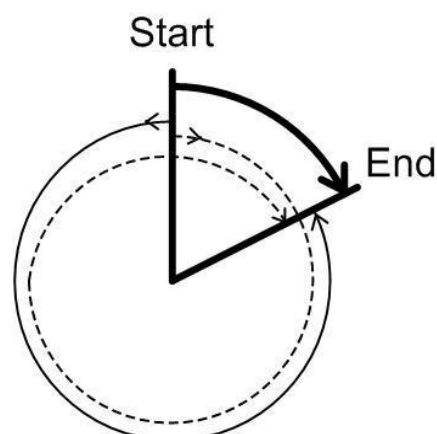
The Shapiro effect is a demonstration of the time delay introduced when a beam of light passes through a high gravitational field and is a specific example of the general effect of gravitational time dilation.

Experiments were performed that sent radar signals from Earth and bounced off Venus or Mercury with the signal passing near the high gravity of the Sun. It was found that a delay was introduced in the reception of the signal back on Earth due to the Sun's gravitational field. The speed of the radar signal's photons, and by implication also the speed of light, must therefore have been slowed down when observed from the Earth. Note that the delay cannot be explained by any deviation in the path of the light beam.

This is another example of the Aether slowing down light that can be attributed to the Aether being denser in a high gravitational field and resulting in more interactions with Aether particles in its travel.

2.22 Sagnac Effect

The Sagnac effect can be illustrated by sending 2 pulses of light from the same point in opposite directions around a circular rotating fibre optic loop. In the illustration below, the light pulses are injected at the start position and the fibre optic apparatus rotated clockwise to the end position where the 2 light pulses are then detected.



It can be seen that the light pulse sent clockwise in the same direction as the rotating apparatus will have to travel further to reach the detection point, which has moved further away, than the pulse sent anticlockwise.

It is found that the speed of light, calculated by dividing the distance the light pulses have travelled by the time taken, is the same for both the clockwise and anticlockwise light pulses.

The same result is found if the light pulses are sent around any closed loop such as an apparatus consisting of a set of mirrors rotated in the vacuum of space.

This therefore rules out the ballistic theory of light propagation where the speed of light is the vector sum of the speed of the emitting object and the speed of light determined by the medium it is travelling through.

The speed of light is simply determined by the local permeability and permittivity which in the case of the vacuum of space is determined by the number of interactions with the Aether particles in a given time.

2.23 Planck's Constant

Planck's constant could arise as a result of the Planck size spacing of Aether particles. A photon would be confined to vibrating at a multiple of this spacing which leads to the discrete quantum energy levels of electrons in an atom that are multiples of Planck's constant.

2.24 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 like a property of the Aether that permeates all space and 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 like 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 can be considered as 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.

2.25 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 simultaneously occupy the same space.

It is also suggested that the General Relativity theory and Quantum Field Theory are incompatible, 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 it is more logical to believe that they actually do have specific positions and velocities. It is just that we cannot measure them 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 modern 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 credible 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 an Aether wind was not 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 the gravitational field of 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. Stellar aberration is not proof that a partially trained Aether does not exist as the Aether does not push or pull photons to the side as if by an Aether wind created by the rotation of the Aether. The Aether simply slows down the speed of light as a result of the delays due to the number of interactions with Aether particles.
2. **Gravitational bending of light**- The denser Aether surrounding large stellar masses causes the light to bend towards them. It is actually being refracted similar to the way 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 ageing.
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. The physical explanation for this is that all particles having lateral movement when moving faster through the Aether results in more interaction with the Aether in a longer zigzag path for them that effectively slows them down.
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 reason for stars rotating faster than predicted nearer the outer reaches of galaxies is more likely to be due to frame dragging that can be explained by Aether drag adding the extra rotational speed. Frame dragging of a star in a circular motion round the rotating mass of the rest of the galaxy would not contribute to the centrifugal force of the straight line inertial motion that counterbalances the galaxy's gravitational pull and determines the star's orbit. Dark matter apparent around colliding galaxies is simply due to the effect of the Aether being dragged like a liquid by the galaxy's gravitational fields. There is therefore no need for a mysterious dark matter.
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 an extremely small ball shaped object 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 a larger electromagnetic vortex surrounding the electron with a larger diameter could provide a larger angular momentum.
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 within a small range and so the deflection force for any angle of dipole is limited to a small band.
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 directly 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 clocks tick faster when travelling in the direction of rotation in the vicinity of a massive object than when moving against the direction of rotation. Similarly light will travel faster in the direction of rotation of a massive object. This is due to the Aether which acts like a liquid being dragged

along by the rotating body and causing photons as well as atomic particles in their orbitals to speed up or slow down as they interact with less or more Aether particles in their travel.

21. **Shapiro Effect** – The time delay introduced when light travels through a higher gravity field illustrates that the speed of light has been slowed down and can be explained by the Aether being denser in a higher gravitational field due to the increased number of interactions with the Aether.
22. **Sagnac Effect** – This rules out the ballistic theory of light propagation where the speed of light is the vector sum of the speed of the emitting object and the speed of light determined by the medium it is travelling through and confirms that the speed of light is simply determined by the local permeability and permittivity which in the case of the vacuum of space is determined by the number of interactions with the Aether particles in a given time.
23. **Planck's constant** – This could be explained by the spacing of Planck size Aether particles that results in the discrete quantum energy levels of electrons in an atom.
24. **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.
25. **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. Only boson-like energy particles can exist that can simultaneously occupy the same space. 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.
