# Dynamic aether from spin2 bosons

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## Abstract

It is postulated that the vacuum of space is filled with a dynamic primordial aether; boson particles moving at the speed of light, forming a tensor flux of spin=2 massless bosons. Each aether particle consists of two destructively interfering spin=1 bosons.

This dynamic aether is compatible with known concepts of spacetime, and further leads to an understanding of the unstoppable arrow of time, and the mechanisms that slow clocks at velocity or in a gravity well.

Mass, energy and momentum is understood, Fermions that interact with the aether gain the property of mass. From the well-known equation $E=mc^2$, E is seen as only the portion of aether that interacts with mass. When a mass is set in motion, the aether bosons traversing an object is perturbed to not only reflect its energy and momentum, but the aether also perpetuates the motion. Further, an equivalence exists; a mass which finds itself in an asymmetric aether, is driven by the aether toward a constant velocity. This may lead to further investigations into the mechanics of gravity.

# Index

# Introduction

## Definition and broad history

**Oxford synonyms for Vacuum: “empty space, emptiness, void, nothingness”**

In a thought experiment, consider two separate points in the vacuum of space, A and B.

- If there is nothing between A and B, then A and B must at the same coordinates, and travel from A to B should be in zero time.
- If the properties of the nothingness allow A and B at different locations, and cannot be traversed within zero time, then the logical conclusion must be that it would take an infinite time to traverse, because nothingness cannot be traversed.

Since the vacuum of space has at the very least the properties of dimension, it cannot be seen as ‘the nothingness’. Traversing space involves both distance and time.

**Oxford Dictionary description of Aether: “The 'luminiferous' aether was the medium that pervaded all space, and in which electromagnetic waves existed, postulated by 19th-century physics.”**

This hypothetical aether, being an absolute and static frame of reference, was widely accepted by scientists in the late 1800s, without any real proof of its existence at the time. Maxwell presented his now famous equations, [1865] which showed electromagnetics as ‘waves in space’, which was believed to require a medium to propagate. The concept of space, also dubbed ‘the aether’ had already become a headache for scientists.

Michelson and Morley (M&M) [1887] set out an experiment to test for the existence of an aether but failed to do so. To this day their null result is offered as proof of a non-existence of an aether, even though their failure to detect was not proof of its non-existence. However, to date no tangible proof of aether has been presented.

The Lorentz[1] aether theory [1904] offered a mathematical solution to some of the physics problems of that time, which included an attempt to explain the M&M null result through length contraction of their experimental apparatus.

Einstein [1905] offered his Theory of Special Relativity[2] (SR) as a solution which had no requirement for an aether, but does not prove its non existence. Einstein followed [1916] with his Theory of General Relativity[3] (GR), which could be interpreted as an aether theory, after which the search for a ‘plastic’ or flexible aether continued. Interestingly, in 1920, Einstein acceded that an aether must exist[4] but since no proof of the aether was evident, and SR and GR were sufficient to explain relativistic effects, without requiring a static aether or an absolute reference frame, the search for the aether became subdued.

## Introducing the dynamic aether

Einstein [1920]: “Recapitulating, we may say that according to the general theory of relativity **space is endowed with physical qualities**; in this sense, therefore, **there exists an ether**. According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time.”

Riemann, as quoted by Daniela Wünsch[5]:
“The effects of ponderable matter on ponderable matter are:
1) attractive and repulsive forces inversely proportional to the square of the distance
2) light and radiating heat.
Both classes of phenomena may be explained if one assumes, that the whole infinite space is filled with a uniform substance and each particle of this substance acts directly on its environment.”

An aether in the form of an omnidirectional flux has previously been proposed in many forms; notably by the publication of Le Sage [1748], which was based on the original idea (non-published) of Fatio [1690]. These, and other ‘push-gravity’ and ‘flow-of-space’ or ‘shadow-gravity’ theories[6-10] have been met with vehement resistance yet also valid objections[11-13] by many prominent scientists.

### Omnidirectional boson flux as the dynamic aether

Postulate: The void of space, ‘the vacuum’ consists of a dynamic aether which is an omnidirectional boson particle flow. This aether is not infinitely divisible but is quantised into compound bosons of spin=2. With each spin=2 boson consisting of two mutually destructive interfering spin=1 bosons, it presents itself as a boson spin = 2 tensor field. The boson flux is omnidirectional at the speed of light.

Space provides a concept of 3 dimensions. Moving space, by way of a boson flux, adds the $4^{th}$ dimension, time.

The boson flux will in this document be labelled ‘dynamic aether’ or ‘aether’, and is not to be confused with the static aether theory of Lorentz[1], nor with the corpuscles flux of the push-gravity theory of Le Sage[6-10]. In legacy, the fixed aether has been described in many attempts, started by Young, Fresnel and Poisson[1828] as being an elastic solid, followed by others as a flexible fabric, a superfluid, a quantum foam, or by Sagnac[14] as a “motionless mechanical aether”. M&M’s null result cast a shadow over the concept of a stationery or even moving aether. In this model none of these concepts apply. A closer analogy may be

found with the zero-point field of Rueda and Haisch[15], or the paired photon vacuum of Grahn, Annila and Kolehmainen[16], or the aether frame of Giuseppe and Bartocci[17].

Note: Since SR does not forbid the presence of an aether, and GR essentially implies its existence, this document does not set out to challenge SR or GR in any form.

**Masud Mansuripur and Pfeiffer et al**:

Because this model leans heavily on the principle that 'photons impart momentum', and not 'photons impart force', a brief introduction of this concept is offered here.

Having described the dynamic aether as a boson flux, it is plausible to ascribe properties and interactions to a flux of bosons, where the aether might interact with objects of mass in a 'photon-like' manner.

Masud Mansuripur describes transfer of a constant momentum from a photon in a non-dispersive medium[18]:

> *When the pulse first enters the dielectric slab, the positive force of its leading edge accelerates the slab. The acceleration continues until the trailing edge enters, at which point the net force returns to zero. If the mass of the slab is denoted by M – this could include the mass of the Earth, to which the slab is attached – its acquired momentum will be given by the integrated force over the pulse duration, namely, MV = ¼$\varepsilon_o(\varepsilon - 1)E_o^2 A\Delta T$. [This reduces to MV = ½$(n^2 - 1)hf/nc$ for a single photon.] So long as the pulse stays within the slab this acquired momentum remains constant. However, as soon as the leading edge of the pulse exits through the slab's rear facet, the trailing edge begins to exert a braking force to slow down the slab's motion. By the time the trailing edge leaves the slab, the motion has come to a halt, and all the momentum initially acquired by the slab has returned to the light pulse*

Pfeiffer et al similarly describes a transfer of a constant velocity[19]:

> *…the block accelerates away from the beam source while it is traversed by the leading edge of the beam, then continues to travel away from the source at constant velocity while the beam is turned on. When the beam is turned off, traversal of the trailing edge restores the block to rest…*

A few points to consider before proceeding:

- Number of photons in transit do not stack onto the imposed velocity, and thus do not add more onto the imposed momentum. However, a large composite object may be seen as consisting of many fundamental particles, which at any moment may each have

a momentum imparted by one or more photons. If the photons are all equal in energy, there is still only one velocity imposed on the composite mass. One particle of mass ‘m’ with one photon traversing, result P=1m*v. Two identical particles with one photon traversing each, result P=2m*v which is seen as momentum of a ‘larger object’. It does not stack for one particle of mass ‘m’ with two photons traversing, because ultimate velocity is still only v, so resulting P=1m*v, no matter how many photons in one particle.

- It cannot naively be assumed that a velocity or momentum will be imparted on an object in ‘0’ time. Inertial effects apply, and an object will accelerate toward the photon-imposed velocity until it reaches said velocity. While accelerating toward the imposed velocity, it appears as if a force is acting on the object, but the ‘force’ must eventually fade away as the object nears the imposed velocity. Here it is expected that ‘more photons in transit’ will add to the acceleration, even if not to the velocity.
- According to Mansuripur, one photon will impose a velocity but brake the object again as soon as it exits. However, an object of mass cannot move equal or faster than light so when the one photon enters and then exits, the exit point of the mass cannot yet have moved. The object may only experience a brief ‘pressure’ from the photon transit.
- If a stream of photons transit through the object, the object will attain a velocity, and exit photons will not ‘stop’ the object while the beam persists.

## A dynamic aether provides the foundation for spacetime.

Thought experiment: The observer may imagine themselves being in empty space, looking in all possible directions, and from all these directions are approaching a never-ending stream of ‘photon-like’ particles. The observer finds themselves mostly transparent to these particles, which briefly and very lightly interact, and then be on their way again.


*Figure 1: Mass is stable in a symmetric omnidirectional (3D space) dynamic aether.*

Consider [Figure 1]. A macroscopic composite mass in equilibrium within the dynamic aether, with equilibrium understood as there being no asymmetry in the aether. When no direction in the aether holds an energy advantage, the composite mass remains stable, and

no net momentum is imposed. A quantum-sized object will surely be flung about by the individual aether particles, but this is not for the consideration of this document.

**Ticking Mechanism and Time**: Even when an object is ‘at rest’ it is still moving through time. The proposed dynamic aether introduces a fundamental mechanism for the behaviour of atoms and the perception of time. Imagine this aether as a sea of flowing spin-2 bosons. When they interact with components of atoms, they induce a 'ticking' mechanism, influencing the internal processes and evolution of atoms. This 'ticking' is what is perceived as the passage of time. Without aether, time does not exist. Thus time does not exist of itself, but it is an effect of moving space.

**Creation of Spacetime**: The dynamic aether's bosons travel at the speed of light from all directions. This constant motion allows witnessing of events in three-dimensional space. With one eye closed a person may perceive two dimensions and have a limited sense of distance based on experiences. With two eyes, the third dimension is experienced. When we think of 'distance,' it is intricately linked to bosons’ speed—the speed of light, and the ultimate speed limit of the universe. The dynamic aether's continuous flux of bosons sets this cosmic speed limit and forms the fundamental framework upon which we build our understanding of space and distance. Rather than thinking of aether moving at the speed of light, this aether defines the speed of light, and light and all associated EM waves move at the speed of aether.

The 'ticking' mechanism introduced by the aether's interactions with atoms provides a foundation for measuring local time. As objects experience different intensities of the boson flux in different reference frames, their internal clocks tick at varying rates, defining their individual perception of time and distance.

For example, an object in motion, or in a gravitational field, finds its ticking mechanism is altered and reduced. This leads to a slower progression of time for the object experiencing these conditions, but it also makes the outside world appear to tick faster.

An object that moves in a relative frame to the boson flux, will also perceive space differently, and will unknowingly experience distances as shortened.

Lorentzian, SR and GR mathematics of time and space are well-known. This intricate interplay forms the core of our understanding of the universe's fabric.

**Kinetic and potential energy**:

Kinetic energy will be further investigated in this document. Here is a brief introduction.

**Kinetic energy**: The earlier introduction of a photon in transit of a mass showed that a photon imparts a velocity or momentum onto the mass. The information of the velocity is contained within the transit photon, and by extension the information of kinetic energy that the object has gained, resides in this photon. Increasing the object's kinetic energy via external forces will increase the energy of the transit photon. Adding energy to the transit photon (before or during transit) adds velocity and kinetic energy to the object. When the object slows down or comes 'to a halt' energy is subtracted from the transit photon and released from the object back into the aether.

**Potential energy**: Consider an object that is prevented from downward motion in a gravitational field, e.g. a rock on the top edge of a cliff. It finds itself lying in an asymmetric aether which pressures it down onto the rock. This pressure implies it has the potential to gain velocity and thus kinetic energy. It is said the rock on the cliff has potential energy and this will be so for as long as the rock and the aether asymmetry remains in place. However, the actual energy of the rock's 'potential' remains in the asymmetric aether and cannot be harvested from the rock where it lies.

**Mechanics of gravity**

Comparing Mansuripur's and Pfeiffer's beams of photons to an asymmetric aether; A constant velocity will thus be imposed on an object of mass in an asymmetric omnidirectional aether, toward a vector direction in which the asymmetry is strongest. Depending on 'beam' strength, an inertial mass will accelerate (over time) until it acquires this velocity imposed by the beam. Gravity is thus not a force, but objects are pushed by asymmetric (curved) space. This work is further pursued in a separate document.

**Origin of the dynamic aether**

The origin of the dynamic aether, the spin-2 boson flux, remains unknown.

Some speculation may be had as to what its origin is, or is not:

- Matter must be mostly transparent to the aether. Radiation from known sources, e.g. stars, are excluded.
- The dynamic aether cannot be radiated from known matter particles because this would create a repulsive effect that would at the least negate gravity and at the most possibly even negate the weak or the strong force.

## Energy, Momentum and Mass from a dynamic aether

- *Postulate: If, according to Mansuripur and Pfeiffer et al, a photon will attempt to move a slab at constant velocity, then by equivalence (and from known observations of Doppler effects), a slab that is given a changed velocity, must also perturb photons entering or*

*exiting. Photons moving parallel direction to the object will be compressed (blueshifted) and photons going anti-parallel will be stretched (redshifted). This also affects any photons entering after acceleration has commenced.*

Consider an imaginary point in space where there might exist a complete symmetry in the surrounding dynamic aether. This point, as per [Figure 1], or others like it, may have been a standard frame of reference to which all other objects could relate. Alas, even if there had ever been such a point, it would no longer exist due to the fluid dynamics of this ever-moving universe. This part of the exercise will remain hypothetic but proves to be essential in the analysis of the concept.

This point in space can be seen in all coordinate systems where under conservation of energy and x-momentum, (not accounting for expanding space) divergence in time and space-momentum is zero, it can be treated as a tensor in Einstein summation index form. For an object in this symmetric aether, as in [Figure 1], the energy and x-momentum divergence from all reference frames equals zero. (Not accounting for quantum level asymmetry)

$$\nabla_v T^{tv} = \nabla_v T^{xv} = 0$$

On average, at this small region in space there exists for all aether bosons, with energy vectors $\mathbf{E}_i(r,\theta,\varphi)$, a probable and equal opposite $-\mathbf{E}_i(r,\theta,\varphi)$, so that in Cartesian coordinates, the sum components of all the (x) energy components equal zero:

$$\overrightarrow{E_0}\hat{x} = \sum_i \overrightarrow{E_r} * sin\theta_i * cos\varphi_i \hat{x} \simeq 0 \qquad Eq1$$

Define then, $E_0$ from [Eq1], as only those aether bosons that may interact with an object, where it is still considered that a very large fraction of aether would not interact and would merely 'flow through' normal atomic matter.

Distinguish then between aether bosons entering and leaving the object, and splitting each into two opposing vector components represented on the (x) axis, as shown in [Eq2] and [Eq3] and visualised in [Figure 2]:

$$\overrightarrow{E_{0in}}\hat{x} = \overrightarrow{E_{01in}}\hat{x} + \overrightarrow{E_{02in}}\hat{x} \simeq 0 \qquad Eq2$$

And (not shown in [Figure 2]), outgoing bosons:

$$\overrightarrow{E_{0out}}\hat{x} = \overrightarrow{E_{01out}}\hat{x} + \overrightarrow{E_{02out}}\hat{x} \simeq 0 \qquad Eq3$$

And so for the (y,z) coordinates in a symmetric aether, which is not considered further:

$$\overrightarrow{E_{0in}}\hat{y} = \overrightarrow{E_{01out}}\hat{y} = \overrightarrow{E_{02in}}\hat{z} = \overrightarrow{E_{02out}}\hat{z} \simeq 0 \qquad \textit{Eq4}$$

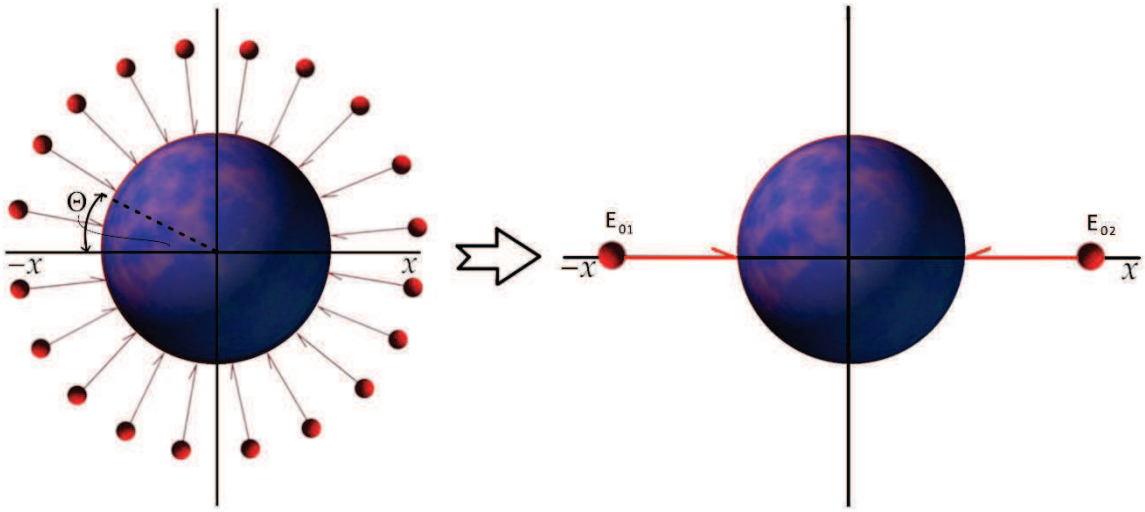


*Figure 2: For this exercise, only the x-direction components of all inward aether bosons are summed up over all directions of space, and then represented as ±X components.*

The net vector sum of all boson energies in a symmetric aether will approach to zero. The net flux in [Figure 2, right] is presented as two single x-momentum (tensor component) bosons approaching the object, of equal energy but from opposite direction on the +x and -x axes, so that the object does not gain any momentum from these bosons combined. The sum of the energies $E_{0i}$ of the initial bosons entering the object, and from [Eq2], can be represented in a symmetric dynamic aether shown in [Eq5]:

$$|E_{01}| = |E_{02}| = \left|\frac{E_0}{2}\right| \qquad \textit{Eq5}$$

**Charlie team's machine converts energy pellets to velocity**

Thought experiment. Team Charlie and team Alex find themselves in a spot in flat space that has a symmetric surrounding aether.

Charlie team has a machine that converts energy pellets to kinetic energy. By burning 1 pellet, (very precise pellets these are) they may achieve an exact change in velocity v for themselves.

For this exercise, ignore the loss of mass from burning a pellet. Charlie team goes ahead and burns 1 pellet. They feel themselves accelerating briefly and conclude soon there-after they have attained a stable velocity 'v' as expected, relative to Alex team. Unbeknownst to Charlie team, they enter an asymmetric aether from the moment they start gaining a velocity. Their clocks are slowed, and their perception of distance is affected. They do not realise that their own measurement of time, space and thus velocity is distorted.[1,2]

The Alex team observed all this, and while knowing for certain that they also started in a symmetric aether, and they did not accelerate themselves, concludes that Charlie team is moving. However, they measure that Charlie team's velocity is less than v, and that Charlie team has only attained a velocity of v/ γ, where γ>1 (γ is the Lorentz factor). Since Alex team's clocks have not moved and thus not changed, this is taken as a trusted result and reflects the true velocity of the Charlie team.

Charlie team burns more pellets, and proclaims their velocity must be 2v, 3v, …. Each time, Alex team responds that γ is getting bigger and Charlie team measures their velocity more wrong than before.

It is as if each time a pellet gets converted to velocity, space pushes back harder against the change in momentum. Seen in another way, if Charlie team had wanted to increase their velocity by a set fixed amount, they needed to burn γ*pellet at each attempt.

Let the object in [Figure 3], be Charlie team and their machine, as observed by Alex team. At the instant of acceleration of the object, the two aether bosons $\pm E_{0i}$ (which are the +x and -x sum of all aether bosons, as introduced in [Figure 2]) are transformed while inside the object. Showing 2 equal but opposite bosons for $E_{0i}$ entering, so that they transform as bosons $E_1 > E_{01}$ (blueshifted) and $E_2 < E_{02}$ (redshifted) in the object:

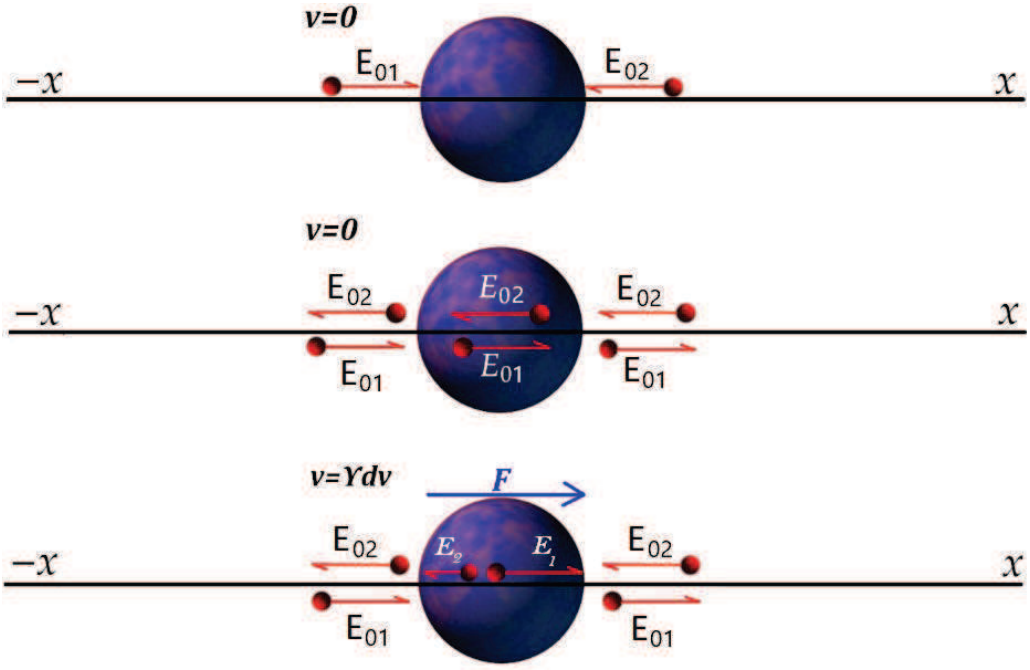


*Figure 3: From an observer point of view, the bosons transiting the object are transformed when the object gains velocity. Top picture: the aether bosons are shown around the object as symmetric ± $E_{0i}$. Mid picture: the object is transparent to the bosons and ± $E_{0i}$ is also shown in transit within the object and exiting unperturbed. Bottom picture: The object is accelerated and the bosons in transit are transformed to $E_1$ and $E_2$, blue-shifted and red-shifted respectively. The surrounding aether bosons remain undisturbed to an external observer. (arrow lengths are not to scale, and represent vector strengths, not boson wavelengths)*

## Method

From the relativistic Doppler equation[19,20], we get the energy of the transformed transit bosons, shown in the bottom of [Figure 3] as $E_1$ and $E_2$:

$$|E_1| = |E_{01}| * \sqrt{\frac{c+dv}{c-dv}} \qquad \textit{Eq6}$$

$$|E_2| = |E_{02}| * \sqrt{\frac{c-dv}{c+dv}} \qquad \textit{Eq7}$$

$$\frac{|E_1|}{|E_{01}|} + \frac{|E_2|}{|E_{02}|} = \sqrt{\frac{c+dv}{c-dv}} + \sqrt{\frac{c-dv}{c+dv}} \qquad \textit{Eq8}$$

But from [Eq5] and simplifying the right-hand side,

$$\frac{|E_1| + |E_2|}{\left|\frac{E_0}{2}\right|} = \frac{2}{\sqrt{1-\frac{dv^2}{c^2}}} \qquad \textit{Eq9}$$

$$\frac{|E_1| + |E_2|}{|E_0|} = \frac{1}{\sqrt{1-\frac{dv^2}{c^2}}} \qquad \textit{Eq10}$$

Reveals the total energy of the transformed bosons as:

$$|E_1| + |E_2| = \gamma * |E_0| \qquad \textit{Eq11}$$

Direction for net acceleration was chosen as +x. A force F was applied to the object, in vector direction +x. According to an observer, the object experienced a relativistic change in velocity in the +x direction, where:

$$\gamma = \frac{1}{\sqrt{1-\frac{dv^2}{c^2}}} \qquad \textit{Eq12}$$

For an object accelerating from rest, after a unit of time dt (set dt=1), the velocity of the object will be dv, in the +x direction.

### Result: Kinetic energy of the object equates to change in total energy of the transiting boson particles.

Change in energy can be calculated by comparing with the total energy of both the bosons. From [Eq11]:

$$|E_1| + |E_2| - |E_0| = |E_0| * (\gamma - 1) \qquad \textit{Eq13}$$

It is already known that for a relativistic object that has been accelerated, its change in energy is the kinetic energy gained by a mass m:

$$|E_k| = (\gamma - 1) * mc^2 \qquad \textit{Eq14}$$

Until this point the object has been referred to as 'object' only. By comparing change in energy of the boson aether interacting with the object [Eq13] to the known change in kinetic energy [Eq14] of the object itself, it reveals the object's inertial mass (m) as a result from aether interaction:

$$\frac{|E_0|}{c^2} = m \qquad \textit{Eq15}$$

**Result: Momentum of the mass equates to difference in energy between transiting boson particles in vector direction.**

In a different approach the resulting bosons indicate the state of motion (dv) of the object, where $|E_1+E_2|=|E_1|-|E_2|$ is the net energy within the object. From [Eq6] and [Eq7]:

$$|E_1| - |E_2| = \frac{dv}{c} * \gamma * |E_0| \qquad \textit{Eq16}$$

Consider for an object in motion the momentum P can be shown as:

$$P = \frac{|E_1| - |E_2|}{c} = \gamma * m * dv \qquad \textit{Eq17}$$

Comparing momentum from [Eq16] and [Eq17], the mass (m) of the object is again revealed from aether interaction:

$$\gamma * m * dv = \frac{dv}{c^2} * \gamma * |E_0| \qquad \textit{Eq18}$$

And once again reveals inertial mass as a result of aether interaction:

$$\frac{|E_0|}{c^2} = m \qquad \textit{Eq19}$$

**Result: Total energy of mass is the sum of energies of transiting boson particles**

A next approach takes the total energy of the transformed particles $E_1$ and $E_2$:

$$|E_1| + |E_2| = |E_0| * (\gamma - 1) + |E_0| \qquad \textit{Eq20}$$

Then from [Eq14] and [Eq15] above, for an object with kinetic energy:

$$|E_k| + mc^2 = |E_1| + |E_2| = \gamma |E_0| \qquad \textit{Eq21}$$

Confirm this as a calculation from total energy 4-vector equation, where:

$$|E_t|^2 = (mc^2)^2 + (pc)^2 \qquad Eq22$$

In terms of boson energies, from [Eq15] and [Eq17],

$$|E_t|^2 = |E_0|^2 + (|E_1| - |E_2|)^2 \qquad Eq23$$

Equals

$$|E_t|^2 = |E_0|^2 + |E_1|^2 - 2|E_1||E_2| + |E_2|^2 \qquad Eq24$$

Add and subtract 2*E1E2,

$$|E_t|^2 = |E_0|^2 + |E_1|^2 + 2|E_1||E_2| + |E_2|^2 - 4|E_1||E_2| \qquad Eq25$$

From[Eq5], [Eq6], [Eq7],

$$|E_t|^2 = |E_0|^2 + (|E_1| + |E_2|)^2 - |E_0|^2 \qquad Eq26$$

Confirms,

$$|E_t| = \gamma|E_0| \qquad Eq27$$

with a reminder that $E_0$, $E_{01}$, $E_{02}$, $E_1$, $E_2$ represent sums of x-components of only bosons that interact with the object and not representative of the entire aether strength.

### Result: Mass is a measure of surrounding dynamic aether's energy

From [Eq15] and [Eq19]above, it is evident that the value of mass, 'm', arises from the local strength of the dynamic aether '$E_0$'.

## Discussion of Doppler equations in a dynamic aether

The equations reveal the relations of mass, kinetic energy, momentum, and total energy of a mass interacting with the dynamic aether, as viewed from a stationary observer. An observer sees the background aether ($E_0$) undisturbed and sees the bosons in transit of the mass get disturbed to $E_1$ and $E_2$. Through manipulation of $E_1$ and $E_2$, the momentum [Eq17] and the absorbed kinetic energy [Eq13**Error! Reference source not found.**] of the object can be derived. Total energy always remain a combination of the original energy $E_0$, multiplied by γ the Lorentz factor.

Note: $E_1+E_2 > E_0$ because $\gamma > 1$ for all v < c and $E_1 > E_{0i} > E_2$ are typical Doppler results.

The currently understood premise of $E=mc^2$ is that energy and mass are interchangeable, or that mass is but one of the many forms of energy. This is a well-established theory. Poincare's aether fluid-mass-density of $E/c^2$ also comes to mind, but here E was proposed as the total aether energy.
Here it has been shown that momentum or kinetic energy is gained though absorption of (boson-like) aether energy, which is from the same energy that reveals the mass.

The formulation of [Eq15] and [Eq19] was intentional to show.

$$\frac{|E_0|}{c^2} = m \qquad \textit{Eq28}$$

It is common knowledge that 'c' represents the speed of light. It is not so common knowledge what $c^2$ would be doing in the equation above. Considering the known properties of space,

$$\frac{1}{c^2} = \mathcal{E}_0 \mathcal{U}_0 \qquad \textit{Eq29}$$

where $\mathcal{E}_0$ and $\mathcal{U}_0$ are the electrical permittivity and the magnetic permeability of space, then,

$$\mathcal{E}_0 \mathcal{U}_0 |E_0| = m \qquad \textit{Eq30}$$

provides a more intuitive understanding of how the property of mass arises from interacting with the vacuum.

It has been argued that the inertial mass of an object is a measure of energies of boson in transit in the mass; a dynamic aether to which all mass is (mostly) transparent will reveal the mass of the object in any direction in which it is accelerated. Inertial mass is apparent for the duration of acceleration (or change in velocity). During acceleration, the bosons in the mass are perturbed, as in the $E_1$, $E_2$ argument above, in a ratio to the gained energy of the mass.

$E_0$ represents the prime reference frame for both mass and observer. Also, to be reminded that $E_0$ is only a linear, one dimensional, representation of an omnidirectional dynamic aether. It should be noted that for a larger mass, it is not expected that $E_0$ would signify a greater energy for each particle, but as shown in [Figure 4], that a larger mass would contain more bosons in transit, proportional to the volume and density of the mass. The conclusion then is that the 'E' in $E=mc^2$ is the measure of a portion of aether energy that interacts with the mass.

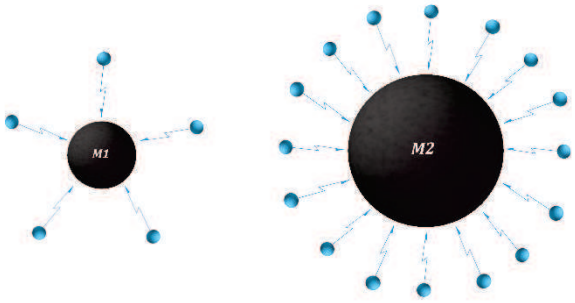


*Figure 4: Small mass, fewer boson interactions; large mass, more boson interactions. Not 'bigger' bosons for larger mass.*

All objects with mass interact with (perturb during acceleration) the aether bosons that are in transit. It is from interaction with the bosons in the dynamic aether that its mass is defined as a resistance to acceleration. If it does not interact, it does not have mass, e.g., other photon- or boson-like particles. If it interacts only a little, it will have low mass, e.g., neutrino or electron.

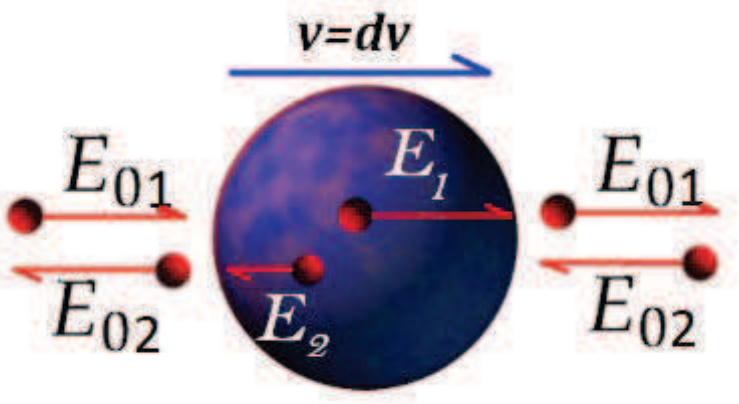


*Figure 5: As seen from the viewpoint of an observer: Once the mass is no longer accelerating, new bosons transiting the mass are continuously perturbed. The net energy in the mass remains constant, and the enveloping aether remains undisturbed. A mass in motion remains in motion unless another force enacts upon it. (Newton's 1st law)*

Once acceleration ends, and the object is in constant motion, the energy of bosons entering, and exiting, are changed (as they enter and exit) to perpetuate the momentum of the object. No energy is lost, so an observer will continue to see the bosons enter as $E_{0i}$, transformed inside the moving object (gain or lose energy) as $E_1$ and $E_2$, and exit again (lose or gain energy) restored as $E_{0i}$. See [Figure 5].

It is as if the observer sees a 'beam' traversing the object and attributing a constant velocity to the mass, as predicted by Mansuripur and Pfeiffer et al.

The dynamic aether does not resist constant motion, and no drag effect will ensue, unless v>c. {Newton's first law, and also Minkowski's straight worldline[22]} The moving mass is now also in a different reference frame in the aether, relative to an observer that did not accelerate, and from here-on they will have a relativistic relationship, as per Einstein's Special Relativity. However, if no knowledge of primordial aether $E_0$ was available at some velocity reference frame, the inertial mass of the object will appear to an observer in that new frame as $\gamma * E_0$, and thus a new $\gamma=1$ is assigned for velocity effects that may already occur within that reference frame. The observer too is unaware of $E_0$, and all laws of physics remain valid.

Further consideration is that the absorption of transit bosons, and the transformation of $E_{0i}$ to $E_1$ and $E_2$, and subsequent velocity v, must happen in a finite time.

It can thus be reasoned that the velocity imposed by an asymmetric aether will equal the escape velocity $V_e$ in the vicinity of an object of mass. Two arguments immediately assist toward this reasoning:

1. An object approaching a gravitational source, starting with zero velocity from an infinite distance, will reach the imposed velocity $V_e$ when it collides.

$$V_e = \sqrt{\frac{2GM}{r}} \qquad \textit{Eq31}$$

2. The SR time dilation T' has the same value for an object travelling in space at velocity $V_e$, as it is for GR time dilation T' of an object on the surface of a large gravity source.

$$T' = \sqrt{1 - \frac{V_e}{c^2}} * T_0 \qquad \textit{Eq32}$$

## Conclusion

A conceptual analysis has been presented in motivation for space as a dynamic aether, an omnidirectional tensor boson flux, to which matter is mostly transparent, and from which equations of mass, kinetic energy and momentum can be derived.

Space is observed to exist as an aether of ‘photon-like’ particles, at velocity ‘c’. Time as the $4^{th}$ dimension arises from the premise that the aether is quantised, and each quantum of ‘time’ must be ‘ticked off’ by transit of aether bosons through fermionic matter. An example of aether asymmetry may be around objects of mass. Should an object find itself in an asymmetric aether, its clock will be slowed, and a velocity will be imposed. Inertial effects prevent this velocity from being reached ‘instantly’.

Through interaction with the dynamic aether, mass is emergent. If a mass is accelerated in a symmetric aether, its mass is observed as a function of the strength of the local aether.

An asymmetric aether will impart momentum (positive or negative) to an object. For an inertial mass, this happens in a finite time; it is accelerated by an asymmetric aether toward a constant velocity.

Time dilation results from an asymmetric aether. Further study is required to confirm the mechanics of gravity arising from an asymmetric aether.

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