

Article

Aether: Immaterial Substance & the God of Physicists (Part I)

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ABSTRACT

In this four-part article, I argue, as many others do, that the aether is the physical but non-material substance from which the universe came to exist. To exist, things must be in spacetime, but the aether is not in spacetime, it is before spacetime. It is, but does not exist as matter. It is all permeating and non-dimensional; it is inside and between particles; it is everywhere. Everything is made from it, even the space that surrounds us. It is indivisible, or it would not be the aether as it was defined thousands of years ago. Wholeness in space and time is what allowed Nature to evolve. Holistic awareness, or self-reference, emerges from an inward necessity which is satisfied as information is chosen from the context in which a system evolves. Human consciousness evolved from the same holistic awareness property all matter has shown to possess. Human consciousness is spacetime dependent, just like matter. No brain equals to no human consciousness.

Part I of this four-part article includes: Preface; Introduction; 1. Aether... where Physics meets Philosophy; and 2. Aether and Relativity.

Keywords: Aether, immaterial substance, human consciousness, physics, God.

To my wife Indiana, who enabled me to complete this work by nurturing me back to health.

Preface

Life has been a quest going from J. L. Borges' "The Garden of Bifurcating Paths", to Everett's Many-worlds Interpretation of Quantum Mechanics. From the collective behavior of sardine schools and J. Cortazar's eels in "Prose from the Observatory", to Bose-Einstein condensates. From the relativity demonstrated by the twins paradox thought experiment, to the non-locality uncovered by the EPR (Einstein, Podolsky, Rosen) experiment. After thoroughly studying the physics of Nature, I am convinced that the aether is the physical, but immaterial substance, from which the universe emerged.

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Introduction

Aether is the empty space in which the universe sits.

Empty space is real but does not exist as matter. Einstein was right, the universe is background free. The gravitational aether does not exist, yet it is the physical but immaterial substance from which the universe emerged.

"It need hardly be pointed out that with things that do not change there is no illusion with respect to time, given the assumption of their unchangeability." (Aristotle, 340BC)

How big is a point? That is just like asking how big is empty space. Size does not apply, points are dimensionless. Same with empty space, it is dimensionless, yet contains the universe. This is why it is said that we could fit the whole universe in a point. In this realm, we need to think in terms of state, not in terms of process. Process occurs as spacetime. Trying to mathematically describe empty space using classical physics laws is not enough. Notions like size, age, velocity, or infinity, which imply motion, quantity, extension, or duration, should not be used to describe empty space. That is what Einstein meant when he said there was no time before the Big Bang. At the aether scale there are no distances to cover, it is all pervading... the aether is one. Instead of asking what happened before the Big Bang, it makes more sense to ask which was its state.

The gravitational aether is but does not exist as matter. It is before spacetime, or the Big Bang, or Inflation, or even Wheeler's Quantum Foam. It is not matter, therefore notions like motion, size, or duration are not applicable. Time does not apply. It is outside the rules of spacetime.

This notion of a primordial substance is a very old one, also known as Akasha, or Brahman, and many times described as pure energy, or spiritual fire. It has been anthropomorphized by man since the times of Plato and Aristotle, the Chaldeans and the Akkadians. Called by names like Zeus, Jupiter, Brahma, and other. Always seen as immaterial, until 1964, when the cosmic microwave background radiation (CMBR, CBR or CMB) was discovered. Since then, there have emerged completely contradictory notions which now compete for acceptance. The reductionists are becoming restless in countless desperate attempts to quantify the unmeasurable. Now there are new claims of an absolute frame of reference showing up everywhere. They claim they finally have a fixed inertial frame, as if we ever needed one. But according to Relativity, objects in spacetime are relative to one another, not to empty space.

Contemporary physics is increasingly turning into a cross between General Relativity and Quantum Mechanics. After we realized there was Wheeler's Quantum Foam, we have slowly integrated particulate space into GR, while starting to take a serious look at emerging Space Flow theories combining QM (Quantum Mechanics) and Relativity.

Here, I use the aether concept, Quantum Mechanics, and Relativity in an attempt to solve what many philosophers call the Hard Problem, and to answer: *What is that which is?*

God is a Thing, Not a Person

In most aether views, whether material or immaterial, the aether is seen as an all knowing creative force, but not in this view. I compare the aether to God in the sense that it is one, omnipresent, and eternal, but at the same time I argue that it is not all knowing, that it is a thing which can neither think, nor see without a brain. That it sees, thinks, and exists through matter.

"A substance cannot be produced from anything else: it will therefore be its own cause, that is, its essence necessarily involves existence, or existence appertains to the nature of it." (Spinoza, 1673)

Basil Hiley is correct, being remains constant during the process of becoming. Matter is only temporary, it has a beginning and an ending, it is subject to time (change). Things are because of the aether, it is what gives them their *temporary being* status. The Real, as Hegel called it, *that which is*, is the aether. Reality, on the other hand, simply refers to the process of becoming. The aether becomes through matter.

Energy is finite, as you probably know, this is the reason why nothing with mass can reach the speed of light. As a proton reaches the speed limit, its waves are flattened, it loses its wavelength and goes back to being aether. Slow down the system and it reappears... as required by local spacetime conditions. For a single proton to reach the speed of light, it would require more than all the energy available to the universe. Because energy is finite and the speed of light needs to be kept constant for fields to work in the allowable speed range (0 to 300,000 km/s), there is time dilation and space contraction for material systems moving at relativistic speeds.

"This shows us two things: you cannot have parts of the infinite and the infinite is indivisible. But indeed, even if the One is more like a Principle, and the one is undivided, then the whole universe will be undivided either in quantity or in form." (Aristotle, 340BC)

Matter is 99.9999...% empty space. Reduce yourself to the size of the smallest particle and you will still see nothing more than empty space. Matter is made of fields and fields are little more than apparitions. Fields are shapes in empty space, lines of force. Matter seems like an illusion, but that is reality, and matter in spacetime is the one drawing the shapes, not some creator or designer. The universe designs itself. Particle creation occurs according to local spacetime's energetic or thermodynamic requirements. Reality is process and process happens as spacetime.

Matter is condensed space and energy is space in motion. Matter is the same as energy, hence $E=mc^2$. Whether there is an aether or not is finally answered: the aether is but does not exist until it turns into matter.

This is not a new theory but a new insight into already existing theories. A freshly synthesized interpretation consistent with already known and well accepted scientific facts. A modern perspective in which the aether concept is reintroduced in an attempt to reconcile a centuries old notion of wholeness in space and time with actually established scientific paradigms. In addition to arguing for a common substrate to all matter in a purely dialectical way, without math or complicated formulas, I relate self-awareness and perception to non-living, self-organized

systems. Thereby suggesting that Consciousness is not an independent supernatural entity separate from matter, but an intrinsic property of all matter.

We need to take a better look at the cold hard facts. We have made huge technological advances, but spiritually and therefore politically, we have been stuck in time for the last two thousand years. For Humanity to solve its spiritual and political problems, it needs to conclusively figure out the relationships that exist between being, matter, and space. Before we can move forward, we need to make up our minds between fantasy and reality, we have to choose between superstition and reason.

This series of articles represents, in a short and informal style, what I have realized after a lifelong quest for proof of wholeness in space and time as a fundamental property of the universe. It is aimed at a general audience, going from the specialist to the layman, with the hope of further popularizing these deeply philosophical issues.

1. Aether... where Physics meets Philosophy

Leading cosmologists picture the universe as a bubble floating in empty space and Einstein's space-time as the space inside that bubble. Now, is that empty space composed of parts? No.

Do the concepts of motion, and therefore time, apply to it? No.

Does it have a beginning and an ending? No, it does not move, and therefore not subject to change. It is eternal.

Is it everywhere? Yes.

Is it the seat to all fields? Yes.

Can there be matter without fields? No.

Is it matter? No.

Is it real?

Traditionally, Western science's tendency has been to fragment and isolate everything we take as the object of our investigations, ignoring the background or the underlying substrate from which the universe emerged.

From the Copenhagen Interpretation of Quantum Physics and the Heisenberg Uncertainty Principle, we gather that light is particle and wave at the same time. That the totality is more than the sum of its parts, and that, when you get down to the size of atoms, there are no solid-like particles spinning in empty space, but a net of interconnected wave-particle systems: a hologram ruled by the laws of Quantum Mechanics, Relativity, and Thermodynamics. From the EPR (Einstein, Podolsky, Rosen) experiment we find that, regardless of the distance between the two, when we measure the spin of one of the photons on a pair of entangled photons the other photon registers the spin direction instantaneously, which gives us non-locality at the quantum level. And, from John A. Wheeler's Delayed-Choice and John Cramer's Transactional Interpretation of Quantum Mechanics, we get undividedness of process, wholeness, self-reflection, and self-organization.

From these facts we can argue that matter originates at a deeper level, and that state is instantaneously registered throughout space thanks to wholeness in space and time. This wholeness, I believe, is what makes these phenomena possible.

It has been argued before that there is an interaction at a deeper level between matter and the environment in which it develops. This notion that energy and matter come from a common substrate is a very old idea. And that is the aim of this book, to examine the philosophical implications that these new scientific facts bring to light, and to reassess this new state of affairs.

I argue, as many others do, that the aether is the physical but non-material substance from which

the universe came to exist. To exist, things must be in spacetime, but the aether is not in spacetime, it is before spacetime. It is, but does not exist as matter.

The aether is all permeating, it is inside and between particles, it is everywhere by its own definition. Everything is made from it, even the space that surrounds you. You cannot conceive a fragmentable aether, or it would not be the aether as it was defined thousands of years ago. It is indivisible. Fields can create the appearance of separated volumes, but you cannot divide the aether into separate entities. In that sense, it is apparently, infinitely divisible.

The aether, as described over four thousand years ago, is materially non-dimensional. It is not matter, therefore not directly observable. You can measure the properties of fields, but you cannot take a direct measurement of the aether.

Motion is not one of the aether's properties, neither is time, nor change. This makes it immutable, or eternal. Since it lacks the property of motion and cannot be described as containing parts that follow a time-line, we can conclude that it is not matter. At the sub-quantum level, the level at which energy is before it turns into multiple entities, motion loses meaning. Any material substance will occupy space, but this physical non-material substance does not. It becomes matter as fields vibrate, or pulsate at very high speeds. Creating material properties like volume, extension, motion, time, mass, gravitation and solidity, eventually causing the formation of objects in spacetime. Once we have the limits, the boundaries, we can talk about notions like size, extension, motion, time, and process.

In this view, the aether has no capacity to hold any *active information*, just *passive information*, the constants, which are used by active information as energy is turned into quantities, or quantized... in spacetime.

The aether gives the universe properties like wholeness, interconnectedness, continuity, and non-locality. There are no parts when you refer to the aether, but you can look at electric and magnetic fields as different *things*, or *parts* of a greater whole. All made from the same continuous and non-fragmentable aether. Everything is connected to the aether because everything is made from it. This is where wave-particle complementarity comes from.

No Mind-Body Gap

According to contemporary Quantum Mechanics, wave-particle complementarity is due to an indivisible process which originates in a common background, but it appears as if the only necessary information being transferred through EMR (Electromagnetic Radiation), from the aether to the particles, is that concerning the momentum and location of the particles in relation to that inertial frame and the rest of the universe. The rest of the information needed for the evolution of the system in spacetime is contained by the system itself, in spacetime. Thereby eliminating the need for an all knowing god, or creator.

$[X, P] = 0 \rightarrow$ commutativity (leads to a dualism)

$[X, P] = ih \rightarrow$ non-commutativity (leads to a monism)

Hence the non-separability of process claimed by so many.

"The non-commutativity of the underlying process produces an ontological complementarity. This must be contrasted to Bohr's epistemological complementarity." --- Basil Hiley

Contemporary Quantum Field Theory supports the idea that the ontology is in the process which matter undergoes as it fluctuates in and out of nothingness. Classical Physics being a description of what the world appears to be, and Quantum Field Theory a description of what the world is.

According to Louis de Broglie, et al., every object exists as a body coupled to a matter wave, or pilot wave, and its displacement through space can be described by a wave-function. Information about the object's relation to its surroundings and the rest of the universe is picked and brought in by each object's particular pilot wave.

Bodies in motion need to continuously reset their energy requirements. As we now know, particles are not these space independent billiard ball-like objects floating in space, they are wave-particle systems in constant motion. Cloud-like standing waves which require a continuous energy flow from the substrate to the particle. This is why position and momentum cannot be known at the same time. This is where the Heisenberg Uncertainty Principle comes from.

The Real

Matter is continuously changing, becoming. What was a second ago is no longer, and the only things real or meaningful to us are the information and processes through which things become and now are. But the immutable, the eternal, the real, is the empty space in which the universe sits. Matter and fields are little more than apparitions, active information, as David Bohm called it. Basil Hiley, one of David Bohm's collaborators, is correct when he says that *being is a relative invariant in the overall process of becoming*. The fundamental laws, that which remains unchanged, is what is real.

Can you be without materially existing? Logic tells us that creation ex nihilo is physically impossible. And from electromagnetic phenomena and gravitation we get that, physically speaking, to be, you don't need to be material, all you need is to be able to act as a force. Existing is not the same as being, you can be without existing, but you cannot exist without being.

Is empty space real? Can we prove it? Can we measure it? Can we mathematically describe the rotation or acceleration of an object in empty space without assuming empty space to be real? I mean, if you were the only particle in space, how could you tell when spinning or accelerating? Is the only time we can have space, rotation, and acceleration when we have more than one object to consider? Empty space may be empirically untenable, but it is already considered as real by present theory, which is why we have spacetime metrics.

The aether is not in spacetime, spacetime is in the aether. Empty space and spacetime are not the same thing. Einstein's spacetime is material, empty space is not. There can be no space without time nor motion, this is why Einstein called it spacetime. As Einstein once said: if we had no time (process), everything would have to happen at once. That is why Einstein described reality as a spacetime continuum where he saw process as the weaver of the *fabric of space*, a fabric made from space and time. Reality is process... spacetime is process.

Time, space, and matter start with the quantum, and quanta can exist only when in motion. Field motion, or energy, turns into matter. If we could stop the motion, matter would go back to being just empty space. Outside of time, quantum events are not possible. There is time and space because there is motion, and there is motion because there is energy. The aether itself does not move, matter does, the quantum does. As Einstein used to say: *energy is space in motion*. In this sense, aether is synonymous to energy, it is pure energy.

In this view, the aether is the substrate to all matter, including Wheeler's Quantum Foam. It is before geometry. Everything depends on this substrate, this is where the laws of gravity and electromagnetism are administered from.

Electromagnetic fields should not appear as ultimate, irreducible realities. Existence starts with the field, and before that there is what we call empty space, or aether, which is neither big, nor small: extension is not one of its properties. Spacetime and geometrization happen after the aether. The aether, unlike spacetime, is primary. Matter, space, and time are not. Empty space which is not really empty but full of pure energy. Energy which exists before EMR, and therefore is neither hot, nor bright.

2. Aether and Relativity

Empty space was, then came the universe. There can be empty space without a universe, but not a universe without empty space... just as there can be no matter without continuity, causality, or process.

Relativity is an aether theory. Everything is related through empty space. That everything exists in a single field, a matrix, is the basis, the foundation of the General Theory of Relativity. It is a philosophical necessity, if not, how could anyone explain why we have inertia, gravity, or action-at-a-distance?

Thanks to Mach and others, Einstein saw that we needed a metric, that we could not accurately describe reality without taking into account what each body in the metric was doing. That in order to explain events according to fact, each point had to be connected to all the other points. That without a metric and relativation, concepts like gravitation, rotation, acceleration, and inertia could not be clearly explained. All he had to do to explain Relativity without an aether was explain motion as a function of position determined through the metric. Using tensors and vectors which tell matter where to go at each point in the metric. What this meant is that the trajectory anybody in space takes would depend on its position in relation to its surrounding objects. Why? Because space is flowing into each and all the surrounding bodies, giving each point in the metric a direction and a force. Which is where tensor math becomes very useful.

But what else is this metric if it isn't a mathematical representation of the all-pervading and unifying aether? Einstein's intuition and common sense told him that, in order to explain inertia and gravitation, there could not be this bunch of separated and unconnected bodies (Newton's Billiard Ball model). This notion of a gravitational aether, a continuous field from which spacetime emerges as objects interact with each other, is the philosophical basis for the General Theory of Relativity.

He also realized that an absolute frame of reference would invalidate Relativity. That by being relative to a fixed inertial frame, things would not need to be relative to each other and there would be no relativistic effects, which we already know is contrary to the facts. There is no need for an absolute frame of reference when you have an infinitely divisible substrate from which everything is made.

This notion of an aether has been integrated into physics for a very long time. We are talking about the perfectly flat vacuum state of Quantum Field Theory. A perfectly flat vacuum state which refers to the quantum mechanical state of the vacuum. But is this vacuum considered a thing? Is it real even though it is not matter? I suppose it is, since how could it be in any given state if it wasn't real? It is real and it is called aether. Some call it the long winded vacuum state of quantum field theory, I prefer to call it what it has always been called: aether. [Since it harkens back to the idea of a fixed frame of reference, which can be misleading, the term aether isn't used much these days.]

Einstein's gravitational aether is the seat to an all relating process which he called spacetime. The aether was re-introduced early in the 20th century by scientists like Einstein, Mach, and

Minkowski as they were trying to describe a substance, or... a thing. Einstein said that matter and fields emerged from the same basic substance, that there could be no universe without an aether because it is the seat to the electromagnetic and gravitational fields. That there are gravitational, electromagnetic, and nuclear forces because there is an aether. According to him, without fields there can be neither matter, nor spacetime, therefore the aether is.

Einstein's Universe is Background Free

But this is not the same aether Newton, Poincare, and Lorentz talked about. Particles come to existence as required by spacetime's energetic and thermodynamic conditions. In this new aether, objects are relative to each other, not to absolute space, therefore there is no violation of the Principle of Relativity. As they explained Relativity, Einstein, Mach, and Minkowski said that things are not relative to absolute space, but to an absolute world. Acceleration is measured in relation to other objects in spacetime, not in relation to absolute space. According to Mach, this is why there is inertia.

Einstein's gravitational aether does not represent an absolute inertial frame. It is not material, therefore cannot represent a background. It is not quantized, like material space. Einstein was correct in his claim of a background free universe in the sense that there are no landmarks to be used as reference to motion, or elapsed time. How could a non-material aether represent a preferred inertial frame if it lacks any landmarks or coordinates? It cannot.

Einstein, Minkowski and Mach described a different aether. This twentieth century aether differs from earlier aethers in that, in it, objects are relative to other objects, not to empty space, therefore avoiding a Principle of Relativity violation.

As Einstein said, spacetime is an extension of matter. That is because spacetime and empty space are not the same thing. Spacetime is neither primary, nor fundamental, it does not exist by itself, it is a product, just as matter and time are. There is flat empty space, then there is curved spacetime, or what is known as the *observable universe*.

Therefore the universe is background free and there is no fixed, nor absolute frame of reference. There is absolute reality. From Einstein's General Theory of Relativity we get that objects are not relative to empty space, they are relative to other objects with mass. Respect to Relativity, what is absolute is not empty space, what is absolute is the objective universe, the world. This is what makes GTR (General Theory of Relativity) true, everything is related through and by the aether. Or, how could it be that when a body is accelerated to near the speed of light, time and length must change in relation to a stationary observer? Wasn't space supposed to be absolute, primary, independent, and not derivable from anything else? According to General Relativity, the universe is one single entity, one process. Space... objects... Mankind... all come from one thing, which by definition, we call aether.

Einstein presented a different notion of the universe with his 1920 essay *Ether and the Theory of Relativity*. He stripped 19th century aethers off any kinematic or mechanical properties. This new

aether lacked the property of motion and was not composed of parts which followed a time-line. What he termed the *Gravitational Ether* came from a completely different idea. Motion and particulation, he said, cannot be considered properties of the aether because it is one and has no components. This oneness can be used to explain action-at-a-distance, gravity, and inertia.

Einstein's aether is more akin to Newton's absolute space than most people think, this is why he sees the universe as background free but imbued with Mach's reciprocity between matter and space. It is Newton's absolute space mixed with Mach's aether, or with relativation. Empty space tells matter what to do and matter tells empty space how to curve. Which is where space curvature comes from.

Einstein said that, when trying to define the aether, we need to put aside notions of motion, extension, size, beginnings, and endings. In essence, he said that this substance lacks the properties of matter, yet all matter emerged and is ruled from it.

Spooky Action at a Distance?

Not Really. Bodies in space never acted on each other from a distance, as Newton argued while explaining gravity: there is no action at a distance because there are no distances to be covered. The aether is one and everywhere, it has no moving parts, motion is not necessary. This is why state can be instantaneously registered throughout material systems. Which means that there are no faster than light (FTL) information transfers, just changes in state (where stress-energy tensors and lines of force can be affected), at the aether level.

If the aether is an all-pervading substance, why would it need a property like motion? Motion and time are for objects, for parts which follow a time-line in spacetime. It is an error to think in terms of spatial extension when trying to understand what is going on at the aether scale. The aether is everywhere, it is the set of all sets. It is the circle Zeno, Bruno, St. Augustine, Pascal, and Borges among others, once talked about; a circle whose center is everywhere and circumference nowhere. The aether is not dependent on geometry, but helps determine the geometry of spacetime. It is a plenum, a matrix... the origin.

This notion of wholeness is probably what triggered Einstein's interest in Bohm's *Undivided Wholeness*. He understood that for there to be a continuum and Relativity to hold, the universe must be conceived as a whole. Why else would an object's dimensions depend on its surroundings if it wasn't for this wholeness? [He eventually became a Pantheist.]

Relativity can only refer to relative time or length because it is the description of a whole where objects are physically and energetically dependent on each other. In other words, if an object were to be conceived as accelerating at relativistic speeds in a perfect void, independently from any object or frame of reference, there would be no time dilation, nor length contraction. But because objects are embedded in a continuous field, a metric which represents the whole, and because the whole's energy is finite, objects exhibit relativistic effects in relation to other objects.

It is a property of the whole which arises from a physical need to abide by the laws of Thermodynamics.

The Fundamental Forces

Some claim that empty space has no physical properties, but if you eliminate the notions of permittivity and permeability from Maxwell or Einstein's equations, ratios on which the existence and behavior of all fields entirely depends, the theories will completely fall apart. Some believe in the reality of nothingness, that empty space as such is real, and accept that notion as an integral part of their physics, but can't even ascribe any physical properties to it. At least Einstein's aether can be said to be real because of its physical nature. It is physical because it can act on matter, and immaterial because it lacks properties like extension and motion. It does not move and has no parts or components in the material sense. To be real there is no need to be in spacetime, just to be able to act in spacetime.

When you have a magnet acting upon an object we say that a magnetic field is what moves the object. But the path, the direction of propagation, and the strength of the magnetic force lines are determined at the aether level.

Free space (empty space) is where the laws that determine the behavior of the four fundamental forces of Nature are set. Laws by which active information (matter) exists. The aether holds basic, changeless, motionless, fixed values; hidden dimensions from which everything else, including meaningful information, is being formed as spacetime.

As many have said, the aether helps determine things like the ratio between the electric displacement and the intensity of the electric field producing it, in free space (permittivity). Or the ratio between the magnetic flux density and the external field strength, in free space (permeability).

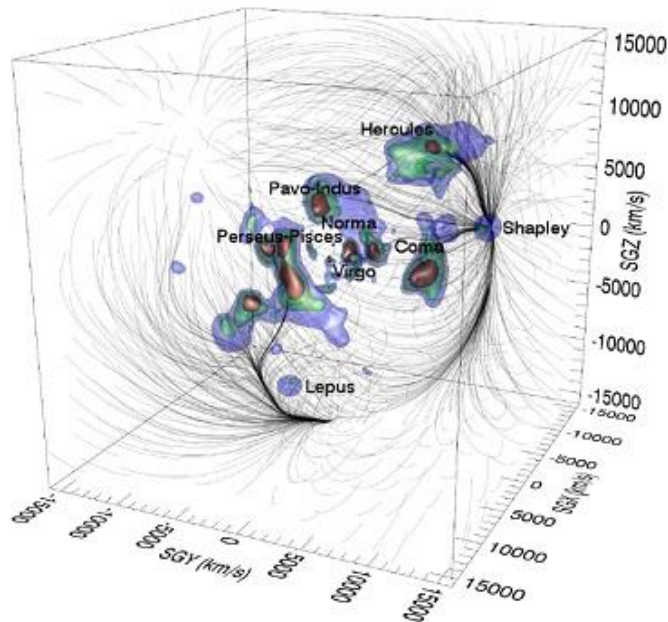
The aether itself is not observable, you cannot say - *here, lets take a look at this piece of aether!* Because it is not matter. It is real, but not in spacetime, hence not directly observable. This is why the MMX (the Michelson-Morley experiment) failed so miserably. But you can measure its effects: things like inertia, gravity, magnetism, electrical charges... etc.

From the MMX results we should conclude that the aether is immaterial and directly unobservable. Now, if there was an empty space before there was matter, isn't the classical vacuum also immaterial and directly unobservable? Can we take a direct measurement of something which is not matter? The only thing proven by the MMX was that we did not understand the aether's nature. Want to measure aether caused drag? Just measure a moving object's momentum, or measure the force needed to accelerate any object, that is aether caused drag!

Is Empty Space Curved?

Some say, but if there is no material aether, how come spacetime is curved? It is curved because of sidereal lines of force. What is curved are the lines of force flowing space follows as it is

sucked into bodies with mass. Spacetime is warped as space sucking bodies with mass are added to it. All particles being affected by those lines of force as they move through spacetime (i.e., gravitational lensing). Mass (process) is what causes spacetime curvature, this is why it is not flat. This is why we need a non-Euclidean geometry to describe it. This is where tensor math and space curvature come from. Empty space has physical properties, which is why vectors and tensors are needed in order to determine the forces involved in the process and the trajectory particles will take as they move through it.



Laniakea Our home supercluster.

See how all matter, including space, flows towards the center of gravity (The Great Attractor).

There is no bending of spacetime, just different values for each point in the metric. Each point in the metric being described by a force with a direction, or in Einstein's words, each point in the metric showing an acceleration with a direction, the direction always pointing to the center of massive objects floating in space.

Aether vs. Spacetime

Before we continue, we must further distinguish empty space from material space, or spacetime. EM fields and matter are observable, or measurable, empty space is not. EM fields have a geometric structure, empty space does not. When you describe an EM field, you may talk about intensity, density, size, magnitude, or duration, but not all of these concepts may be properly used to describe Einstein's gravitational aether.

I see empty space as the seat to EM fields, synonymous to Einstein's aether, and I see it as a primary, or fundamental component of physical reality. Material space, or what many call the

Cosmic Background Radiation (CBR), remnant radiation left after the Big Bang, is seen as a product. Since, in this view, aether and empty space are synonymous, from now on I will refer to them as one and the same thing.

Einstein's aether is not the same as his spacetime. Spacetime is an aether product, synonymous to Timothy Boyer's material space, which is nothing more than a combination of CBR, Wheeler's Quantum Foam and invisible quantum matter. Spacetime is material, and Einstein's aether is physical but immaterial. First, there needs to be an aether before we can have anything like EM fields, matter, spacetime, or even Wheeler's Quantum Foam.

We have to be careful with meanings. What Einstein was referring to as *empty space* is more akin to a perfect vacuum than the space we usually talk about. Remember that, at the time Einstein wrote his 1920 essay, Big Bang and Inflation theories were still in their infancy. He thought that, in order to obtain an empty space, it was possible to extract all matter from a given volume. It wasn't until Timothy Boyer and what many call, the Casimir effect, that we began to really understand the meaning of empty space. In a true empty space, there can be no Casimir force.

Big Bang and Inflation theories may still need more work, these may still be incomplete. I am starting to think that matter pops up where matter is less dense, as if the universe were fighting against fragmentation, giving rise to objects like Quasars where it is less dense, and Black Holes where there is too much.

"The particle can only appear as a limited region in space in which the field strength or the energy density are particularly high..." --- Albert Einstein

Particles can emerge anywhere and as needed, e.g., particle pair creation, but from where and what do they feed from, creation ex nihilo? I don't think so, that seems like a physical impossibility. Anyway, why would we have wave-particle complementarity if it were not because matter depends on the substrate? Isn't this the reason why we need a Higgs mechanism?

The aether has a non-zero vacuum expectation value, that is the reason why particles emerge as expected... or as dictated by spacetime conditions. This is probably why Alan Guth calls it a false vacuum.

The way I see it, what keeps the whirlpool moving in a spiral galaxy is space tension (the stress-energy tensor, the source for gravity, space curvature, and hence gravitation). Nature fighting against fragmentation, or against entropy.

We must not confuse the concept of space outlined by Inflation theories with Einstein's gravitational aether. Extension is a material property not applicable to Einstein's aether, neither is density. On the other hand, Einstein's spacetime is material, and properties like extension and density do apply. But this is something we learned after Einstein's Relativity. Inflation theory came after Relativity. Remember Einstein's cosmological constant, which he later called his greatest blunder? Einstein's universe was initially static, then, after Hubble, he learned about what we now call Inflation.

EMR, CMBR, and ZPE are all observable, material phenomena, with mechanical properties, like density and pressure. The universe inflates as background radiation, Wheeler's Quantum Foam and dark matter fill spacetime. Spacetime is packed full of particles.

Aether is Finite

The aether is a spatially boundless but physically finite substance. Energy is finite. Mass is finite. Finite, because if it were not, we would not be having phenomena like time dilation and space contraction, there would be no need for energy conservation. Zeno was right, the aether is infinitely divisible... but, as Relativity says, physically finite.

Imagine a totally empty space with no boundaries, what do you have? You have Basil Hiley's pre-space. Spatial extension becomes an unnecessary concept. Since it lacks any landmarks to use as reference points, you are unable to measure extension or motion, thus cannot tell size nor distance. This is also why allowing for an aether does not constitute a violation of the Principle of Relativity. According to Relativity, things are not relative to empty space, things are relative to the universe. If objects were relative to empty space, all objects would have to move in relation to absolute space and time, and there would be no need to include covariance as we explain acceleration. But the reality is that we do need covariance to accurately describe objects under acceleration, especially when moving at relativistic speeds.

Since the aether's energy is finite, time and space will contract and dilate accordingly, while mass will increase or decrease. Reality automatically adjusting itself to present spacetime conditions and thermal requirements as matter follows Nature's fundamental laws. Because it is physically finite, matter and energy are also finite at any given moment, but infinite as a function of time and transformation. Even though proportions and ratios are kept constant, spacetime dimensions must be constantly adjusted to fit each inertial frame.

The reason that objects in spacetime must be related is because it all comes from a single entity, reality is one single process. All inertial frames within the observable universe are related by the aether, through the aether. The aether is one, and because of that, the universe is also one. It is a single entity, yet contains everything that exists in spacetime.

Einstein's aether is not bound by time but by topological properties, a set of ratios determined at the aether scale. Frame independent fundamental constants, a very small number of fixed laws by which all matter must abide. Physical (real) but non-material quantities (topological). Time independent continuity and connectedness. We can also call it topological space, a false vacuum, inertial space, or momentum space.

Lorentz invariant values originate at the aether level, they are real but non-material ratios. Hidden dimensions which help determine the geometrical properties of objects in spacetime. This is the level at which frame independent constants, like the propagation speed of fields are set. Take the fine structure constant for example, change its value and you may get a totally different universe. Thanks to these frame independent constants, the universe is isometric.

What did Murray Gell-Mann use to create his multidimensional geometric structure? A bunch of extra, hidden dimensions, or fundamental topological values that could represent reality. He learned that by manipulating this structure he could reproduce real world interactions. As he placed his extra dimensions into this new geometry, he found that he needed a few new particles to complete it, to fill the gaps, so to speak. He predicted what some of these fundamental particles would be before they were actually found, earning himself the Physics Nobel prize in the process.

Spacetime is four dimensional, and all these other hidden dimensions rule matter but are not matter as such. This is why, in addition to analytical and non-commutative geometry, we need tools like topological quantum field theory (TQFT) to effectively describe what happens at the aether level.

If we could manipulate and rearrange its parts, and as long as we could maintain and continue to use the same fundamental constants, we could take a pound of earth and turn it into a pound of gold.

Because the aether is finite, and the propagation speed of fields must be kept constant, we need the equivalency and relativity principles. We need to describe reality in terms of covariance and deformation in order to be accurate. Matter changes, but not the fundamental values it follows as it takes shape.

Covariance and Deformation

Consider $c = 1/\sqrt{\mu_0\epsilon_0}$, where μ_0 and ϵ_0 are permeability and permittivity in free space.

This relationship holds true because the speed of light (and of all electromagnetic phenomena) is determined at the aether level. It remains constant in all inertial frames because it is not dependent on a coordinate system, as matter with mass is. Since ratios like permeability and permittivity are determined at the aether level and the aether is immaterial and not bound by spacetime laws, 'c' (speed of light) can be frame independent.

The speed of light is frame independent, and only dependent on the physical properties of free space. This is why the speed of light is a constant unaffected by neither the speed of the observer, nor the speed of the observed.

The speed of light sets the scales. For fields to continue to work regardless of spacetime conditions, there must be time and spatial distortions between the observer and the observed when moving at relativistic speeds. This is where the principles of relativity and equivalency come from. Because a field's speed must not change regardless of relative motion, and because energy is finite, for reality to work, all parameters must be adjusted around the speed of light. This is how and why we get time dilation and length contraction.

Since the speed of light, hence the propagation speed of fields, must remain constant for all the other fundamental constants to continue to be proportionally the same, mass (process) has to increase in order to keep up, but to a limit. Once we go over the speed limit and fields can no longer keep up, matter disintegrates. When we reach the speed of light, wavelength and frequency drop to zero, waves become flat, devoid of any information, and we are back to being immaterial empty space.

Spacetime is dynamic. Time and length contractions are real. They need to be in order for the Equivalency Principle and the laws of Thermodynamics to hold. Spacetime, or material space, is a product, not for fundamental or primary component of reality, which is precisely what is claimed by Relativity. In spacetime, space-like separation is relative. If spacetime were static, as Newton's absolute space, then spatial extension would be neither variable nor dynamic, but it is, it shrinks and expands, just as clocks run slower or faster, depending on energy usage vs. energy available.

Since the speed of light is constant and closely related to the Compton wavelength and the Schwarzschild radius, the universe is the same everywhere, independently from existing spacetime conditions. This means that matter will always have the same properties and behave the same way everywhere, regardless of the existing spacetime conditions. It means that a carbon atom will look and behave as a carbon atom basically anywhere in the universe.

(Continued on Part II)