

The Cause of Gravity: A Concept

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Einstein's General Theory of Relativity sets out a theory of gravity which does not postulate a physical force as the cause of gravity; rather, it provides a geometric explanation for gravity. The present paper makes a proposal to fill this gap with a concept of gravity that is strictly physical. The proposal is premised upon the propositions that a sub-atomic substance ("aether") permeates space and that stars, planets and other cosmic bodies absorb aether. The absorption of aether is seen as part of the process of the operation of cosmic bodies. The mechanism which this paper offers as the cause of gravity is that the absorption of aether by a cosmic body causes a flow of aether towards the cosmic body, and the inflow of aether exerts ram pressure upon any matter in its path. The result is gravity. This paper also considers several phenomena which may be explained by the proposed aether and gravity concepts.

1. Introduction

What causes gravity? What is it that physically clamps you to your chair? What ties the planets and the Sun together in the solar system? I pose these age-old questions in the sense of seeking a mechanical process which causes gravity.

The ideas set out below are strictly conceptual. I approach the subject with the basic premise that the cause of gravity is mechanical – a physical process that is explainable in concrete terms of cause and effect. The ideas proposed by this paper do not, so far as I am aware, stray from that premise. I fully agree with the observation made by Isaac Newton a long time ago: [1]

"It is inconceivable, that inanimate brute matter, should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact. That Gravity should be innate, inherent and essential to matter so that one body may act upon another at a distance thro' a vacuum without the mediation of anything else, by and through which their action and force may be conveyed, from one to another, is to me so great an absurdity that I believe no Man who has in philosophical matters a competent faculty of thinking can ever fall into it."

Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my readers. When I see a ball thrown into the air and fall back to the ground, I attempt to visualize a mechanical cause of what is occurring. I reason that the rise of the ball is slowed down and stopped and its acceleration back towards the Earth's surface is caused by something physical putting pressure on the ball.

Some say that Einstein's General Theory of Relativity sets out what causes gravity. In my view, the General Theory of Relativity sets out the geometry of gravity, but it does not describe the underlying physical mechanics of gravity in the sense of my approach to the subject in this paper.

Richard Feynman, in *The Feynman Lectures on Physics*, [2] addressed the mechanics of gravity. He said:

"What about the machinery of it? All we have done is to describe *how* the earth moves around the sun, but we have not said *what makes it go*. Newton made no hypotheses about

this; he was satisfied to find *what* it did without getting into the machinery of it. *No one has since given any machinery.*" [italics in original]

I have tried to conceive of ideas that give physical substance to gravity – concepts that are simple and consistent with other known phenomena. While I have considered many possibilities, I think the one set out below has the best prospect of being substantially correct.

The concept of gravity proposed by this paper has two fundamental components – atoms and aether. I picture atoms as complex organisms which have the capacity and the need to absorb aether. I postulate aether to be a sub-atomic substance which pervades the universe. Atoms absorb aether and this process causes aether to flow towards cosmic bodies such as the Earth and the Sun. The incoming aether exerts ram pressure on any matter that the aether comes into contact with. The result is gravity.

The development of this concept has led me to consider various phenomena that may well be explained by the aether and gravity proposals set out in this paper. My observations concerning these phenomena are set out below under the heading "Related Matters".

2. Aether

A dominant premise of the proposed concept for the cause of gravity is the existence of aether. The idea of aether is certainly not new. Isaac Newton in his treatise *Opticks* [3] posed the question of whether a highly elastic substance called aether pervades the universe and is the medium that carries heat and light.

Michael Faraday and James Clerk Maxwell were of the view that there must be such a substance as aether. They saw it as a medium which carries electromagnetic waves. In *The Dynamical Theory of the Electromagnetic Field*, [4] Maxwell said:

"It appears therefore that certain phenomena in electricity and magnetism lead to the same conclusion as those of optics, namely, that there is an ethereal medium pervading all bodies, and modified only in degree by their presence; that the parts of this medium are capable of being set in motion by electric currents and magnets; that this motion is communicated from one part of the medium to another by forces arising

ing from the connections of those parts; that under the action of these forces there is a certain yielding depending on the elasticity of these connections; and that therefore energy in two different forms may exist in the medium, the one form being the actual energy of motion of its parts, and the other being the potential energy stored up in the connections, in virtue of their elasticity."

I postulate that aether is made up of individual cells. Collectively the cells act much like a gas. The size of the aether cells is extremely small, such that they can easily penetrate cosmic bodies. The cells have mass, but their mass is tiny compared to that of atoms. The cells contain a combination of positive and negative charges, but are in a neutral state because the combined charges neutralize each other.

I visualize aether cells being flexible and complex, such that collectively they act as a medium which carries a vast variety of electromagnetic waves. Maxwell in effect recognized this in saying: [5]

"Thus, then, we are led to the conception of a complicated mechanism capable of a vast variety of motion, but at the same time so connected that the motion of one part depends, according to definite relations, on the motion of other parts, these motions being communicated by forces arising from the relative displacement of the connected parts, in virtue of their elasticity."

My own sense of reason tells me that there must be a physical substance which we call aether. Evidence to support this proposition lies in every day experience. There must be something physical pushing us towards planet Earth and keeping us here when, without that pressure on us, the centrifugal force from the rotation of the Earth would toss us into space. I am influenced by Young's two-slit experiment which, in my view, demonstrates that when light travels through what we call a vacuum, it produces the same kind of interference patterns as are created by waves travelling through a physical medium, such as water. While other scientific explanations are offered for the interference patterns evidenced in Young's two-slit experiment, to my mind the waves-through-a-medium explanation is the most convincing.

Einstein in his Special Theory of Relativity asserted that there is no need for aether. This assertion appears to have become mainstream scientific opinion. There are, however, many notable scientists who contend that there is a medium which occupies space. Here are some examples:

- Paul Dirac, a Nobel Laureate in physics (1933). In a letter published in NATURE in 1951, entitled *Is there an Aether?*, [6] Dirac opined, with supporting reasons, that aether must exist.
- Herbert E. Ives, recipient of the Rumford Medal in 1951 for outstanding contributions to the sciences of heat and light. In his paper entitled *Genesis of the Query "Is there an Aether?"*, [7] published in 1953, Ives set out reasons for the existence of aether. In an earlier paper, entitled *Derivation of the Lorentz Transformations*, [8] he attributed the Lorentz transformations of mass, length and time to the speed of bodies travelling through aether.
- Stephen Wolfram, in his work entitled *A New Kind of Science*, [9] published in 2002, speaks of space being a "giant network

of nodes" or "cells", and opines that this network is tied to gravity.

- Robert B. Laughlin, Nobel Laureate in physics (1998). In his book, *A Different Universe*, [10] published in 2005, Laughlin expresses the view that a form of matter, which he calls "stuff" and "relativistic ether", permeates space. He says that he does not call it "aether" because that is "taboo".
- Reginald Cahill, in his book *Process Physics: From Information Theory to Quantum Space and Matter*, [11] published in 2005, states that a "quantum foam" forms the substructure of space and that its inflow into matter is the cause of gravity.
- Frank Wilczek, a Nobel Laureate in physics (2004). In his book *The Lightness of Being— Mass, Ether, and the Unification of Forces*, [12] published in 2008, he says that space is filled with a substance which causes gravity and from which all else is formed. He uses the word "Grid" for this substance.
- Patrick Cornille, in his book *Advanced Electromagnetism and Vacuum Physics*, [13] published in 2003, sets out his analysis of why "ether" must exist.

See also:

- James DeMeo, *Dayton Miller's Ether-Drift Experiments: A New Look*. [14]
- Maurice Allais, Nobel Laureate in Economics (1998), *L'Anisotropie de L'Espace*. [15]
- Tom Van Flandern, *Dark Matter, Missing Planets and New Comets*. [16]
- Yuri Galaev, *The Measuring of Ether-Drift Velocity and Kinematic Ether Viscosity Within Optical Waves Band*. [17]

There is a body of opinion that the Michelson-Moreley experiment in 1887 and subsequent interferometry tests establish that there is no such thing as aether. However, there is also a body of opinion that interferometry tests establish that there is in fact an aetherial substance. Cahill, in his book *Process Physics*, [18] goes into considerable detail explaining why the interferometry testing from Michelson-Morley onwards in fact supports the proposition that aether exists and that it flows into the Earth and the Sun. See also the works of James DeMeo and Maurice Allais, both cited above.

I think it is significant that Einstein, despite what he said in his Special Relativity paper in 1905, eventually came to embrace a form of aether. In an address given at the University of Leyden on May 5, 1920, he said:

"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 (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it."

In summary, I conclude that it is reasonable to postulate the existence of a subatomic substance which permeates the universe. It is of little or no importance whether this substance is called "Grid", "stuff", "relativistic ether", "quantum foam", "net

work of nodes or cells", "ethereal medium", "ether" or the word I have chosen to use - "aether".

Where does aether come from? I conceive aether to be something fundamental in the makeup of the universe, and accept it as such in this paper. Its source is to me a mystery, much like the source of any fundamental particles. Possible sources of the generation and re-generation of aether include:

- spontaneous combining of negative and positive charged particles.
- black holes and/or accretion discs and jets expelled therefrom.
- supernova explosions.
- release of residual aether from cosmic bodies.

3. The Underlying Process

I conceive of atoms as complex, organized structures, far more sophisticated than they are generally thought to be. I picture them as having certain fundamental characteristics, including: constant movement; capacity to radiate energy into space; incapacity for perpetual motion without the influx of energy; a need to acquire energy in order to operate continuously; a capacity to absorb aether, from which it obtains energy; and a high degree of flexibility.

I visualize the absorption of aether as part of the process of the operation of cosmic bodies. As I picture the process, cosmic bodies absorb aether and use it for their continuous operation and to replace energy that is lost by radiation and by the elimination of residual aether into space.

I postulate that cosmic bodies use aether for various purposes. Here are some suggestions: as fundamental building blocks from which atoms are formed and existing atoms are transformed into heavier atoms; as a source of electrical energy; as a medium in which electric and magnetic fields operate; as a form of structure connecting the nuclei of atoms with their outer reaches; as structural material joining atoms and molecules together; and as fuel for the continuous burning processes of cosmic bodies.

It might be argued that stars and planets have no need for aether because they produce their own energy from nuclear fusion (stars) and the burning of radioactive elements (planets). I suggest, however, that these burning processes, combined with electromagnetic and particle radiation into space, would deplete the energy resources of stars and planets were it not for the influx of aether replenishing the energy. One may well ask, how do the burning processes of cosmic bodies carry on for billions of years? I suggest that they do so because they are constantly receiving energy from aether that is drawn in from space.

4. Gravity

Based upon the assumption that atoms absorb aether, the aggregation of the atoms comprising the Earth, for example, must have a large capacity for absorption. The Sun's capacity is far greater yet. It is the absorption of aether that I postulate causes the inflow of aether to cosmic bodies.

How do atoms absorb aether? A postulate of this paper is that aether permeates space. This includes not only outer space but also the space within the atomic structure of cosmic bodies. Ac-

ording to present day scientific theory, it is said that atoms absorb photons. This paper suggests that the absorption is actually of aether cells rather than photons. More on this point is set out below in the section entitled **Wave/Particle Duality**. What causes aether to move towards a cosmic body? I postulate that aether acts much like a gas, that is to say that it tends to expand to fill the space available. Thus, when atoms absorb aether cells, the remaining aether in the vicinity of the atoms expands and, in doing so, pushes aether cells into the space that was formerly occupied by the cells that have been absorbed. The moving cells leave behind spaces which their neighbours then occupy. When this process is multiplied by countless atoms absorbing aether cells, a flow of aether towards and into cosmic bodies is the inevitable result.

Does the inflow of aether provide acceleration? The answer is yes. Aether is drawn from the vast expanse of outer space into the relatively small area occupied by a cosmic body. This will inevitably cause acceleration as the aether moves closer to its target. It is helpful to picture of the flow of air being drawn into a vacuum cleaner. The air which is several meters away from the machine moves slowly, whereas the air that is close to the machine moves much faster. The same phenomenon applies to the aether flow from space moving in towards cosmic bodies.

What happens to the aether that penetrates into a cosmic body? Most of the aether collides with the cosmic body's atoms and the aether which already permeates the body (the resident aether). Some of the aether may go right on through the cosmic body without touching anything. Most of the aether rebounds off the cosmic body's atoms and resident aether, and thereby transfers momentum to the cosmic body. It is the momentum exerted by the aether impacting upon us, the inhabitants of the Earth, that keeps us clamped to the Earth.

We on Earth are impacted by aether coming from all directions, including from above and from below. This in turn causes aether to emerge from beneath us. The ram pressure caused by the aether coming in from above us is greater than the pressure from below because of the absorption of some of the aether en route through the Earth. It is this net effect that provides what we call weight.

The proposed gravity concept is clear in regard to ourselves being pushed towards the Earth. We are of insignificant size compared to the Earth, and the constant inflow of aether is dominant.

But what about the situation of the Earth vis-à-vis the Sun? Does the inflow of aether cause gravity between cosmic bodies? The answer is yes. While the Sun and the Earth draw in aether from all directions, the amount of aether arriving in the area between the Sun and the Earth that is available for each body to absorb is shared between the two, thus reducing the amount of aether that each body receives from that area. In contrast, there is no sharing of the aether drawn in on the far sides of the Sun and the Earth. Therefore, the inflow of aether on the far sides of the Sun and the Earth will be greater than the inflow on the sides that face each other. The resulting pressure differential puts the Sun and the Earth in the grip of each other's gravity.

What is the speed of the incoming aether? I suggest that the speed of the aether approaching Earth is very slow compared to the speed of light. I have in mind that the acceleration which it

causes is only about 9.8 metres per second per second, relatively slow in cosmic terms. The speed of aether approaching the Sun must be much higher, but still only a minor fraction of the speed of light. On the other hand, the speed of aether approaching an accretion disk and/or a black hole at the hub of a galaxy or a cluster of galaxies would more likely be close to if not beyond the speed of light, given the difficulty of light escaping from a black hole.

Assuming that some aether is absorbed by the atoms of cosmic bodies, what happens to the aether cells that the incoming aether is replacing? My principal suggestion is that the surplus aether cells are expelled from cosmic bodies by elastic collisions initiated by the incoming aether. In addition, a portion of the aether may be accounted for by the phenomenon of accretion, a subject that I deal with below under the heading **Accretion**.

I finish this section with a general description of the universe which the above aether concept of gravity suggests to me. I visualize aether flowing throughout the universe. It does so in various directions, speeds, degrees of curvature and amounts, all based upon the presence of cosmic bodies and their interplay with the aether. I visualize that the flow of aether into cosmic bodies and the use of aether by cosmic bodies as a process which is fundamental to the overall operation of the universe.

5. Concerns and Responses

During the preparation of this paper I have encountered certain concerns that have been raised in regard to the proposed gravity concept. Several of these concerns are dealt with where they naturally arise in the text of this paper. There are three, however, that have the potential of falsifying this paper if they prove to be correct. The nature of these points and my responses to them are set out below under the headings **Incineration**, **Aether Drag** and **Tides**.

5.1. Incineration

It is said that the impacts of the incoming ether will raise the heat of planets, such as the Earth, and quickly cause them to incinerate. A principal source of this criticism is James Clerk Maxwell. [19] He said:

“If any appreciable fraction of this energy is communicated to the body in the form of heat, the amount of heat so generated would in a few seconds raise it, and in like manner the whole material universe to a white heat.”

Henri Poincaré has expressed a similar opinion. [20] Does the incineration assertion falsify the present gravity proposal? In my view, it does not.

I make the assumption that aether cells and atoms are highly elastic. I also assume that elastic collisions and rebounding of aether cells with other aether cells and with atoms are the principal cause of the pushing of the Earth into its orbital path.

As a general proposition, when objects that are highly elastic collide and rebound off each other, almost all of the momentum of the elastic objects is preserved. The directions and velocities of the objects may change, but their total momentum remains essentially the same. As a result, these collisions generate practically no heat.

The lack of heat produced by elastic collisions has been described by Richard Feynman in *The Feynman Lectures on Physics*. [21] He said:

“It is possible to make the colliding bodies from highly elastic materials, such as steel, with carefully designed spring bumpers, so that the collision generates very little heat and vibration. In these circumstances the velocities of rebound are practically equal to the initial velocities; such a collision is called *elastic*.” [Italics in original]

According to Feynman, collisions between gaseous atoms and molecules are almost perfectly elastic and produce very little heat. [22]

This phenomenon is well recognized by adherents to the Le Sage theory of gravity. The Le Sage theory posits high speed gravitons impacting cosmic bodies. (See the section below entitled **The LeSage Theory of Gravity**.) Victor J. Slabinski, in his paper entitled *Force, Heat and Drag in a Graviton Model*, [23] distinguishes between gravitons which are absorbed and therefore cause heat, and gravitons which rebound on impact and are scattered. According to Slabinski, gravitons that rebound and scatter are the main contributors to the gravitational force and produce “little or nothing to the heating of masses”.

Tom Van Flandern, another proponent of the Le Sage theory, agrees with Slabinski. [24] He says:

“The absorbed-graviton models had a severe difficulty with heat flow because, if all gravitons must be absorbed to produce a net force, then the heat is so great that it soon vaporizes the receiving mass. Slabinski shows the answer to this dilemma. When some gravitons are absorbed, that produces an asymmetry for the far more numerous scattered gravitons that allows them to produce a net force too. Then scattered gravitons are the main contributors to the gravitational constant, while the relatively rare absorbed gravitons are the main contributors to heating of masses.”

I apply the same reasoning to the posited collisions between aether cells and other aether cells and with atoms. It follows that the amount of heat generated by the elastic collisions of the incoming aether cells with the atoms and aether cells of a cosmic body must be relatively small.

It is inevitable, however, that some heat will be generated, essentially caused by the portion of the aether cells that are absorbed by atoms and by whatever friction the aether cells may generate. The question here is whether there is a means by which this heat is dissipated. I suggest that there is such a means. I posit that aether cells within the Earth absorb heat and, when aether cells exit the Earth, they carry away the absorbed heat into space. In effect, the aether flow from the Earth provides a form of global refrigeration, keeping the Earth in a state of thermodynamic equilibrium.

Tom Van Flandern takes a similar approach. He posits that an aether-like substance, which he calls “elysium,” passes through the Earth and carries away the heat caused by incoming gravitons. Van Flandern likens this process to that of refrigeration. He says: [25]

“This brings to mind the heat generated by a refrigerator. Most of it must be siphoned off and dumped to allow the im-

portant part of the process to operate. The net result is just what we need to make the Le Sage graviton model work. The gravitational constant (Slabinski's eqn.16) depends on the products of absorption and scattering coefficients, the latter being huge compared to the former. Meanwhile, the heat flow (Slabinski's eqn. 19) depends only on the absorption coefficient (the part of the heat absorbed by matter instead of by elysium), and is therefore miniscule in comparison."

The proposition of heat being drawn away by outflowing "gravitons," "ether", "elysium", or "flux" finds support with various members of the scientific community, including V.V. Radzievskii and I. I. Kajalnikova, [26] K. E. Veselov, [27] H.-J. Treder, [28] and Barry Mingst and Paul Stowe. [29]

I return to the incineration assertions of Maxwell and Poincaré. In my view, their dire predictions cannot be relied upon because neither Maxwell nor Poincaré made any compensatory adjustment for heat dissipation. In this regard, see the previously cited works of Van Flandern [30] and Radzievskii and Kajalnikova. [31]

I draw certain conclusions. Given the elasticity of aether cells and atoms; given the relatively small amount of heat generated by the gravity-producing impacts; given the posited process of heat dissipation; and given that the incineration predictions of Maxwell and Poincaré make no compensation adjustment for heat dissipation, I conclude that the incineration criticism does not rest on solid ground. I also conclude that the elasticity and the heat dissipation propositions are reasonable and, more likely than not, provide the correct solution to the incineration concern.

5.2. Aether Drag

Will the friction from the Earth passing through aether cause the Earth to slow down in its orbit and spiral into the Sun? This criticism is articulated by Feynman in regard to the shadowing approach to gravity such as proposed by Le Sage. Feynman put it this way: [32]

"This particular idea has the following trouble: the earth, in moving around the sun, would impinge on more particles which are coming from its forward side than from its hind side (when you run in the rain, the rain in your face is stronger than that on the back of your head!). Therefore there would be more impulse given the earth from the front, and the Earth would feel a *resistance to motion* and would be slowing up in its orbit. One can calculate how long it would take for the earth to stop as a result of this resistance, and it would not take long enough for the earth to still be in its orbit, so this mechanism does not work." [Italics in original]

In my view, there is a significant flaw in the above reasoning. That flaw is the implicit assumption that friction will slow down a body that is maintaining its speed by the continuous application of enough force to overcome the friction. For example, consider the scenario of a person swinging around his body a weight attached to a tether. The weight and the tether will, of course, be subject to friction from the air they are moving through. However, as long as the person keeps applying adequate force to overcome the friction, the weight will remain in "orbit" around that person's body despite the friction. It is only when the application of the acceleration force is diminished or discontinued that the

weight will cease being in orbit and fall toward that person's body.

In the case of the proposed aether theory, the application of force causing the acceleration of the Earth in orbit around the sun is continuous. As long as the incoming aether continues to provide the acceleration force of gravity and as long as the magnitude of that force is sufficient to compensate for whatever friction that the Earth is encountering, there should be no slowing down of the Earth's orbital speed and no spiralling into the sun.

5.3. Tides

It is said that monstrous tides will result from the proposed concept of gravity. This criticism arises from an article published by H.N. Russell in 1921 entitled *On Majorama's Theory of Gravitation*. [33] Based upon the premise of gravitational absorption, Russell opined that solar tides on the side of the Earth facing away from the Sun would be 370 times as large as solar tides on the side of the Earth facing towards the Sun. Is this criticism correct? I think not.

I observe that Russell's criticism has been rejected by V.V. Radzievskii and I. I. Kajalnikova in their article *The Nature of Gravitation*. [34] Their detailed analysis demonstrates that Russell's contention is not applicable to the Le Sage Theory of gravity. In my view, their analysis is applicable to the gravity concept proposed by the present paper. See also the article by Matthew Edwards entitled, *Lesage's Theory of Gravity: The Revival By Kelvin And Some Later Developments*. [35]

6. The LeSage Theory of Gravity

I mentioned earlier that I had considered other mechanical concepts of gravity, but concluded that the proposed aether approach had the best prospect of being substantially correct. In this regard, I should mention a close competitor, that being the Le Sage Theory of Gravity.

In the 17th century, at the time of Isaac Newton, Nicolas Fatio proposed a mechanical theory of gravity. The theory was revived and further developed by Georges-Louis Le Sage in the 18th century and has been refined even further by a number of present-day scientists. The theory now postulates that gravitons arrive from space at a speed in excess of 20 billion times the speed of light. [36] Most of the gravitons pass right on through cosmic bodies, but some strike and, in doing so, exert momentum upon cosmic bodies. This process produces a shadowing effect between bodies, such as the Sun and the Earth. The net effect of this shadowing is that the gravitons push these bodies towards each other.

The aether approach proposed in the present paper and the Le Sage theory are similar in the sense that both are strictly mechanical. However, there are several significant differences which suggest to me that the aether approach is preferable. To start with, the aether concept is consistent with the instinctual sense that the engine which drives gravity lies within the bodies that do the "attracting." It is the absorption process within each cosmic body which causes the inflow of aether and guides its direction. In contrast, the direction of the gravitons arriving from space under the Le Sage theory is strictly random and, apart from the shadowing effect, is unrelated to the cosmic bodies. Further, it is the process of cosmic bodies making use of aether that is the

underlying rationale of the aether concept, whereas the Le Sage theory has no such fundamental rationale. In addition, the concept of flowing aether provides a concept of the universe that is not provided by the Le Sage theory. Finally, as noted above, the Le Sage theory claims that the speed of gravitons is more than 20 billion times faster than the speed of light, an as-yet unproven postulate. The aether concept makes no comparable assertion.

It should be noted, however, that I do not assert that the Le Sage theory is incorrect. Indeed, while I contend that the gravity concept set out in this paper is preferable, I am nonetheless intrigued by the Le Sage theory and, despite criticisms that have been levelled against it, I am not yet convinced that it has been falsified.

7. Related Matters

I suggest that the proposed aether and gravity concepts open up the possibility of providing explanations for various phenomena and disputed areas of physics. Subjects of this nature are dealt with below.

7.1. The Twins Paradox

The twins paradox has one twin travelling through space at a speed approaching that of light while the other twin remains behind. It is said that the twin travelling at great speed will age at a slower rate than the twin who stays at rest. Apart from mathematical explanations, it is difficult to visualize how the twin paradox can make any physical sense unless space is occupied by aether. The problem as I see it is that if space is an absolute vacuum, one cannot say which twin is moving at speed and which is at rest. In a total vacuum there are no physical guideposts to differentiate between the speeding twin and the resting twin.

However, if space is occupied by aether, then that aether provides a physical setting against which the concept of speed has meaning. In addition, the aether setting provides a physical basis for the slowing down of clocks and shrinkage of matter travelling at high speeds. Visualize the pressure that aether would exert against matter travelling through it at high speeds – much like travelling through a headwind. Would that pressure slow down the atomic processes of the speeding matter? Would that pressure cause atoms to shrink? It seems reasonable that these things might occur.

Viewed this way – in a strictly physical sense – the internal processes of the atoms comprising the twin travelling at great speed vis-à-vis the aether may well be slowed down by the pressure of the aether. As such, when that twin returns to the starting point, the fact that he or she will be younger than the twin who stayed at rest becomes a believable proposition.

For similar reasoning see papers by Herbert Ives entitled *Derivation of the Lorentz Transformations* [37] and *Historical Note on the Rate of a Moving Atomic Clock*. [38]

7.2. Mass

It takes considerable energy to accelerate particles to close to the speed of light. The result of the acceleration is that extra mass is produced, far in excess of the mass of the particles that entered the process. Frank Wilczek in his book *The Lightness of Being: Mass, Ether, and the Unification of Forces*, [39] says:

“At the Large Electron-Positron Collider (LEP), which operated at the CERN laboratory near Geneva through the 1990s, electrons and positrons (antielectrons) were accelerated to velocities within about one part in a hundred billionth (10-11) of the speed of light. Speeding around in opposite directions, the particles smashed into each other, producing a lot of debris. A typical collision might produce ten π mesons, a proton, and an antiproton. Now let’s compare the total masses, before and after:

“electron + positron: 2×10^{-28} gram

“10 pions + proton + antiproton: 6×10^{-24} gram”

What comes out weighs about *thirty thousand times* as much as what went in. And further: [40]

“But the search for simpler building blocks inside protons and neutrons ran into a bizarre difficulty. If you bang protons together really hard, what you find coming out is...more protons, sometimes accompanied by their hadronic relatives. A typical outcome would be, you collide two protons at high energy, and outcome three protons, an antineutron, and several π mesons. The total mass of the particles that come out is more than what went in.”

I suggest a mechanical explanation for this phenomenon: that the accelerated particles are ploughing through aether and the source of the increased mass is the aether cells encountered in the process.

It is known that the increase of mass with speed returns to its initial level when the speed is reduced to zero. [41] Why should this be so? It is not yet known why this occurs. However, it must be more than coincidence that the reduction in mass takes place when the accelerated particles are no longer plowing through the aether. There surely must be something of substance in the aether itself which accounts for the increase mass when particles are moving at high speed through the aether. The cessation of this phenomenon when the speed is decreased to zero would seem to support this proposition.

7.3. Wave/Particle Duality

Einstein’s photo-electric effect and the Compton effect are said to prove that light is not just a wave, but is also particulate. The particles are said to be photons. In contrast, the proposed aether postulate in the present paper contemplates that light is not particulate – rather, light is comprised only of electromagnetic waves carried through the medium of aether. Can the aether postulate be rationalized with Einstein’s photo-electric effect and the Compton effect? I suggest that the answer is yes. I contend that these effects are explainable by electromagnetic waves

proceeding through aether and activating aether cells already at the destination point. The activated aether cells at the destination give the impression of being particles (photons) that have travelled all the way from the source of the electromagnetic waves. That impression, I suggest, is an illusion. In reality, the activated cells were already at the destination when the waves left the source.

An apt analogy is a passing ship sending waves ashore. The actual water that strikes the shore is the water that was already there, not the water that the ship was passing through. In addition, Young’s two-slit experiment displays the same kind of pat-

tern for light waves as waves of water passing through two slits and, in my view, is cogent evidence that light is a wave carried by a medium.

For a discussion on the demise of the photon, see the Ives lecture entitled *Adventures with Standing Light Waves*. [42]

7.4. Dark Matter and Dark Energy

Dark matter and dark energy are phenomena which - if they exist - may well be explainable by the aether concept of gravity offered in this paper.

Scientists infer the existence of dark matter from the extra amount of gravity exhibited in galaxies and clusters of galaxies over and above the level of gravity that their constituent luminous cosmic bodies can account for. It is said that there must be a further and powerful source of gravity - thus the inference of dark matter.

In order to follow the idea that I am about to propose, it is necessary to make the assumption that black holes and/or accretion disks exist and are located at the gravitational hubs of galaxies and clusters of galaxies. It is also necessary to make the assumption that these black holes and/or accretion disks absorb aether and therefore cause aether to flow towards them. Based upon these assumptions, one can visualize that immense gravitational force will be caused by the incoming aether.

With this picture in mind, I turn to a consideration of dark matter. I suggest that dark matter - the otherwise unaccounted for level of gravity - may well be aether, itself, which is flowing towards and into black holes and/or accretion disks.

I consider next the question of dark energy. The existence of dark energy is inferred essentially from observations of galaxies and clusters of galaxies appearing to accelerate away from us. It is said that dark energy is causing that acceleration. If, in fact, such acceleration is occurring, I suggest that it may be explained by the flow of aether toward super massive gravity sources located beyond the limits of our present-day capability of observing the universe. This idea arises from consideration of a recent paper by A. Kashlinsky, F. Atrio-Barandela, D. Kocevski and H. Ebeling entitled *A Measure of Large Scale Peculiar Velocities of Clusters of Galaxies: Results and Cosmological Implications*. [43] The paper analyzes the velocities and trajectories of galaxies and clusters of galaxies that appear to be accelerating toward the outer limits of the known universe. The authors find a coherent flow of these galaxies and clusters toward sources calculated to be outside the present-day observation limits. The paper states:

“Our findings imply that the Universe has a surprisingly coherent bulk motion out to at least $\approx 300h^{-1}\text{Mpc}$ and with a fairly high amplitude of $\geq 600\text{-}1000\text{ km/sec}$, necessary to produce the measured amplitude of the dipole signal of $\approx 2\text{-}3\mu\text{K}$. Such a motion is difficult to account for by gravitational instability within the framework of the standard concordance ΛCDM cosmology but could be explained by the gravitational pull of pre-inflationary remnants located well outside the present-day horizon.”

While the authors suggest that the sources of the gravitational force could be “pre-inflationary remnants”, I think it equally fair to suggest that the gravitational sources could well be one or

more enormous black holes and/or accretion disks located outside the present-day horizon.

7.5. Accretion

The concept of gravity proposed by this paper raises the question of whether absorbed aether will exceed outgoing aether, such as to increase the mass of cosmic bodies. There is a body of opinion - albeit disputed - that cosmic bodies, including the Earth, tend to increase their mass with the passage of time. [44, 45, 46] The development and growth of our solar system during the billions of years since its birth appears to support this view. So does the existence of accretion discs observed at the centers of galaxies and clusters of galaxies.

I observe that the phenomenon of accretion - assuming it to exist - appears to be consistent with the concept of gravity proposed by this paper.

7.6. Unexplained Orbits and Trajectories

The shift in the perihelion of Mercury is, of course, well known. So is the anomalous drifting of the Pioneer 10 and 11 spacecraft toward the Sun. Other anomalies have also been observed, including trajectory shifts for the Galileo I and II, Ulysses, MESSENGER, NEAR, Cassini and Rosetta spacecraft. [47, 48]

I suggest that all these anomalies may be explained by the gravity concept proposed by this paper. As for the planet Mercury, the perihelion shift may be accounted for by Mercury proceeding through the aether in its elliptical orbit at different speeds when Mercury is closest to the Sun compared to when it is furthest from the Sun. Likewise, the trajectory shifts of the spacecraft may be explained by the effect of travelling through aether. See Herbert Ives' paper entitled *Behaviour of an Interferometer. II. Application to a Planetary Orbit in a Gravitational Field*. [49]

7.7. Bending of Light by the Sun

Einstein predicted that part of the bending of light as it goes by the Sun is attributable to light being subject to the pull of the Sun's gravity. The eclipse measurements taken in 1919 appeared to bear out his prediction. I suggest that the gravity concept proposed in this paper can lead to a similar result. Assuming that aether is a medium which carries light waves, and assuming that aether travels towards and into the Sun, then it follows that when light passes by the Sun it will encounter a cross-wind of aether being drawn in toward the Sun. This, I suggest, should cause some bending of light as it passes by the Sun.

7.8. Gravitational Lensing

The phenomenon of gravitational lensing occurs when light from distant cosmic entities, such as galaxies or clusters of galaxies, passes by less distant cosmic entities and is bent in the process. This bending of light is evidenced by such phenomena as the “Einstein Cross”, mirage-like multiple images of a more distant cosmic entity as seen by observers on Earth.

I suggest that the gravity concept proposed by this paper may provide an explanation for gravitational lensing similar to that which is set out in the above section on the bending of light by the Sun. In other words, it may well be that the lensing is caused by light traveling through aether which is moving toward an intervening galaxy or cluster of galaxies.

7.9. Effect of the Moon

In that the proposed aether concept of gravity posits the sharing of aether between cosmic bodies, should there be some noticeable gravitational effect when the moon lies between the Sun and the Earth, particularly during an eclipse? If so, where is it? I think there should probably be some noticeable effect when the moon is interposed between the Earth and the Sun and is therefore blocking and absorbing some of the aether inflow to the Earth.

Has this effect actually been observed? I can only say that certain gravitational anomalies have been observed during eclipses of the Sun by the moon. See: *L'Anisotropie De L'Espace* [50] by Maurice Allais, *Gravity's Arc* [51] by David Darling and *The Nature of Gravitation* [52] by Radzievskii and Kagalnikova. Whether these anomalies are a result of the concept of gravity proposed by this paper is an open question. I observe, however, that the anomalies appear to be consistent with the aether gravity proposal.

8. A Possible Experiment

The basic proposition in this paper, that gravity is caused by the flow of aether, may well be subjected to testing by experiment, by observing the freefall of objects towards the Earth or the Sun, preferably well outside the atmospheres of the Earth and the Sun. Another potential site is the moon. Depending on where an object is let loose in free fall, observations and calculations may give some indication of the strength and direction of the prevailing flow or flows of aether. In fact some freefall data may exist already, taken from the space-craft observations referred to in the **Unexplained Orbits and Trajectories** section above.

9. Conclusions

As noted at the outset of this paper, the General Theory of Relativity suggests a geometric explanation for the cause of gravity. In my view, the development of a simple physical concept for the cause of gravity is needed. This is what I have endeavored to provide in this paper.

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