

The Cause of Gravity

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ABSTRACT

This paper proposes a physical explanation for the cause of gravity. The proposal is built upon two fundamental postulates: (1) the existence of aether as a sub-atomic substance; and (2) the absorption of aether by atoms. The explanation which the paper offers for the cause of gravity is that the absorption of aether by atoms causes a flow of aether towards the atoms (e.g., the Earth) and the flowing aether exerts momentum upon any matter in its path. The result is gravity.

In addition, this paper suggests that the above concept provides an explanation for dark matter, dark energy and other phenomena.

INTRODUCTION

What causes gravity? I pose this age-old question in the sense of seeking a mechanical process which 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 am a retired Judge of the British Columbia Supreme Court. I started my pursuit of the question of what causes gravity by reading various books, texts and papers on the subject of gravity. I also talked and communicated with several helpful physicists. I concluded that the physical cause of gravity is not known and that this subject is open to the development of new concepts.

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:

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.¹

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 pushing or pulling 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.

¹ Newton's Third Letter to Bentley, February 25, 1692-3, Cited in Lord Kelvin's Paper *On the Ultramundane Corpuscles of Le Sage*, December 18, 1871, and in numerous other publications.

John A. Wheeler, in his book *A Journey Into Gravity and Space Time*², aptly describes the setting for what this paper is attempting to achieve. He says:

How is this abstract world of curved spacetime geometry wired up to the everyday world of tennis balls and falling weights, of spaceships and planets, of stars and galaxies? The answer is simple yet wonderful: spacetime geometry is wired up to the everyday world by a geometric principle of fantastic innocence and power, a principle that says that “the boundary of a boundary is zero.” This boundary principle reaches out guiding hands from every region to the surroundings of that region. In this way *spacetime grips mass, telling it how to move*. In this way *mass grips spacetime, telling it how to curve*. With those two states in hand, we hold before us in a nutshell all of Einstein’s great geometric theory of gravity.

Arising out of Wheeler’s observations, I ask: What is curved spacetime? How is curved spacetime “wired up” to tennis balls and galaxies? How does mass “grip” spacetime? How does spacetime “grip mass”? In this paper I approach these questions in the literal, mechanical sense, not in the geometric sense used by Wheeler.

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. They are atoms and aether. Atoms are complex organisms which have the capacity to absorb aether. Aether is a sub-atomic substance which pervades the universe. Atoms absorb aether and this causes aether to flow towards bodies such as the Earth and the Sun. The momentum of the incoming aether exerts pressure on any matter that the aether comes into contact with. The result is gravity.

² Scientific American Library, 1990, preface at pp. xi-xii.

The development of this concept has led me to consider the subjects of dark matter and dark energy. I address these topics under the heading *Dark Matter and Dark Energy*.

In addition, I set out various thoughts and ideas that are related to the gravity proposal. They are collected under the heading *Related Matters*.

AETHER

A dominant premise to the proposed concept 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 which 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 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 suggest that aether is made up of individual cells. The size of the aether cells is extremely small, such that they can easily penetrate atoms. They have mass, but their mass is small

³ 4th Edition, London, 1730, Questions 18-23.

⁴ 1864, Wipf and Stock Publishers (1996), p. 39 at para. 15.

compared to that of atoms. In addition, the cells are flexible and complex, such that they have the capacity to act as the medium which carries the vast variety of electromagnetic waves.

Maxwell in effect recognized this in saying⁵:

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 the mainstream scientific opinion. There are, however, many notable scientists today who contend that there is a medium which occupies space. A few examples:

⁵ *Supra*, p. 39 at para. 16.

- Frank Wilczek, a Nobel Laureate in physics (2004). In his book *The Lightness of Being - Mass, Ether, and the Unification of Forces*⁶, in the chapter entitled “The Grid (Persistence of Ether)”, he says:

So: What is the world made of? Subject, as ever, to addition and correction, here is the multifaceted answer that modern physics provides:

- The primary ingredient of physical reality, from which all else is formed, fills space and time.
- Every fragment, each space-time element, has the same basic properties as every other fragment.
- The primary ingredient of reality is alive with quantum activity. Quantum activity has special characteristics. It is spontaneous and unpredictable. And to observe quantum activity, you must disturb it.
- The primary ingredient of reality also contains enduring material components. These make the cosmos a multilayered, multicolored superconductor.
- The primary ingredient of reality contains a metric field that gives space-time rigidity and causes gravity.
- The primary ingredient of reality weighs, with a universal density.

There are words that capture different aspects of this answer. *Ether* is the old concept that comes closest, but it bears the stigma of dead ideas and lacks several of the new ones. *Space-time* is logically appropriate to describe something that is unavoidably *there*, everywhere and always, with uniform properties throughout. But *space-time* carries even more baggage, including a heavy suggestion of emptiness. *Quantum field* is a technical term that summarizes the first three aspects, but it doesn't include the last three and it sounds, well, too technical and forbidding for use in natural philosophy.

I will use the word *Grid* for the primary world-stuff.

- Robert B. Laughlin, another Nobel Laureate in physics (1998). In his book, *A Different Universe*,⁷ Laughlin expresses the view that a “relativistic ether” permeates space. He says:

Relativity actually says nothing about the existence or nonexistence of matter pervading the universe, only that any such matter must have relativistic symmetry.

⁶ Basic Books, 2008, chapter 8, p. 74.

⁷ Basic Books, 2005, p. 51.

It turns out that such matter exists. About the time relativity was becoming accepted, studies of radioactivity began showing that the empty vacuum of space had spectroscopic structure similar to that of ordinary quantum solids and fluids. Subsequent studies with large particle accelerators have now led us to understand that space is more like a piece of window glass than ideal Newtonian emptiness. It is filled with “stuff” that is normally transparent but can be made visible by hitting it sufficiently hard to knock out a part. The modern concept of the vacuum of space, confirmed every day by experiment, is a relativistic ether. But we do not call it this because it is taboo.

- Reginald Cahill, in his book *Process Physics: From Information Theory to Quantum Space and Matter*,⁸ argues that a “quantum foam” forms the substructure of space and that its inflow into matter is the cause of gravity. Cahill says:

Here we show that the Newtonian theory of gravity may be exactly re-written as a ‘fluid flow’ system, as can General Relativity for a class of metrics. This ‘fluid’ system is interpreted as a classical description of a quantum foam substructure to space, and the ‘flow’ describes the relative motion of this quantum foam with, as we now show, gravity arising from inhomogeneities in that flow. These inhomogeneities can be caused by an in-flow into matter...

- Stephen Wolfram, in his work entitled *A New Kind of Science*⁹, speaks of “nodes” or “cells” as the underlying structure of space. He says:

In the last section I argued that if the ultimate model of physics is to be as simple as possible, then one should expect that all the features of our universe must at some level emerge purely from properties of space. But what should space be like if this is going to be the case?

The discussion in the section before last suggests that for the richest properties to emerge there should in a sense be as little rigid underlying structure built in as possible. And with this in mind I believe that what is by far the most likely is that at the lowest level space is in effect a giant network of nodes.

In an array of cells like in a cellular automaton each cell is always assigned some definite position. And indeed, the only thing that is defined about each node is what other nodes it is connected to.

Yet despite this rather abstract setup, we will see that with a sufficiently large number of nodes it is possible for the familiar properties of space to emerge -- together with other phenomena seen in physics.

⁸ Nova Science Publisher, Inc. 2005, p. 51.

⁹ Wolfram Media, Inc., 2002, p. 475.

See also:

- James DeMeo, *Dayton Miller's Ether-Draft Experiments: A New Look*¹⁰.
- Maurice Allais, Nobel Laureate in Economics (1998) *L'Anisotropie de L'Espace*¹¹.
- Tom Van Flandern, *Dark Matter, Missing Planets and New Comets*¹².

There is a body of opinion, starting with Michelson-Moreley in 1887, that various interferometry tests establish that there is no such thing as aether. However, there is also a body of opinion that interferometer tests establish that there is in fact an aetherial substance. Cahill, in his book *Process Physics*¹³, 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 DeMao¹⁰ and Allais¹¹ 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.

¹⁰ Infinite Energy Magazine #35, Summer 2001, and Pulse of the Planet #5, 2002.

¹¹ Clément Juglar, Paris, 1997.

¹² North Atlantic Books, 1993, p. 62.

¹³ *Supra*, at pp. 117-148.

In summary, I conclude that it is reasonable to postulate the existence of aether as a basic premise of this paper.

GRAVITY

I postulate that atoms are complex, organized structures, far more sophisticated than they are generally thought to be. I also postulate that atoms are not perpetual motion machines. They are subject to the stresses and strains of constant movement and collisions. Parts get dislodged and need to be replaced. The energy of atoms, whether stored by rotation, spin or vibration, or a combination thereof, is dissipated over time, and must be replenished. How, then, do atoms carry on, seemingly forever?

I suggest that atoms have the capacity to absorb and use energy and particles that they need to operate continuously. I further suggest that this process is fuelled by aether. In effect, atoms draw aether into their atomic structure and use aether to sustain their needs. The process of atoms absorbing aether is a fundamental premise to the gravity concept proposed by this paper.

Assuming that atoms absorb aether, the aggregation of the atoms comprising the Earth must have a massive appetite. The appetite of the Sun will be far greater yet. The result? Vast inflows of aether to the Earth and the Sun.

A large part of the aether that flows into cosmic bodies passes right on through and out the other side. Some of the aether comes into contact with the bodies' atoms and some of that is absorbed. The force of the contact transfers the momentum of the incoming aether to the atoms. The contact point is predominantly the nucleus. The transfer of momentum is proportional to the mass of each atom, in conformity with the principle of equivalence.

It is the foregoing process that this paper proposes as the mechanical cause of gravity. It is thus that aether coming into the Earth keeps us clamped to the Earth.

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. Both the Sun and the Earth draw in aether from all directions. In the area between the Sun and the Earth the amount of aether available for each body to absorb is diminished by both bodies drawing in a partial share of that aether. 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 on the sides that face each other. The resulting pressure differential accounts for the Sun and the Earth being in the grip of each other's gravity.

What makes the aether flow toward cosmic bodies? The driving force which causes the inflow of aether comes from within the atom itself. Each atom has the capacity to absorb aether. It is the energy which atoms possess which drives the absorption process. As atoms absorb aether cells, the space that the absorbed cells formerly occupied is filled by adjacent aether. This is because aether acts like a gas and expands to fill the space available. This process results in a continuous flow of aether into matter.

Will 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 cosmic bodies. Think of a wide river flowing into a narrow canyon. The speed of the river's flow will accelerate. Likewise, the same phenomenon applies to the aether flow from space in towards cosmic bodies.

How can cosmic bodies make use of aether cells? Here are some suggestions:

- Aether is fuel for the continuous operation of atoms.
- Aether cells permeate the space between the nucleus and the outer perimeter of atoms. As such, they provide a structure that holds atoms together.
- This structure allows atoms to form molecules and hold them together.
- The aether structure is a medium for communication between the nuclei and the outer reaches of atoms and molecules.
- Aether cells are raw materials cosmic bodies use in the process of constructing new atoms and transforming lighter atoms into heavier atoms.
- Aether is the medium in which electric and magnetic fields operate.

There may well be other ideas as to the use of aether cells by atomic matter.

Any system that has the power to sustain itself must have a means to eliminate that which it no longer needs. I postulate that atoms have that capacity. Without such a process, the build up of particles and energy caused by the influx of aether would be impossible to cope with.

While the proposed gravity concept postulates the inflow of aether as the essential mechanism of gravity, I suggest that a counterbalancing force diminishes the gravity force. I visualize a balance between the incoming force exerted by the flow of aether coming into contact with the atoms of a cosmic body, and the outgoing force of radiation of particles and energy from the cosmic body. The balance must be in favour of the inflow of aether -- otherwise, there would be no gravity.

Why does the balance favour gravity? I suggest that the probable answer lies in accretion. In effect, more mass stays than leaves, with the net balance accounting for the predominance of the force of the incoming aether. The fact of accretion may be inferred from the development and growth process of stars and planets. Further evidence lies in accretion discs which surround black holes.

I finish this section by expressing my view on the nature of the universe which this aether concept of gravity envisages. I visualize constant flows of aether throughout the universe. The flows are in various directions, speeds, degrees of curvature and amounts, all based upon the presence of cosmic bodies (including black holes) and their interplay with aether. This, I suggest, gives physical meaning to the expression “curved spacetime”.

DARK MATTER AND DARK ENERGY

The following ideas are proposed to explain dark matter and dark energy. The ideas proceed from the cause-of-gravity concept 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 helpful to picture a black hole as the gravitational hub of a galaxy or cluster of galaxies and to visualize the immense flow of aether being drawn into such a black hole. The gravitation caused by the incoming aether will be enormous.

I suggest that dark matter -- the otherwise unaccounted for level of gravity -- may be accounted for by the flow of aether into black holes, particularly those which form the hubs of galaxies and galaxy clusters.

I turn to 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. I propose that the acceleration is in fact caused by the flow of aether toward one or more super massive gravity sources located beyond the limit 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*¹⁴. 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 a source 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 $\simeq 300h^{-1}\text{Mpc}$ and with a fairly high amplitude of $\gtrsim 600\text{-}1000\text{ km/sec}$, necessary to produce the measured amplitude of the dipole signal of $\simeq 2\text{-}3\mu\text{K}$. 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 source of the gravitational force could be “pre-inflationary remnants”, I think it equally fair to suggest that the source or sources could well be one or more enormous black holes.

¹⁴ The Astrophysical Journal, Vol. 686, 22 Sep 2008.

In summary, the ideas which I propose for dark matter and dark energy imply that these are not separate and distinct phenomena; rather, they are simply the gravitational flow of aether drawn into massive sources such as black holes.

RELATED MATTERS

The Cahill Theory of Gravity

Earlier in this paper I referred to a book (*Process Physics: From Information Theory to Quantum Space and Matter*) written by Reginald T. Cahill. He is a professor of physics at Flinders University at Adelaide, Australia. In his book, Cahill proposes a gravity theory that is similar to my concept in the sense that both approaches involve the flow of a substance (he uses “quantum foam” and I use “aether cells”) into cosmic bodies as the instrument of gravity. I discovered Cahill’s work after I had conceived and put into draft form the concept I am proposing in the present paper. I am pleased that Cahill’s theory, at least in part, appears to provide a measure of credibility to my approach.

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.¹⁵ 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 cosmic bodies, such as the Sun and the Earth. The net effect of this shadowing is that the gravitons push these bodies towards each other.

¹⁵ *Experimental Repeal of the Speed Limit for Gravitational, Electrodynamical, and Quantum Field Interactions*, Tom Van Flandern and Jean-Pierre Vigièr, *Foundations of Physics*, Vol. 32, No. 7, July 2002, p. 1032; *The Speed of Gravity -- What the Experiments Say*, Tom Van Flandern, *Phys. Lett. A250#1-3*, 1-11 (1998).

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. It is consistent with the instinctual sense that the engine which drives gravity lies within the bodies that do the attracting. In contrast, the direction and the speed of the gravitons arriving from space under the Le Sage theory are not caused by the bodies that are receiving the gravitons. The proposed gravity concept is based upon the uses which atomic matter may make of aether, whereas the Le Sage theory has no such underlying rationale. Aether provides a certain structural concept of the universe, whereas the Le Sage theory does not. A concern expressed by scientists about the Le Sage theory is that the incoming gravitons will cause a destructive build up of heat; this problem is not built into the aether approach. 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.

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 contemplates that light is not particulate -- rather, light is 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 pattern 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.

Perihelion of Mercury

I suggest that the particular portion of the change in the perihelion of Mercury which is not accounted for in Newton's approach to gravity may be explained by Mercury encountering much more aether in the part of its elliptical orbit that is closest to the Sun than in the part of its orbit that is furthest from the Sun.

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 theory. I suggest that the gravity concept proposed in this paper can lead to a similar result. Assuming that aether is the medium which carries light waves, and assuming that aether is drawn in towards the Sun, the moving aether and/or any other substance which the aether carries along with it should cause some bending of light as it travels by the Sun.

Gravitational Lensing

Similar to the above explanation for the bending of light waves passing by the Sun, the presence of aether and/or some other substance surrounding and being drawn into galaxies offers an explanation for the bending of light passing by those galaxies, i.e., the lensing effect.

Action-At-A-Distance and Aberration

Between the Sun and the Earth, there is substantially no apparent aberration arising from gravity. This lack of apparent aberration gives the impression of gravity between the Earth and the Sun being instantaneous. Thus, the expression "action at a distance". In contrast, there is aberration in respect of sun light which takes about eight minutes to travel from the Sun to the Earth.

The question here is whether the concept of gravity proposed by this paper is consistent with the appearance of action-at-a-distance and lack of gravitational aberration between the Sun and the Earth. This is not a simple problem to solve.

There are several explanations that scientists have provided for the appearance of action-at-a-distance and lack of aberration. All of these explanations depend upon various underlying

assumptions. These assumptions include the speed of the agents which are said to cause gravity, the application of general relativity, the transverse speed of the Earth in regard to the Sun, the effects of rotation, the Fitzgerald-Lorentz transformations and Mach's principle. I refer to the following:

- Steve Carlip, *Aberration and The Speed of Gravity*.¹⁶
- Tom Van Flandern, *Experimental Repeal of the Speed Limit for Gravitational, Electrodynamical, and Quantum Field Interactions*.¹⁷
- Oleg Jefimenko, *Causality Electromagnetic Induction and Gravity*, 2nd Ed.¹⁸
- Oliver Heaviside, *A Gravitational and Electromagnetic Analogy, Part II, The Electrician*.¹⁹
- Henri Poincaré, *On the Dynamics of the Electron: Introduction*.²⁰
- Reginald Cahill, *Process Physics*.²¹
- Amitabha Ghosh, *Mach's Principle and the Origin of Inertia*.²²

An interesting thing about the explanations based upon differing basic premises is that all the scientists who propose the explanations conclude that their proposals are consistent with the appearance of action-at-a-distance and the appearance of lack of aberration.

I note that Reginald Cahill, whose theory of gravity involves the inflow of "quantum foam", addresses the question of action-at-a-distance in his book *Process Physics*,²³ and concludes that his theory is consistent with the notion of action-at-a-distance. Cahill says:

¹⁶ Phys. Lett. AZ67 (2000) 81-87.

¹⁷ Foundations of Physics, Vol. 32, No. 7, July 2002.

¹⁸ Electret Scientific Company, 2000, p. 92.

¹⁹ Vol. 31 (1893), p. 359.

²⁰ SS 1.9, Rend. Circ. Matem. Palermo 21 (1906) 129.

²¹ *Supra*, at p. 85.

²² (C. Roy Keys Inc. 2003), p. 14.

²³ *Supra*, at p. 85.

The new theory of gravity, as expressed in (7.19)-(7.20) [Cahill's gravity formulas] and the corresponding expression for the gravitational acceleration, has a remarkable property, namely that it is invariant under a Galilean transformation, as explicitly discussed in the following two sections. But most importantly this implies that gravitational effects are instantaneous, that is, that there are no time delays in the 'propagation' of gravitational effects. In fact to be more accurate these effects do not propagate. This is not to be confused with the gravitational wave effects which do propagate with finite speeds. Hence the new theory shares with the Newtonian theory of gravity the notion of 'action at a distance'.

I do not have the mathematics required to calculate whether the gravity concept this paper proposes leads to the same conclusion. Accordingly, I must leave unanswered the question of whether the proposed explanation of gravity is or is not consistent with the appearance of action-at-a-distance and the appearance of lack of gravitational aberration.

The Twin Paradox

The twin 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 operation of the Lorentz transformations of the slowing down of time and shrinkage of matter travelling at high speeds. Visualize the pressure that aether would exert against matter travelling through it at high speeds. Would that pressure slow down the atomic processes of the

speeding matter? Would that pressure cause atoms to shrink? It seems reasonable that these results would 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.

Mass

It takes considerable energy to accelerate particles to close to the speed of light. This process appears to produce a curious result: the mass produced exceeds the mass of the particles that entered the process. I draw this proposition from the following passages in Wilczek's book *The Lightness of Being*²⁴:

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 further²⁵:

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

²⁴ *Supra*, at p. 16.

²⁵ *Supra*, at p. 31.

be, you collide two protons at high energy, and out come 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 these phenomena: The accelerated particles are ploughing through aether and the increased mass is caused by the absorption of aether cells encountered in the process.

Inertia

There are several theories of the phenomenon of inertia. I suggest that inertia is a form of bonding of atomic matter to aether arising from the process of atomic matter absorbing aether. In effect, atomic matter tends not to move from the hold of aether unless some force causes that movement.

Where there is a constant flow of aether into matter from all sides, the aether tends to hold the matter in place. With respect to ourselves on earth, we are subject to the flow of aether coming into the earth and so the grip on us is essentially one-sided. Thus we experience what we know of as weight.

If matter is subjected to a force which breaks the hold of inertia, that matter will be generally subject to an almost imperceptible slowing down of its speed as it encounters aether in its trajectory. This process may well explain the precession of the perihelion of Mercury.

The Source of Life?

I cannot avoid the temptation to note that the concept of the structure and operation of atoms in the present gravity proposal raises the question of whether the atomic structure itself may be considered as the prototype of life. If the atom does in fact have the capacity to absorb aether, to

use it for its operation and maintenance, absorb and emit electromagnetic waves, and eliminate that which it does not need, then is the atom far removed from that which is the essence of life?

A Possible Experiment

The acceleration caused by gravity on Earth is well known to be about 10 metres per second per second. Is this consistent with the proposed concept of gravity? It seems to me that the gravity concept set out in this paper implies that there must be a limit to the speed of matter in freefall. This proposition 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 or of the Sun. Another potential site is the moon. Depending upon where an object is let loose in free fall, observations and calculations may give some indication of the strength and direction of: aether drawn into the Earth; aether drawn into the moon and the Sun; aether through which the Earth travels in orbit around the Sun; and galactic flow of aether.

It has been suggested to me that the freefall speed should be the same as the escape velocity. I have some doubt that this is so, given the different kinds of aether flows mentioned above. However, simple experiments as suggested above may well demonstrate the validity or otherwise of this suggestion.

ANSWERS TO SPACETIME QUESTIONS

I return to questions I posed after quoting John Wheeler's colourful description of the relationship between mass and curved spacetime. I now answer the questions, not by reference to geometry, but by applying the physical concepts set out in this paper. Question: What is curved spacetime? Answer: Curved spacetime is the flow of aether in space. Question: How is curved

spacetime wired up to tennis balls and galaxies? Answer: The momentum of flowing aether wires up spacetime to tennis balls and galaxies. Question: How does mass grip spacetime? Answer: Mass grips spacetime by the atoms of matter drawing in aether. Question: How does spacetime grip matter? Answer: Spacetime grips matter the same way as it wires up tennis balls and galaxies - by aether exerting its momentum on any matter in its path.

CONCLUSION

In my view, the question of what causes gravity needs a new and simple conceptual approach.

This is what I have tried to provide in this paper.

To those who may read this paper, I invite comment.

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