# The cause of gravity—a concept

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**Abstract:** The concept of gravity proposed by this article is based on the proposition that a subatomic substance called *aether* permeates space and all cosmic bodies that occupy space. The concept posits that aether flows from space into cosmic bodies and, at the same time, aether or its constituent particles, collectively "aether," is expelled out of cosmic bodies into space. The movement of aether exerts ram pressure on any matter in its path. The ram pressure exerted by aether that flows into cosmic bodies is greater than the ram pressure produced by aether that is expelled into space. The difference between incoming and outgoing ram pressure is the force of gravity. The process is cyclic and never ending. Spatial aether possesses internal energy and this internal energy drives the flow of aether into cosmic bodies. Incoming aether impacts upon cosmic bodies and the impacts generate energy in the form of heat. This heat causes the expulsion of resident aether from cosmic bodies. The expulsion of aether lowers the density of the aether that is left behind, and spatial aether flows into the lower-density aether. Expelled aether proceeds into space, where it regenerates the supply and the energy of spatial aether. Aether that flows into the Sun is derived from a catchment area that extends well beyond the area occupied by the solar system. Thus, as aether moves toward the Sun, it encounters the planets en route, pushing them in the direction of the Sun. © *2012 Physics Essays Publication*. [DOI: 10.4006/0836-1398-25.1.66]

**Résumé:** Cet article propose un concept de la cause de la gravité. Il est basé sur la proposition qu'il existe une matière sous-atomique qui s'appelle l'éther et qui existe dans l'espace et dans les astres qui occupent l'espace. Selon ce concept, l'éther coule de l'espace et entre dans les astres cosmiques et, en même temps, l'éther ou ses particules constituantes, collectivement "l'éther", est expulsé des astres en l'espace. Le mouvement de l'éther exerce de la pression directe sur la matière que l'éther rencontre. L'éther qui entre dans les astres cosmiques exerce plus de pression directe que l'éther qui en sort. La pression directe nette est la force de la gravité. Le processus est cyclique et ne cesse jamais. L'éther spatial possède de l'énergie interne qui pousse l'éther à l'intérieur des astres cosmiques. Les collisions produisent de la chaleur. La chaleur fait expulser l'éther des astres. L'expulsion réduit la densité de l'éther qui reste encore dans des astres, et de l'éther spatial coule dans l'éther de densité réduite. L'éther expulsé va dans l'espace ou il augmente l'éther spatial et son énergie. L'éther qui coule vers le soleil provient du volume de l'espace bien plus large que le volume occupé par le système solaire. Donc, quand l'éther est en route vers le soleil, l'éther rencontre chacune des planètes et pousse chaque planète vers le soleil.

Key words: Cause of Gravity; Aether; Ram Pressure; Flow of Aether; Regeneration of Aether.

## I. 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? Is there a mechanical process that causes gravity? This article explores these questions and proposes a concept of the physical cause of gravity.

The concept is based upon the fundamental premise that the cause of gravity is mechanical—a physical process that is explainable in terms of cause and effect.

In one of the most quoted passages of all science, Newton said:[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 is material or immaterial, I have left to the consideration of my readers.

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Visualize a ball thrown into the air and falling back to the ground. What is the mechanical cause of what is occurring? The rise of the ball must surely be slowed down and stopped and accelerated back towards the Earth's surface by something putting physical pressure on the ball.

Some say that Einstein's General Theory of Relativity sets out what causes gravity, but this is not so. The General Theory of Relativity sets out the geometry of gravity, but it does not describe the underlying physical mechanics of gravity.

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]

Newton's Third Law says: For every action there is an equal and opposite reaction. This law is equally valid when stated in reverse: For every reaction there is an equal and opposite action. The importance of considering Newton's Third Law in reverse is that for gravity we know the "reaction" side of the equation. We know that the Earth and the Sun constantly accelerate toward each other. Therefore, there must be an equal and opposite action that causes the mutual acceleration of these bodies. What is that action? It must surely be a pull or a push. Either the Earth or the Sun are pulled toward each other, or they must be pushed toward each other.

Are the Earth and the Sun being pulled toward each other? The answer must be no. It is axiomatic that a pull requires an unbroken mechanical connection by which the pull is effected. But there is no discernible unbroken mechanical link between the Earth and the Sun. The pull mechanism as the cause of gravity must therefore be eliminated.

This leaves the push alternative: something that is pushing the Sun and the Earth toward each other must be the cause of gravity. What might be doing the pushing? This article proposes that the ram force of flowing aether does the pushing.

The gravity concept is premised on the proposition that a subatomic substance called *aether* permeates space and all cosmic bodies that occupy space. Aether flows into and out of cosmic bodies, exerting ram pressure on any matter in its path. The ram pressure of inflowing aether is higher than the ram pressure of outflowing aether. Gravity is the result of the pressure difference.

The process is cyclic. Inflow is driven by the internal energy of spatial aether. The impacts of incoming aether cause heat that in turn causes the expulsion of aether from cosmic bodies. The expelled aether regenerates the supply and the energy of spatial aether.

Aether that flows into the Sun comes from a catchment area that extends into space well beyond the area occupied by the solar system. Thus, as aether is moving toward the Sun, it encounters the planets and pushes them in the direction of the Sun.

The concept accords with the acceleration aspect of gravity. As aether moves from outer space towards the relatively small target of a cosmic body, the aether continuously converges and therefore continuously accelerates.

## II. AETHER

The proposed gravity concept is premised upon the existence of aether. The idea of aether is not new. Newton, in his treatise *Opticks*,[3] queried whether a highly elastic substance called aether pervades the universe and is the medium that carries heat and light. He also queried whether the "elastick force" of this medium might be the power of gravity.

Faraday and Maxwell were of the view that there must be such a substance as aether. They saw it as a medium that 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.

Maxwell conceived of aether being flexible and complex, such that collectively it acts as a medium that carries a vast variety of electromagnetic waves. He said:[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.

Evidence to support the proposition that there must be a physical substance that we call aether lies in every day experience. There must be something physical pushing us toward planet Earth and keeping us here when, without that pressure upon us, the centrifugal force from the rotation of the Earth would toss us into space. Young's two-slit experiment demonstrates that when light travels through what we call a vacuum, it produces the

same kind of interference patterns as are created by waves traveling through a physical medium, such as water. Although other scientific explanations are offered for the interference patterns evidenced in Young's two-slit experiment, the waves-through-a-medium explanation remains 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. Nevertheless, many notable scientists contend that there is a medium that occupies space. Here are some examples:

- Dirac, Nobel Laureate in physics (1933). In a letter published in *Nature* in 1951,[6] entitled "Is There an *Aether*?" Dirac opined, with supporting reasons, that aether must exist.
- Ives, recipient of the Rumford Medal (1951) for outstanding contributions to the sciences of heat and light. In his 1953 article[7] entitled "Genesis of the Query 'Is There an *Aether*?'," Ives set out reasons for the existence of aether. In an earlier (1945) article,[8] entitled "Derivation of the Lorentz Transformations," he attributed the Lorentz transformations of mass, length, and time to the speed of bodies traveling through aether.
- Allais, Nobel Laureate in Economics (1988). In his 1997 book, *L'Anisotropie de L'Espace*,[9] he gave detailed reasons why there must be "éther" and argued that it is what present-day scientists call a "field."
- Wolfram, author of *A New Kind of Science*,[10] published in 2002. He describes space as a "giant network of nodes" or "cells," and opines that this network is tied to gravity.
- Cornille, author of *Advanced Electromagnetism and Vacuum Physics*,[11] published in 2003. In his book he analyses in detail why "ether" must exist.
- Laughlin, Nobel Laureate in physics (1998). In his 2005 book, *A Different Universe*,[12] Laughlin expresses the view that a form of matter permeates space. He calls it "stuff" and "relativistic ether." He says that he does not call it "aether" because that is "taboo."
- Cahill, author of *Process Physics: From Information Theory to Quantum Space and Matter*,[13] published in 2005. In his view, a "quantum foam" forms the substructure of space and its inflow into matter is the cause of gravity.
- Wilczek, a Nobel Laureate in physics (2004). In his 2008 book *The Lightness of Being — Mass, Ether, and the Unification of Forces*,[14] he says that space is filled with a substance that causes gravity and from which all else is formed. He uses the word "Grid" for this substance.

There is a body of opinion that the Michelson-Morley 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*,[15] provides a detailed explanation of 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 work of Allais, cited earlier.

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:[16]

> 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, the present author suggests that it is reasonable to postulate the existence of a subatomic substance that permeates the universe. It is of little or no importance to the gravity model proposed by this article whether this substance is called "grid," "stuff," "relativistic ether," "quantum foam," "network of nodes or cells," "etherial medium," "field," "ether," or the word chosen for use in this article—"aether."

The aether that is posited for this article permeates space and all material bodies that occupy space. It is made up of flexible cells and the cells are comprised of particles that permit the cells to be flexible. Aether possesses properties of a gas, with the thermodynamic parameters of temperature, pressure, and density, and the capacity to flow like a fluid and exert ram pressure on any matter in its path.

## III. THE GRAVITY CONCEPT

The proposed gravity concept is based upon the proposition that aether exists in space and in all cosmic bodies that occupy space. The concept posits that aether flows from space into cosmic bodies and, at the same time, aether or its constituent particles, collectively, "aether," is expelled out of cosmic bodies into space. The movement of aether exerts ram pressure on any matter in its path. The ram pressure exerted by incoming aether is greater than the ram pressure produced by outgoing aether. The difference between incoming and outgoing ram pressure is the force of gravity.

The process of incoming and outgoing aether is cyclic and never ending. Spatial aether possesses internal energy that drives the flow of aether into cosmic bodies. Incoming aether impacts upon cosmic bodies and the impacts generate energy in the form of heat. This heat

causes the expulsion of resident aether from cosmic bodies. The expulsion of aether lowers the density of the aether that is left behind, and spatial aether flows into the lower-density aether. Expelled aether proceeds into space, where it regenerates the supply and the energy of spatial aether.

Aether that flows into the Sun is derived from a catchment area that extends well beyond the confines of the solar system. As aether moves toward the Sun, it encounters the planets en route. In doing so, the flowing aether exerts ram pressure on the planets, pushing them in the direction of the Sun.

Details of the gravity concept are explored later.

The phenomenon of "ram pressure" plays an essential role in the gravity concept. What is ram pressure? It is that part of the dynamic pressure of a flowing fluid that actually transfers kinetic energy to any object in its path.[17] In other words, ram pressure is that portion of dynamic pressure that actually pushes a material object.

Clarke and Carswell, in *Principles of Astrophysical Fluid Dynamics*,[18] explain that ram pressure is a stress tensor produced by bulk motions of a fluid. They cite an example:

> We conclude with a simple example of the flow of a hot fluid, pressure $p$, down a pipe. *Any* surface in the fluid will experience momentum flux $p$ due to the thermal pressure, but only a surface whose normal has some component along the direction of the flow experiences the ram pressure.

The gravity concept starts with the proposition that aether flows from space into cosmic bodies. Spatial aether possesses internal energy—like a gas. It is this energy that powers the flow of aether into cosmic bodies. The proposition that aether has internal energy is well recognized. Newton, in his queries in *Opticks*, attributed "elastick force" to aether. Maxwell opined that aether has energy that consists of the elastic motion of its parts and in its connections. In present-day science, Wilczek says that aether (his "ethereal grid") is "alive with quantum activity." Likewise, the zero-point energy field theory posits that there is energy in cells that occupy space. Cosmic background radiation, with its temperature of 2.7 K, provides further indication of energy in space.

Although the internal energy of aether is the driving force of inflowing aether, something else is necessary to give direction to the flow—something that causes the flow to be toward cosmic bodies. This brings into play the property of aether—like a gas—to flow from areas of higher density into areas of lower density. In this regard, the expulsion process is significant. Expulsion is caused by heat that is generated by the impacts of inflowing aether. The result of expulsion is that it leaves behind places of reduced density—spaces that the expelled aether occupied before being expelled. Spatial aether flows like a gas into these places of reduced density. In effect, inflow and expulsion are inextricably tied to each other. Each is a primary cause of the other. Together they form a continuous cycle.

It is helpful to consider the analogy of an ordinary vacuum cleaner. This household appliance draws in air by a form of suction. Note what causes the suction. The suction is caused by the vacuum cleaner forcibly expelling air and thereby creating a partial vacuum into which ambient air flows. Likewise, "ambient" aether from space flows into areas of lower density of aether in cosmic bodies, the reduced density of which is continuously caused by the expulsion of aether.

The ram pressure of aether is continuously transferred to cosmic bodies. When inflowing aether enters a material body, it comes into contact with the body's matter and its aether. This sets off a series of elastic collisions between the body's atomic matter and its aether cells, proceeding throughout the body and every part thereof. This process is called scattering. It is like the scattering of a rack of pool balls when struck by a cue ball. This process transfers ram pressure from the incoming aether to the whole of a cosmic body.

The expulsion of aether is an essential element of the gravity concept. In addition to the role that expulsion plays in regard to the direction of inflow (as described earlier), there are three further reasons for expulsion of aether being essential to the gravity concept. The first is that expulsion of aether is essential for the dispersal of heat generated by inflowing aether. The production of heat caused by the impacts of inflowing aether, would, if not dispersed, be sufficient to incinerate and destroy cosmic bodies. This proposition has been established by Maxwell, Poincaré, and Kelvin; see Section IV. The second reason is that without the compensating factor of outflow, the constant influx of aether that is required to provide the force of gravity would quickly cause cosmic bodies to balloon in size. The third reason is that regeneration of spatial aether is essential for the never-ending operation of gravity. Expulsion of aether into space permits this to occur. It provides the continuous supply and energy to spatial aether.

Heat that is imparted to cosmic bodies by the impact of inflow is the essential source of energy that causes the expulsion of aether from cosmic bodies. The precise mechanism of outflow is difficult to pinpoint. However, there are a number of means known to science that may be applicable. They include radiation,[19] convection,[20] diffusion,[21] evaporation,[22] superfluidity,[23] and rebounding.[24] The scope of this article does not extend to analyses of each of these possible outflow mechanisms.

Of the mentioned possible mechanisms, there is one that the present author considers as one of the more likely alternatives. It is a form of radiation of the particles that make up aether cells. In this scenario, the impacts of incoming aether and scattering cause aether cells to fragment into their constituent particles. The generated heat expels the particles into space, where they eventually reconstitute into aether cells and regenerate the supply and energy of spatial aether. An advantage of this approach is that the particles that make up aether cells are obviously smaller than aether cells themselves, and are

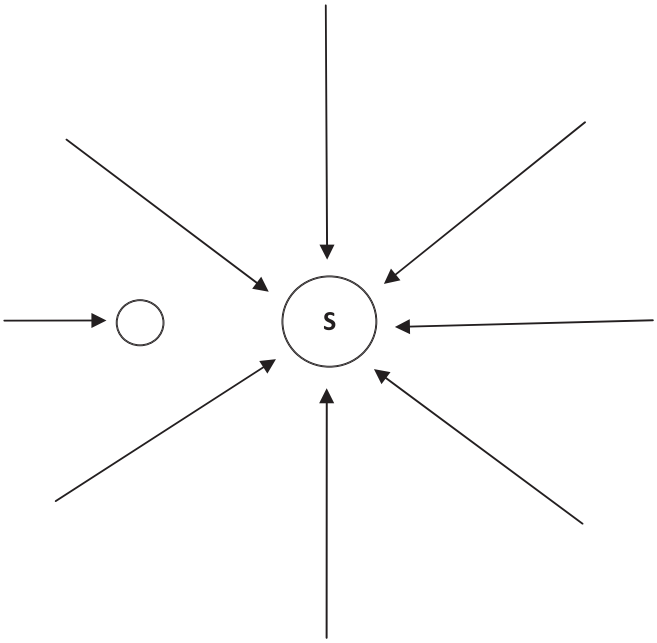


FIG. 1. Aether pushing the Earth toward the Sun (S).

therefore better suited to pass on through or by material matter and aether cells with much reduced ram pressure.

An essential element of the gravity concept is that ram pressure exerted by inflowing aether on material matter is greater than ram pressure produced by expulsion. If the proposition that inflow and expulsion of aether both exert ram pressure on any matter they encounter is correct, then the question of which flow exerts the greater ram pressure is answered by the immutable fact that the direction of the force of gravity is inward, toward cosmic bodies.

There are compelling reasons to expect that inward and outward ram pressures are unequal. The first is that inflow and outflow are quite separate and distinct processes. On the one hand, inflowing aether is driven by its internal energy. The application of this energy is continuous throughout the whole of the journey of inflowing aether from space to its destination. On the other hand, the application of energy to expel aether occurs essentially instantaneously. It takes place at the point where aether cells or their constituent particles are expelled from cosmic bodies. Once the expulsion occurs, there is no further application of energy. Batchelor's text, *An Introduction to Fluid Mechanics*,[25] draws a distinction between long-range forces of the bulk flow of fluids and short-range forces that propel molecules.

The mechanisms of inflow and outflow bring into consideration an array of variable factors that bear upon ram pressure. These variables include temperature, viscosity, density, the size and shape of the flowing particles, and the size, shape, and density of the objects encountered by the flow. See Batchelor's text recently referenced[26] and Battaner's book *Astrophysical Fluid Dynamics*.[27] This article does not analyze the several variable factors that affect the level of ram pressure. Such analyses, when done, could well give guidance as to the mechanisms of inflow and outflow and explain why inflow ram pressure is greater than outflow ram pressure.

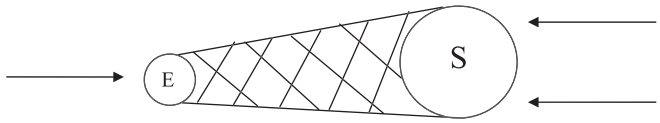


FIG. 2. Shadowing between the Earth (E) and the Sun (S).

This leads back to the suggested mechanism of expulsion, that being radiation of the constituent particles of aether cells. Pushing this line of thought to the extreme, it opens up the possibility that the ram pressure of expelled particles may be so negligible that incoming ram pressure effectively becomes the sole cause of gravity.

The article now turns to the application of the gravity concept to our Solar System. Visualize the catchment area of aether that flows into Sun. It extends into space well beyond the area occupied by the Sun and the planets. In this setting, aether that is drawn toward the Sun encounters each of the planets en route. In doing so, the impacting aether pushes the planets in the direction of the Sun. Figure 1 illustrates this point as between the Earth and the Sun.

The same phenomenon occurs with aether that is drawn toward each of the planets and encounters the Sun en route. To the extent that the Sun intercepts these aether flows, the flows push the Sun toward each of the planets.

In addition, there is a related shadowing effect. As noted earlier, the planets intercept aether that is flowing toward the Sun and the Sun intercepts aether that is flowing toward the planets. This deprives the sides of the Sun and the planets that face each other of ram pressure that they would otherwise receive. Figure 2 illustrates the Earth and the Sun shadowing each other.

In summary, greater ram pressures on the far sides of planets and the Sun and reduced ram pressures on the sides of the planets and the Sun that face each other cause the planets and the Sun to be in each other's gravitational grip. It is thus that the phenomenon of gravity applies to all cosmic bodies.

In a similar manner, we on Earth are subjected to gravity. The ram force exerted by aether coming into the Earth is greater than the ram force of aether exiting the Earth. The net effect of the ram force of incoming aether less the ram force of outgoing aether provides what we experience as gravity. Thus, the ball that is tossed in the air is slowed down, stopped, and brought back to Earth by the pushing force of flowing aether.

A dominant characteristic of gravity is acceleration. The proposed model provides for acceleration. It does so by the convergence of aether as it flows toward a cosmic body. A cosmic body is a relatively tiny target in the vast expanse of space. As aether travels toward a cosmic body, convergence is inevitable and, therefore, so is acceleration. It is helpful to visualize air flowing toward a household vacuum cleaner. The closer the incoming air gets to the vacuum cleaner, the faster it travels. In effect, inflowing aether is subjected to a global form of the

Venturi effect applicable to any fluid, the flow path of which is progressively restricted. The fluid's velocity accelerates and, accordingly, so does the ram pressure it exerts.

Another characteristic of gravity is its proportionality to mass. To state the obvious, a given volume of gold weighs more than the same volume of water. It is suggested that the reason for this is that gold is impacted by more aether than water on a per-unit volume basis. This explanation looks to the phenomenon of the mean free path of the movement of gas molecules and applies it to aether. When flowing aether encounters matter, the number of impacts by the flowing aether will vary with the size of the atoms and their collective density. Feynman used the expression "collision cross section." In his words:[28]

> The average distance a molecule goes before colliding with another molecule—the mean free path *I*—will depend on how many molecules there are around and on the "size" of the molecules, i.e., how big a target they represent. The effective "size" of a target in a collision we usually describe a "collision cross section," the same idea that is used in nuclear physics, or in light-scattering problems.

At what speed or speeds does aether travel? This article does not attempt to calculate exact speeds. However, it is suggested that the acceleration rate of gravity at the Earth's surface (9.8 $m/s^2$) provides a rough indication that the speed of aether flowing into the Earth is relatively slow as compared to the speed of light. The speed of aether approaching the Sun is no doubt faster, but likely no more than a minor fraction of the speed of light. In contrast, the speed of aether approaching a galactic nucleus may well be closer to, if not beyond, the speed of light, this being evidenced by the difficulty of light escaping from galactic nuclei.

## IV. HEAT

The works of Maxwell, Darwin, Poincaré, and others attack the Le Sage theory of gravity on the ground that impacts of incoming gravific corpuscles would heat cosmic bodies to such an extent that they would quickly be destroyed. The purpose of this section is to answer the heat argument, and do so with particular reference to the gravitation model proposed by the present article.

According to the Le Sage theory, gravific corpuscles crisscross space at extremely high speeds, collide with matter in cosmic bodies, and thereby cause gravity. The present article posits that gravity is caused by aether that flows at velocities generally under the speed of light. However, both models require the same amount of pushing force to maintain the Earth in its orbit around the Sun. This conclusion is required by Newton's third law. Thus, this reply to the heat issue follows.

In 1872, in an article entitled "On The Ultramundane Corpuscles of Le Sage,"[29] Thomson (Lord Kelvin) answered the heat allegation by positing that heat caused by the impacts of incoming gravific corpuscles is carried away into space by outgoing gravific corpuscles. In the following passage, Kelvin articulates the heat issue:[30]

> If the gravific corpuscles leave the earth or Jupiter with less energy than they had before collision, their effect should be to continually elevate the temperature throughout the whole mass. The energy which must be attributed to the gravific corpuscles is so enormously great, that this elevation of temperature would be sufficient to melt and evaporate any solid, great or small, in a fraction of a second of time. Hence, though outward-bound corpuscles must travel with less velocity, they must carry away the same energy with them as they brought.

Kelvin then stated his solution:[31]

> Suppose now, the whole energy of the corpuscles approaching a planet to consist of translatory motion; a portion of the energy of each corpuscle which has suffered collision must be supposed to be converted by the collision into vibrations, or vibrations and rotations. To simplify ideas, suppose for a moment the particles to be perfectly smooth elastic globules. Then collision could not generate any rotatory motion; but if the cage-atoms constituting mundane matter be each of them, as we must suppose it to be, of enormously great mass in comparison with one of the ultra mundane globules, and if the substance of the latter, though perfectly elastic, be much less rigid than that of the former, each globule that strikes one of the cage-bars must (Thomson & Tait's National Philosophy, §301), come away with diminished velocity of translation, but with the corresponding deficiency of energy altogether converted into vibration of its own mass. Thus the condition required by Le Sage's theory is fulfilled without violating modern thermo-dynamics...

In 1875, Maxwell took issue with Kelvin's solution. He did so in the "Atom" section of the 1875 (9th) edition of the Encyclopaedia Britannica.[32] Maxwell argued that Kelvin's solution could not "account for the temperature of bodies remaining moderate while their atoms are exposed to the bombardment." Maxwell reasoned that it was "tolerably certain" that the number of gravific corpuscles within any unit of volume is small compared to the number of molecules of matter. It followed, he said, that the mass times the square of the velocity ($M\mu^2$) of the incoming corpuscles "must be enormous compared with the corresponding quantity for ordinary bodies, and it follows that the impact of the corpuscles would raise all bodies to an enormous temperature."

In 1877, Preston answered Maxwell. In an article entitled "On Some Dynamical Conditions Applicable to Le Sage's Theory of Gravitation, No. 2," Preston took direct issue with Maxwell's reasoning.[33] He said:

> . . .I think it admits of being surmounted on taking certain facts into consideration. It will be admitted that, in order to produce gravity, it is only necessary that not less than a certain *total* of energy should be contained in a given volume of the gravific medium, not that thereby the energy of *each* particle should necessarily be great. The energy of each particle (whose sum produces a given total of energy) would evidently depend on the number of particles in unit volume. Professor Maxwell assumes that it is 'tolerably certain that N, the number of (gravific) corpuscles which are at any one time within unit of volume, is small compared with the value of N for the molecules of ordinary bodies.' Now we may ask, Is this *certain* or necessary? For the whole hinges upon this. If, on the contrary, the number of gravific particles in unit volume were not restricted, then by adding to the number of particles, and thus subdividing the total energy among them, the energy of each particle might be made indefinitely small.

Preston then went further. He considered Kelvin's approach to heat dispersal, and agreed with him. Preston said:[34]

> It would be in the highest degree unlikely that portions of matter differing so vastly from each other in dimensions as a molecule and a gravific particle should have the *same* elastic rigidity. If the elastic rigidity be not the same, it is a strict dynamic fact, not a supposition, that the energy of the particle after its rebound from a molecule, though the same in amount, will not be the same in *kind* as before; but if the elastic rigidity of the large molecule be greater than that of the minute particle, a part of the translatory motion of the particle will be shivered into vibratory motion at the encounter; and therefore the particle will rebound with a less translatory motion, the deficiency of translatory motion representing the amount converted into vibratory motion at the encounter.

Maxwell never did publish a reply to Preston's article. Likely this was because Maxwell's untimely death in 1879 cut short his opportunity to reply. In the meantime, Kelvin's interest in the Le Sage theory diminished, apparently as a result of Kelvin's abandonment of his own theory of vortex atoms.[35]

In 1905, Darwin authored an article entitled "The Analogy Between the Le Sage's Theory of Gravitation and the Repulsion of Light,"[36] in which he argued that Le Sagean gravity was falsified on the ground that one of its essential elements, that being porosity, was incompatible with the inverse square rule of gravity. In his article, Darwin dealt with Kelvin's "modification" of the Le Sage theory. He concluded that the Le Sage theory and Kelvin's modification must "stand condemned." It is important to read Darwin's words in context. In substance, what Darwin was saying was that because the Le Sage theory must fail on the porosity point, there remained no base upon which the Kelvin modification could stand. In fact, Darwin did not attack Kelvin's reasoning in regard to heat dispersal—his real aim was the falsification of the Le Sage theory itself.

In 1908, Poincaré's *Science and Method*[37] addressed the Le Sage theory. Poincaré dismissed the theory on the ground of exponential buildup of heat. He did not address the subject of heat dispersal. He did not even mention the proposals of Kelvin and Preston. Thus, Poincaré's observations are of no assistance on the subject of dispersal of heat.

The heat debate continues to the present day. In an article published in 1964 entitled *Gravitational Theory of Georges Louis Le Sage*,[38] Aronson analyzed the articles of Kelvin, Maxwell, Preston, Darwin, and Poincaré. Aronson said that he was "uncertain" as to how Maxwell reached his conclusions. Nonetheless, he concluded that Maxwell's heat arguments dealt a "fatal blow" to the Le Sage theory.[39]

There are certain troubling aspects of Aronson's article. One is an error he made by stating that Maxwell's telling blow was delivered after Preston's paper. In Aronson's words:[40]

> The history of the nineteenth century debate over the theory is briefly this: Preston and Kelvin first quickly brought Le Sage's hypothesis up to the standard of a very respectable and convincing theory. Subsequently, Maxwell dealt the theory a telling blow.

In fact Preston's article (1877) was two years after Maxwell's (1875), and Preston's paper refuted Maxwell's arguments, not the other way around.

A further problem with Aronson's article is that he did not deal with or even mention Preston's refutation of Maxwell's reasoning. Consequently, Aronson's apparent acceptance of Maxwell's argument should be accorded little weight.

Recent papers and articles on the Le Sage theory are collected in a book, published in 2002, entitled *Pushing Gravity: New Perspectives on Le Sage's theory of Gravitation*.[41] One of the authors, Edwards (he is also the editor) addressed Preston's answer to Maxwell. He said:[42]

> As noted by Preston (1877), the questionable assumption with Maxwell's argument is that the value of $N$ for corpuscles is much smaller than $N$ for ordinary bodies. Preston argued that, on the contrary, the value of $N$ for corpuscles might be made as large as desired if the value of $M$ was correspondingly smaller. In this way, the Le Sage pressure could be maintained despite the low kinetic energies of the individual corpuscles.

One of the other authors, van Flandern, said:[43]

> However Maxwell's subsequent proof that, contrary to the requirement of thermodynamics, the kinetic energy of gravitons must always exceed that of

> molecules rests on an invalid assumption about the relative numbers of gravitons and molecules, and ignored the possibility that most of the heating of molecules might be quickly carried away and dissipated by elysium. . ..

In conclusion, the present author contends that the proposals of Kelvin and Preston make good sense and stand untouched. Their proposals are based upon the gas analogue. So is the proposed gravity concept. It is a logical step to conclude that outgoing aether can and does carry away heat caused by the impacts of incoming aether.

Further, it is important to bear in mind that there is a significant difference between the Le Sage theory and the present gravity proposal. The Le Sage corpuscles travel at speeds enormously beyond the speed of light (some estimate 20 billion times faster),[44] whereas the posited aether generally flows at well under the speed of light. Maxwell's attack in regard to heat is tied to the immense velocity of the Le Sage gravific corpuscles. Thus, whatever application the Maxwell argument might have to the Le Sage theory, it does not have logical application to the proposed gravity concept.

## V. ENORMOUS TIDES

In 1919 and 1920, Majorana conducted experiments that produced data appearing to show an appreciable level of gravity shielding.[45] In 1921, Russell published an article entitled "On Majorana's Theory of Gravitation."[46] Russell demonstrated that applying Majorana's data to his theory of gravity (inflow of gravity waves) would produce solar tides on the side of the Earth facing away from the Sun 370 times higher than on the side of the Earth facing the Sun. Russell also showed that the lunar tides would be doubled in size based on Majorana's data. These observations by Russell were devastating to Majorana's theory.

Does Russell's analysis falsify the present gravity proposal? The answer is no, for the following reasons.

Russell's analysis has been shown to be inapplicable to the Le Sage theory of gravity. This is the purport of a United States Government report entitled "The Nature of Gravitation,"[47] authored in 1960 by Radzievskii and Kagalnikova. It would therefore be unsafe to apply Russell's tidal prediction to the present concept.

More importantly, there are serious doubts about the validity of Majorana's data. Numerous experiments demonstrate results that contradict the data obtained by Majorana. These experiments are detailed in an article entitled "Constraints on Gravitational Shielding" by Unnikrishnan and Gillies.[48]

Concerns about the correctness of Majorana's results are also raised in an article by Martins entitled "Majorana's Experiments on Gravitational Absorption."[49] Martins' doubts are based upon (1) the limited sensitivity of Majorana's measuring equipment, (2) systematic errors of the same order of magnitude as the measured effects, and (3) the failure of Majorana to disclose some of his collected data.

In summary, it is evident that the suggestion that Russell's paper, based as it is on Majorana's data, falls far short of falsifying the present gravity concept. On this point, see also the article by Edwards entitled, "Le Sage's Theory of Gravity: The Revival by Kelvin and Some Later Developments."[50]

## VI. ACTION-AT-A-DISTANCE

A long-standing puzzlement concerning gravity, particularly as it is observed in our solar system, is that it has the appearance of action-at-a-distance. It appears to transfer gravitational force between the Sun and the planets instantaneously. If, in fact, the force of gravity travels without delay over the distances that lie between the Sun and the planets, this would falsify the basic premise of this article that gravity is explainable in concrete terms of cause and effect.

The direction of the force of gravity as between the Sun and, for example, the Earth is essentially directly toward the Sun, virtually without aberration. In contrast, sunlight is subject to significant aberration. It takes 8.3 min for sunlight to travel from the Sun to the Earth. Thus, we see the Sun where it was 8.3 min ago. It is the lack of aberration in regard to gravity that creates the impression of instantaneous action-at-a-distance.

There are several explanations that scientists have provided for the appearance of action-at-a-distance for gravitation. These explanations depend upon various underlying assumptions. The assumptions include the speed of the agents that 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. See the following:

- Carlip, "Aberration and The Speed of Gravity."[51]
- van Flandern, "Experimental Repeal of the Speed Limit for Gravitational, Electrodynamic, and Quantum Field Interactions."[52]
- Jefimenko, *Causality Electromagnetic Induction and Gravity*.[53]
- Heaviside, "A Gravitational and Electromagnetic Analogy, Part II."[54]
- Poincaré, "On the Dynamics of the Electron: Introduction."[55]
- Cahill, *Process Physics*.[56]
- Ghosh, *Mach's Principle and the Origin of Inertia*.[57]

The present author suggests an explanation based upon the gravity concept proposed by this article. Visualize aether flowing into the Sun, with the supply area for that aether extending into space well beyond the confines of the Solar System. When the incoming aether encounters the planets en route to the Sun, the aether is flowing directly toward the Sun. Thus, the ram pressure exerted by the aether on the planets is directly at the Sun. There is no angle of aberration. The aether may take some time yet to reach

the Sun, but that is irrelevant. It is irrelevant because the gravitational effect on the planets is caused at the instant that the aether impacts the planets, not when the aether reaches the Sun. In result, there is no aberration angle for the gravitational force. The appearance of action at a distance is simply an illusion. The illusion is caused by the fact that the flow of aether that encounters the planets actually travels on a direct line toward the Sun.

Recall, however, that the Sun is not the only cause of inflowing aether. Each one of the planets also causes inflowing aether, albeit to a much lesser extent. One might ask—as did Newton—whether the gravity force on the Sun that is caused by the planets makes any significant difference to the apparent direction of gravity being toward the Sun. The answer is provided by Newton. He observed in *Principia*[58] that the force provided by the "great body" (the Sun), may be so large compared to the forces provided by the "lesser bodies" (the planets), that any change to the common center of gravity is insignificant. Accordingly, the proposed gravity concept provides a rational explanation for the appearance of action-at-a-distance.

## VII. FRICTION

An argument posed against pushing concepts of gravity is that cosmic bodies must encounter friction while traveling through space. In the case of the Earth, for example, it is said that friction would cause the Earth to slow down in its orbit and spiral into the Sun. This criticism is articulated by Feynman, as follows:[59]

> 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]

With great respect, the present author suggests that there is a significant flaw in Feynman's reasoning. The flaw is that his reasoning is based upon the implicit assumption that acceleration cannot be maintained where resistance is encountered. In fact, acceleration can be maintained if the driving force is sufficient to provide for the acceleration and the resistance. A simple example shows this to be so. Attach a weight to a rope and swing the rope and the weight in an orbit around your body. The weight and the rope will encounter friction from the air through which they travel. However, as long as you supply sufficient force, the weight will remain in its orbit despite the resistance.

In regard to the Earth in orbit around the Sun, it is fair to infer that whatever friction the Earth encounters, the gravitational force from the inflowing aether is sufficient to maintain the Earth's acceleration and surmount the encountered resistance. As long as the force provided by flowing aether is of sufficient magnitude to compensate for whatever friction the Earth—and the other planets—encounter, there should be no slowing down of their orbital speed and no spiralling into the Sun.

One might argue that there is no proof that flowing aether provides enough force to overcome whatever friction the Earth may encounter. In response, it can equally be argued that there is no proof to the contrary. While the result is saw-off, one cannot overlook the fact that the Earth remains, as ever, in its orbit. It does not spiral into the Sun.

## VIII. THE LE SAGE THEORY

This article makes several references to the Le Sage theory of gravity. In the 17th century, at the time of Newton, Fatio proposed a mechanical theory of gravity. The theory was revived and further developed by Le Sage in the 18th century and has been refined even further by a number of present-day scientists. It has come to be known as the Le Sage theory.

The Le Sage theory posits high-speed gravific corpuscles that criss-cross the universe in all directions. Their speed is many orders faster than the speed of light.[60–62] Most of the gravific corpuscles pass right on through cosmic bodies, but some collide with cosmic bodies and exert a pushing force upon them. Cosmic bodies partially shadow each other from gravific corpuscles. The result of the shadowing is that gravific corpuscles push cosmic bodies toward each other.

The Le Sage theory has been subjected to various criticisms over the years. It has not become part of mainstream science. However, it does remain the theory of choice of some present-day scientists.[63]

There are significant differences between the gravity concept proposed by this article and the Le Sage theory. One difference is the extremely high speed of the Le Sage gravific corpuscles—some say more than 20 billion times the speed of light[64]—compared to flows of aether that are generally well under the speed of light. Another difference is that gravific corpuscles crisscross space at random in all directions, whereas the direction of flowing aether is not at random, but is towards and away from cosmic bodies and is determined by the interaction of aether with cosmic bodies. A further difference is that the Le Sage theory requires that cosmic bodies be almost completely porous, such as to allow most gravific corpuscles to pass right on through them untouched. No such claim is made by the present model, which is based upon scattering for the transmission of ram pressure.

It is respectfully suggested that the proposed model is superior to the Le Sage theory in each of the foregoing respects. It does not propose virtually unbelievable velocities. It proposes flowing aether that is actively controlled by cosmic bodies. And, it does not require Le Sage's porosity.

## IX. CONCLUSION

The proposed gravity looks to the once accepted, then rejected, and recently in the process of being revived, concept of a subatomic substance—aether—that pervades the universe. The force of gravity is seen as the ram pressure of aether flowing into cosmic bodies less the ram pressure of expelled aether or its constituent particles.

The model provides rational explanations for known phenomena associated with gravity and answers questions that have been raised against the concept of gravity as a physical pushing force. These subjects include acceleration, proportionality to mass, action-at-a-distance, heat, porosity, tides, ballooning, friction, and regeneration. It is respectfully suggested that although these answers and explanations do not prove that the proposed concept is correct, they do lend it a measure of authenticity.

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