The Theory of Antigravity

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Abstract

This paper extends the principles of earlier gravitational theory by which the constant of gravitation G *has been deduced in terms of an electrodynamically based graviton theory. Demonstrable anomalous gravitational effects reproducible in the laboratory, which reveal the prospect of antigravitational action, are discussed. It is shown that the theory does include features which can explain observed antigravitational effects. The action points to vacuum energy fluctuations arising from graviton decay and regeneration. Recently reported weight loss accompanying gyroscopic spin in a nonprecessing mode is also explained.*

Key words: gravitons, antigravity, gyroscopes, vacuum field structure

1. INTRODUCTION

The recent media interest in antigravity devices and their public demonstration has presented a technological problem, which is complicated by the lack of interest of the theoretical physicist. Theory has not yet given us an accepted comprehensive understanding of the true nature of gravitational forces and particularly the field unification with electromagnetism. It is, therefore, rather bewildering to be confronted with the suggestion that there are any laboratory-verifiable anomalies of an antigravitational nature. This is even more disconcerting when we consider that our hopes for resolving the unification problem have come to rely on our imaginary probes into the events when the universe was first created.

The immediate concern, however, is that posed by the weight loss of a flywheel spinning in vacuum about a vertical axis.[1] The report in Ref. 1 claims the extraordinary observation that the flywheel lost weight in a measure directly proportional to the speed of rotation, *but only for rotation in one direction, clockwise as seen from above in a laboratory test performed in the northern hemisphere.*

The fact that this experiment was performed in a university laboratory in Japan reveals the concern on the broader issue of antigravitational effects of gyroscopes, but hitherto the claims of antigravitational effects have related essentially to gyroscopes that are force-precessed. By this is meant the action of causing a gyroscope to precess faster than arises from normal gravitational action on the flywheel.

It is the object of this paper to discuss, in physical terms, why antigravitational effects can occur and then point to the experimental evidence in support. Claims that experiments can breach accepted principles of gravity or basic Newtonian mechanics tend to be discounted in the absence of theoretical support. Equally, theories of antigravity can justifiably be seen as wild speculation in the absence of experimental support.

Apart from the latest Japanese data,[1] the author is relying for such support on a report by a laboratory that has performed a test as part of a commercial investigation plus what he has seen demonstrated by those in possession of antigravitational gyroscopic devices.

Whatever the viewpoint or bias of the reader who is well versed in gravitational theory, there is a need to come to terms with the phenomena that are now in evidence.

2. THE HAYASAKA-TAKEUCHI EXPERIMENT

It is assumed that the reader will not be disposed to accept antigravitational phenomena readily. Therefore, the claim that this experiment[1] reveals a speed-dependent weight reduction by a flywheel in spin must be examined with other force-producing agencies in mind. One that has apparently occurred to the authors of the experiment is that magnetic levitation effects, perhaps involving the geomagnetic field, are involved. They discount such action on the strength of having performed diagnostic tests involving inverting the flywheel and screening the geomagnetic field. Others have already expressed the opinion that experts on general relativity will soon find a way of explaining the antigravity anomaly. That should not, however, deter us from considering an interpretation based on the more likely outcome, which is that the theory of relativity itself has been overtaken by physical realities that cannot be tamed by the abstract techniques of that theory.

The Japanese paper seems to be a very authoritative account and so, subject to comments presented in the Appendix commentary, it must be presumed that the lift force which they measure as

$$2 \times 10^{-5} M\omega r \text{ g} \cdot \text{cm} \cdot \text{s}^{-2} \tag{1}$$

is genuine. Here, M is the mass of the flywheel, r the mean radius of its mass elements, and ω the angular spin velocity of the flywheel in radians per second.

We should take special note that the experiment was performed in a *vacuum* to eliminate aerodynamic lift actions, and it gave the most remarkable result that levitation force effects occurred only for clockwise flywheel rotation.

The fact that the lift force depends upon direction of spin is a clear indicator of an asymmetry arising from charge displacement. The author's theory of the vacuum field in terms of synchronous lattice electrodynamics[2] specifies that there is a preferred spin direction in the vacuum. An action conductive to vacuum spin will displace electric charge radially outwards or inwards according to the orientation of the spin axis relative to the preferred direction. However, such displacement must be balanced by charge displacement in matter, and electrons can flow outwards in a conductive flywheel to sit just outside the vacuum region in spin, but positive ions cannot be so displaced. Accordingly, the coextensive rotation of the vacuum medium within a flywheel can only occur readily for one direction of spin, that which corresponds to the rotation of the Sun and all the planets.

Now, to make sense of this, it has to be understood that the vacuum is really a structured medium somewhat like a fluid crystal. Depending upon field energy criteria, it develops structure centered on individual atomic nuclei, and this structure can extend to interface boundaries located in the proximity of the outer electrons of the atom. At these boundaries whatever constitutes the structure can dissolve as part of a heavy lepton field, and it is this heavy lepton form that can migrate so as to conserve momentum and thereby make the coupling between matter and the vacuum rather tenuous. It would seem that flywheel rotation one way can rapidly establish a spin motion of the vacuum structure which avoids the countermotion of the heavy leptons, whereas rotation in the opposite sense means that the heavy leptons are moving through the structure as part of a countermotion state. In the latter case they constitute pockets of space in which the vacuum structure has dissolved, and this means that there is no gravity action associated with the portion of the flywheel occupying those pockets of space.

To bring this seemingly speculative proposal to a conclusion, it seems best to derive the weight loss formula to show how it agrees with Eq. (1), the result obtained by Hayasaka and Takeuchi.[1].

The vacuum structure comprises virtual lattice particles of mass m_0 which does not increase relativistically because the particles are constrained in a synchronous harmonic system which assures energy exchange keeping the mass constant. The motion is a jitter motion which is dynamically balanced by gravitons relative to which the lattice moves at speed c. This results in the particles each having motion relative to the inertial frame at speed $c/2$ and so a kinetic energy $\frac{1}{2}m_0(c/2)^2$.

Equipartition of energy by interaction of the lepton states means that this jitter energy becomes the kinetic energy of the free heavy lepton nucleated from such a lattice particle. Therefore, τ being the mass of this heavy lepton, this energy is $\frac{1}{2}\tau s^2$, where s is the speed of the heavy lepton. We can therefore deduce that

$$c/s = 2(\tau/m_0)^{1/2}. \tag{2}$$

If ωr is the speed of the spin motion in the flywheel at radius r and this is shared by vacuum structure in which the main mass of the flywheel is seated, the pockets of heavy leptons in this structure, assuming a uniform virtual mass density, must take up $\omega r/(\omega r + s)$ of the space involved. In other words, this is the fractional loss of weight that we can expect. Assuming that fraction is small, it can be approximated as $\omega r/s$, and so we can write the weight loss as $Mg\omega r/s$, where M is the mass of the flywheel and g is the acceleration of gravity. From (2) we know s, so that the weight loss is

$$(2g/c)(\tau/m_0)^{1/2} M\omega r. \tag{3}$$

Reference 3 shows how the following formula for the fine-structure constant is deduced in terms of m_0:

$$hc/2\pi e^2 = 108\pi(4m_0)^{1/2}, \tag{4}$$

where m_0 is here in units of electron mass. With this value for the reciprocal of the fine-structure constant as 137.036, we see that m_0 is 1/24.52. The mass of the heavy tau lepton in similar units is 3485 (corresponding to 1.781 GeV). Therefore, if the heavy leptons are exclusively of tau form, expression (3) has a coefficient found to be 1.92×10^{-5} in the units used in (1). This is in good accord with the measured value.

We see from this that there is a case for arguing that weight involves something intermediating with a vacuum structure and that there can be weight loss if that structure is somehow dissolved or decoupled from the mass of the matter present. If the countermotion of heavy leptons can be avoided, as by developing the full vacuum spin condition for the opposite sense of flywheel motion, then there is no weight loss. However, even then there is an antigravitational phenomenon confronting us if the flywheel is forcibly caused to precess. Then that weight loss can be very substantial.

The above-mentioned Japanese experiment was reported after this paper was first submitted. It is of such importance that extensive reference to it has been incorporated at the outset so that the reader can take, as a starting point, the test data showing that a flywheel loses weight and that this occurs without forced vibration effects. Apart from a special Appendix commentary dealing with reviewer criticism, the remainder of this paper assumes no knowledge of the Japanese flywheel experiment, because it was written prior to that disclosure.

3. THE FUNDAMENTAL QUESTION

At the very outset of this discussion it is necessary to distinguish between two schools of thought as to the action involved in antigravity. Most of those researching this field believe that mass retains its full and normal gravitational property, but that the anomalous levitation or propulsion effect comes from an out-of-balance force which somehow is developed by exploiting the absence of centrifugal effects when a spinning flywheel, offset from a separate axis of rotation, is caused to precess. Others, including this author, subscribe to the view that there is a loss of weight by the force-precessed mass in the flywheel and that the underlying energy action in the vacuum field plays a role in this enigmatic behavior. The distinction is most important, because in the first case the action is a dynamic action akin to the effect of an electric or magnetic field that can act across empty space to produce force developing thrust. It should operate to produce horizontally directed thrusts or could act vertically to balance the downward force of gravity. In the second case there is something far more fundamental involved where levitation effects are an issue, because the suggestion is that the mass property and the weight property can become separated to cause mass to lose weight.

The author believes that there could be a case for both of these anomalous effects to be present together. It is the possibility of this dual circumstance that compounds the mystery and has made it very difficult for scientists listening to the evidence to believe any of it on hearsay. Indeed, only those few scientists who have seen the demonstrations are inclined to believe that the phenomenon is real and even then some look for conventional answers they have yet to find. Certainly, they are not prepared to listen to the somewhat naive theories being advanced by those whose primary claim is that they can demonstrate the pecularities of these machines.

One clear way of distinguishing between the two effects is for those who assert that the observed levitation action is a controlled dynamic effect, not connected with weight loss, to demonstrate that they can produce an equal downward thrust merely by reversing the controlling force. The search for an antigravity machine able to levitate by some mysterious force field captures the imagination, whereas there is little interest in the equally revolutionary scientific accomplishment of causing a downward thrust which enhances the normal gravitational action.

We proceed we explore first the dynamic case and then later the theoretical basis of the antigravity phenomenon on the assumption that an actual loss of weight is involved.

4. THE ENIGMA OF ZERO CENTRIFUGAL FORCE

We begin by considering a spinning top in precession on a smooth surface.

An experiment demonstrated to the author by Eric Laithwaite at the Imperial College of Science and Technology in London reveals that a flywheel spun on a shaft having a pointed end supported on a very smooth, frictionless surface can precess around the point of support without there being any lateral slip. It purports to show that somehow there is no centrifugal action attributable to the precessional motion communicated through to the point of support.

The problem here is that the precessional velocity is normally quite small and so the centrifugal effects could only be of the order of 1 percent of the weight of the flywheel. Therefore, this is not a convincing interpretation. More convincing is the showing by Laithwaite that if, for example, a pencil is held upright and inserted in the path of the shaft of the precessing flywheel, the arrest of the flywheel's precessional motion imparts no force on the pencil. Here is the primary clue to the phenomenon by which a precessing gyroscope can be used to produce a propulsive force which appears to defy Newtonian law.

The author offers the following argument to suggest how a propulsive device wholly contained in a closed compartment can develop a force without apparent reaction on structure outside the compartment.

Suppose the mass of a flywheel describes a circle at a steady speed in a horizontal plane subject to a momentary state of rest after completing each half orbit. If it precesses under gravity over the first half of an orbit, this motion arises from a reorientation of the conserved spin angular momentum of the flywheel. The gravitational drop in potential supplies the orbital kinetic energy and there is no impulsive reaction in the horizontal plane apart from the centrifugal force. Having completed half an orbit, suppose we then lift the flywheel very slightly into a nonprecessing support position. This involves negligible effort because it is aided by the arrest of the orbital motion as the kinetic energy is returned to gravitational potential and angular momentum is conserved about the vertical axis as the flywheel spin is reorientated. Then for the next half orbit, with the flywheel fully supported, we drive it from rest and force it around the orbit at a steady speed until it is arrested after completing that half orbit. This latter phase involves a net balance of impulse forces and centrifugal forces. We are left with a forward propulsion of the vehicle attributable to the centrifugal action during the precessing phase and powered by sustaining the flywheel spin and the restoration of gravitational potential.

In effect, therefore, whilst adhering to the principles governing inertia as expressed in Newton's first and second laws, the principle that action balances reaction as required by the third law is challenged by this argument. In confronting and accepting or disposing of this proposition it seems best to appeal to the experiments that have raised the question. However, what we find here is that those who do the experiments, even in university laboratories, and find anomalies are ridiculed by those who rely on their theoretical training and decline to perform such experiments themselves.

Although many of those experimenting in this field believe that a cyclic dynamic action such as that just discussed is the way forward in the effort to drive or levitate a vehicle by breaching Newtonian principles, there is the other possibility that weight can in fact be reduced with the right technique. This will now be considered. It is relevant because the author has witnessed a demonstration by Laithwaite, which involved effortless lifting of a heavy flywheel in precession. There was no way in which this could have been possible unless the weight of the flywheel was virtually zero, because the supporting shaft itself was quite heavy.

5. THE NATURE OF THE GRAVITY FORCE

If a particle has mass and mass is acted upon by gravity, how can a "manipulated" mass ever lose weight in a gravitational field that acts normally, without loss of weight, on an "unmanipulated" mass in the same position? The expression "manipulated" applies to whatever we do to the particle to cause it to respond in the anomalous antigravitational manner.

The answer to this question has to be that we have recited an impossibility. There is, on the evidence of observation of the phenomenon, something wrong with the way in which we have formulated the question. Let us therefore recite the preamble to the question a little differently.

We now say, "If a particle has mass and this mass affects the local field in such a way that something in that field, normally coupled to the mass, is acted upon by gravity . . . ." Clearly, we can now develop the argument, because we are bringing in the field and any distortion of the space-time lattice or structure that might be said to give rise to the effects we associate with gravitation.

We do not, however, commit ourselves to the Einstein space-time doctrines. We go so far as to say that there is a local lattice in vacuum space which has an affinity to form a local structural association with the structured elementary atomic nuclei constituting the particle.

Readers will now realize that this means that we do have an optional situation. Regard that lattice structure as like the crystalline form that can nucleate in a liquid crystal. The structure can be minimal in extent, broken into local minute crystal units each nucleated on a microscopic element of nuclear matter, or it can spread until the boundaries of these units interface throughout the material system and so embrace also the relatively vast regions of empty space that intervenes between those atomic nuclei. The structure of each atom might well extend no further than the body of the nucleus or might reach some but not all of the satellite electrons.

We take what has just been said as our working hypothesis which gives us a basis for distinguishing between the abnormal and the normal and guides us concerning the nature of the gravitational action.

We now bring the theory along a track that has already been explored with some success in connection with derivation of G, the universal constant of gravitation, as a function of the properties of so-called "gravitons." The actors in this natural scenario are, therefore, the mass of the particles involved, the space lattices nucleated on those particles, the in-fill lattice of empty space, and the transient gravitons created from the vacuum background in the vicinity of the particles which decay as they transfer their energy and momentum to the lattice system.

In a normal body at rest or one in a steady state of motion, the action of gravitation proceeds by the creation of gravitons of energy Mc^2 adjacent a mass M. These gravitons fall under their mutual gravitational action but are short-lived. Upon decay, after falling a very minute distance possibly commensurate with the Compton wavelength of the electron, which is less than the atomic spacing in solid matter, their energy and momentum are absorbed back into the vacuum energy system and so forces are exerted on the space-time lattice. In the body under consideration this lattice extends a sufficient distance from each nucleating atom in the material of the body, really filling all intervening space in the body, so that all the gravitational force is absorbed by lattice physically locked on to the material of the body. In this roundabout way we can see how the mass of such a body "appears" to be the seat of the gravitational force.

The merit of this scenario, however, is that the gravitons are discrete quanta by which one can build a quantitative theory of gravitation and calculate G in terms of fundamental particle data. This has been the primary thrust of the author's work on gravitation over many years (references to be listed later). The gravitons are created from energy borrowed from the vacuum state, as vacuum energy fluctuations which leave a virtual muon field in deficit. All this means is that we do not "see" the gravitons as mass and only sense them by their gravitational action and by their indirect influence on the observed mass spectrum of fundamental particles normally produced under high energy conditions.

The additional merit of this same scenario is that if we can cause the body to so move that its motion is not steady or not that of simple linear oscillation, we see scope for the lattices centered on each nucleus contracting to become more localized. This means that the graviton momentum is partly absorbed by the in-fill lattice, which might, for example, be coupled to the body Earth. In other words, we have with this theory the quite remarkable possibility that the weight of the body can be partially shifted to act directly on the Earth and across the intervening space in some unseen way. This would mean partial loss of weight by the body in so far as it is not considered as part of the body Earth itself. In other words, the weight of the body has transferred to become part of that of the Earth.

The effect of simple linear oscillation has been excluded because there is evidence to show that Maxwell's equations involve lattice oscillations of this kind and that the vacuum lattice system can respond perfectly to all frequencies up to that at which electron-positron creation occurs. It is as if the lattice is tuned in respect of its linear motion to have, when displaced by an electric field, a restoring force rate that adjusts in compliance with the frequency to give perfect resonant response. Thus the linear oscillation or vibration of a coextensive body will not break down the lattice.

The question then arises as to which kind of motion does break up the lattice units to cause their inward collapse to a more confined form. To approach this we now consider two ways in which we can apply force to regulate the motion of a body. One way is to remove its supports to let the force of gravity drive the body. Another way is to apply mechanical force via the structure in which the body is mounted. We ignore electrical and magnetic forces, but assume that such forces, like mechanical forces, do act via the structure and so act directly on the matter constituting the body. In contrast, the gravitational force acts via the gravitons and their coupling with the matter constituting the body.

There are therefore two basic types of force action. The gravitational force is a distributed force spread over the graviton population, and so the lattice system as a whole is subjected to the driving action of this force. The lattice system is less likely to be ruptured by a distributed force spread throughout its structure than it is by force action communicated via the atomic nuclei on which the lattice is nucleated. Bear in mind that the lattice dimension of this space-time system is commensurate with the size of an atomic nucleus in that the nucleons tend to occupy lattice sites. Thus this dimension between lattice sites is hundreds of times smaller than the interatomic spacing of the substance. What this means is that the applied mechanical force which causes a kind of twisting or nonlinear motion can rupture the lattice into small units, whereas the gravitational force tends to preserve the integrity of the larger lattice form, even though that gravitational force is causing the nonlinear motion.

As an aside it is noted that there is a mystery that cannot be resolved by aeronautical engineering experts familiar with winged flight. The bumble bee has long been recognized as defying what we understand from the physics or aerodynamics of the flight technique. Their wings do not flutter rapidly enough. This makes one wonder whether precessing flywheels are essential and whether that "twisting or nonlinear motion" mentioned above as rupturing the vacuum lattice can be occurring within the body of the bumble bee as it agitates its wings.

6. FORCED OR NATURAL PRECESSION

Reverting to the flywheel problem, precession can be forced or natural, depending upon whether it is caused by applied forces or gravitation. The mechanical system in which this distribution of applied forces is exemplified is provided by the precessing gyroscope which is offset mounted. The toy gyroscope formed by a spinning flywheel on a shaft precessing about a central tower is the most familiar form of this system.

The force couple provided by gravitation via the weight of the flywheel is the force causing the precession and this gives rise to what we term "natural" precession. If, however, we apply a couple which tends to cause the shaft to move at a different angular speed, we have a "forced" precession driven by force applied in the direct mechanical sense. It is in this latter case that the flywheel can tend to lift in a way that does not transfer weight to the support. There is here the loss of weight that we have been discussing, and it is readily seen that the hypothesis we have developed can explain this phenomenon. Conversely, the experimental observation of the phenomenon can be taken as support for the hypothesis and so the graviton theory on which it is based.

A very important question we now face is whether such a device can ever lift more than the weight of the flywheel. Based on the argument used the answer to this would seem to be negative. However, here the graviton theory as developed in the earlier work of the author has something else to offer. It was part of that theory to regard the space-time lattice as being something truly physical rather than an embrionic geometrical notion. As such it was seen as comprising what can be said to be "subelectrons," electric charge in its most degenerate particulate form, set in a structured array in a uniform background of degenerate nonparticulate continuum charge of opposite polarity. This means that the lattice itself has mass, and could develop its own graviton population and exhibit gravitational effects. However, such effects are not felt by interaction with matter, because the space-time lattice is universal, and there is no way in which the repositioning of matter in space can alter the gravitational potential available for energy exchange with matter.

The consequence of this proposition has far-reaching implications. We assumed that the in-fill lattice in the case of the force-precessed gyroscope would be coupled to body Earth. Suppose, however, that this is incorrect and that the in-fill lattice is coupled with the Sun or even is free in the sense of being an absolute or preferred universal frame in its own right. Then it becomes possible for some of the weight of the lattice coextensive with the atomic nuclei to be transferred to an action in that frame. In other words, some of the local space-time lattice itself can lose weight in a sea of lattice which is subject to normal weight pressures. Given that the space-time lattice is a uniformly dense system, this can but mean that whatever is coupled to the local lattice units must experience a positive lift force. The flywheel of the force-precessed offset gyroscope can then lift more than its own normal weight.

It follows that if tests confirm this phenomenon, we have a way of measuring the mass properties of space-time itself and can see scope for the levitation of vehicles carrying a payload. Such are the horizons now ahead of us, bearing in mind the experimental facts discussed below.

7. THE EXPERIMENTAL FACTS

To the author, the most significant fact of experiment is presented to anyone who has witnessed Laithwaite lift that heavy spinning flywheel by applying a slight manipulating force to a supporting shaft. The end of the shaft remote from the flywheel is supported in the crook of his little finger on an outstretched arm. The lift force needed is said to be less than 1 kg, whereas the wheel weighed 8 kg and the supporting shaft weighed 2.7 kg. Readers who have difficulty believing this should examine the photograph of this demonstration in Ref. 4, p. 64.

In this experiment there is no vibration and the evidence points to the wheel being able to lift more than its own weight.

This phenomenon appears to have been shrugged off by most scientists who look to others with deeper knowledge of mechanics to give it formal explanation. Since there is no accepted theory for what Laithwaite demonstrates, there has been a tendency to discredit what he has claimed. Yet, how can one discredit what is there to be seen? Those who have performed this simple test, either by lifting Laithwaite's own shaft and spinning flywheel or by lifting their own equivalent device, experience this loss of weight.

Happily Laithwaite's pioneer spirit has captured the imagination of others who have built levitating machines and, it must be said, others have preceded Laithwaite in such work. The phenomenon is one that persists, but Laithwaite is the one who has been bold enough to minimize the mechanical elements involved to a shaft and a wheel and become an operating force-producing part of the machine himself. It is his test which this author sees as so far beyond dispute that the later machines become mere means for formal experimentation in an effort to develop the technology commercially.

It is also this demonstration which shows that whatever energy is needed to lift the heavy flywheel by hand through a distance of some 1.5 m does not come from the forces asserted manually.

A machine test under controlled laboratory conditions with variable flywheel speed and measurement of both speed and input power is needed to trace what is happening in a physical sense.

The machine that has captured media attention is that of Scotsman Sandy Kidd of Dundee, essentially because it was developed by commercial interests and subjected to independent precision laboratory tests to verify the positive lift force.[5] This machine in full levitation has been recorded by Australian television interests and will have been shown by an internationally distributed program before this paper appears in print.

Other machines operative at this time are those built by another Scotsman, Scott Strachan of Edinburgh, one of which was demonstrated at a symposium in Canada in June 1988.[6] It incorporated its own precision balance and operated under remote radio control to show hands-off lift action.

Although government, academic, and commercial interests as well as the media are now all showing interest in this phenomenon, it remains to be seen how the scientific scene will develop. The progress will be slow, because none of those in authority have conceded acceptance of the antigravity phenomenon. What appears certain, however, is that antigravity has now a place in physics which extends beyond that mooted by Massey when he wrote[7]:

> ANTI-GRAVITY? One curious question arises. Particles and antiparticles are produced in pairs. How could matter and anti-matter ever separate? One possibility that cannot be ruled out at the present stage, is that of a repulsive force of gravity between matter and anti-matter. We cannot yet say whether a piece of matter exerts a gravitational attraction or repulsion on a piece of anti-matter – we do not know whether anti-protons tend to fall downwards or upwards! The nature of the force of gravity is still so obscure that no reliable answer can yet be given from theory and it will be some time before any experimental tests will be practicable.

One further aspect of antigravity phenomena is that known as the Hutchinson effect. This peculiar phenomenon, by which electromagnetic influences developed by a peculiar combination of electric power equipment, including Tesla coils, can cause blocks of wood or metal to lose weight, has been captured by video camera.[8] To witness what is shown is quite disconcerting, because it is quite incomprehensible in terms of accepted physics, and yet one cannot just write it off as an unnatural phenomenon. Perhaps what is happening is that there are powerful low frequency electromagnetic field oscillations that are interfering in some way so as to set up electrical vibrations or displacements that are not confined to one steady direction. If this were to break up the lattice units and cause them to contract around their nucleating atoms in the block of wood or metal, then again we see basis for the antigravitational phenomenon revealing itself.

It remains to summarize the key scientific papers and other references from which the author has argued in the above discussion. Concerning the possible imbalance of force in the interaction of matter, and particularly any breach of Newton's third law of motion, the author has written numerous papers on the electrodynamic law of interaction. See, for example, Ref. 9 and, of particular relevance to this antigravity topic, Ref. 10. It is to be noted that the Lorentz force breaches Newton's third law, as is well known by experts on electromagnetism. Also, particle physicists well know that beta decay breaches the laws of linear and angular momentum conservation as well as the law of conservation of energy. This is why the enigmatic neutrino concept was invented, a hypothetical particle having no mass but all the necessary qualities needed to keep the balance in accord with Newtonian and/or Einsteinian philosophy. In this author's opinion this was merely a way of embracing the vacuum properties, including aspects of vacuum energy fluctuations, into the mathematical logic of a form of physics that seeks to avoid reference to the ether.

Concerning the author's theory of gravitation, based on an ether model having the space lattice structure already mentioned, the book references are 11, 12, and 13. For scientific papers concerning the derivation of G and the graviton properties, see Refs. 14, 15, and 16. It is also to be noted that the same theory has addressed the issue of proton creation and yielded a precise theoretical value for the proton-electron mass ratio.(17) Concerning the tuned lattice response and conformity with Maxwell's equations arising from a study of a nondispersive vacuum property, a key reference is 18, but see, also, 19. Concerning earlier gyroscope experiments revealing anomalous propulsion results, there are many references, particularly in the patent literature. The most informative is that of Di Bella of the Institute of Naval Architecture, University of Genoa, Italy(20) (see, also, the U.S. Patent(21)). The latter experiments, in common with many others, have been ignored because the general assumption is that the vibration involved interacts with nonlinear frictional effects to produce a propulsive effect. For this reason it is imperative either to conduct precision integrated force measurement tests on devices that are immune from external friction but which may vibrate (as applies to the status of the Kidd or Strachan machines) or to focus on experiments that have no vibration at all, such as that of Laithwaite described above. This, therefore, has been the basis on which the argument presented in this paper is founded.

Acknowledgment
The author has not engaged, as yet, in any experimental work bearing upon what is reported above. Concerning the experiments on the force-precessed gyroscopes, the author acknowledges the very helpful discussions he has had with Professor Eric Laithwaite and Messrs. Sandy Kidd and Scott Strachan, as well as other pioneers in this field such as Alex Jones and Fred Scovell. All of these have seen the practical potential of this scientific endeavor and are or have been involved in patent applications on this antigravitational phenomenon. None may succeed in the eventual quest, but science will be better served if the issues they have raised are resolved with certainty by objective research focused on what are claimed to be the anomalies in the hope that there really is something new to be discovered.

APPENDIX: RESPONSE TO REVIEWER COMMENT

A referee report on this paper pointed out that it is "premised on the belief that the Hayasaka and Takeuchi experiment is correct" and declared, "In fact, all recent repetitions of the Japanese experiment with more precise equipment have shown that the original experiment was wrong." The referee gave three references (22, 23, and 24) relating to the authoritative tests performed to check the Japanese claims and observed that this author "is putting forward a theory to explain an effect which does not exist."

Now, this author is not aware of any admission by the Japanese rescinding what they claim, though certainly this author cannot vouch for their findings. However, thanks to the editor of *Physics Essays* allowing response to the referee comment, it seems appropriate to ask the reader to consider the following points.

First, when the author first took an interest in the gyroscope weight loss anomalies, it was pointed out to him by expert aeronautical authority that flywheels spinning in air can experience a lift force that is aerodynamic in origin. This made the Japanese experiment all the more credible besides being rather unique, because in doing the tests *in vacuo* they had made absolutely sure that no such lift action could account for the anomaly they found.

Second, the refuting experiments (22, 23, and 24) were actually published in February and April 1990, within weeks of the publication of the report of the Japanese work and such urgent evaluation is an indication of the importance attached to the task of rejecting what had been claimed and also of the cursory nature of the tests. It meant, presumably, that in repeating the experiment none of the three research teams involved in discrediting the Japanese had gone to the trouble of building a system having the essentially the same vacuum test facility. They were all content to rely on tests in air and that, then, destroys their right to challenge the Japanese findings. The Japanese would presumably not have bothered to use vacuum if what they were researching did, in fact, reveal itself in air.

Third, one must take note of the case put by Faller *et al.*(22) in discussing why they did not use a vacuum. Their reason in their words is, "Since we know of no steady-state effect of internal air currents on the weight of a sealed system, we decided a simple O-ring seal on the cover of our gyro was sufficient." They prejudged the nature of the weight loss by assuming it must relate to lift action due to air and decided that because they were unaware of any anomaly that could depend upon steady-state air current effects, the presence of air was irrelevant in judging what would happen in a vacuum.

They also stated, "In spite of the fact that they [Hayasaka and Takeuchi] observed similar effects for three different gyros, it is still very difficult to think of any fundamental reason for their observed effects."

Now, this author conceived this paper as a discussion of antigravitational phenomena which can occur in air but only with force-precessed gyroscopes. However, the circumstances of the Japanese experiment were special and were satisfied by nonprecessing spin *in vacuo*. The author has derived a formula that fits what Hayasaka and Takeuchi found, not by reference to air currents, but by assuming that electric charge could be radially displaced within the flywheel, its polarity depending upon direction of rotation, so that electrons could escape from the substance of the flywheel but not the heavy positive ions.

The reader must now take a position on the question of whether all physical action in air depends upon "air currents" or whether certain electrical phenomena can occur in air, such as Maxwell-type electric charge displacement. Unless the critics have certain knowledge that the antigravitational action cannot depend upon the microscopic electrical nature of matter as opposed to the macroscopic mechanical properties of matter, then the issue is open. Can, for example, the positive and negative ions that neutralize the vacuum spin charge displacement in the theory presented in this paper have a mobility if comprised by air dragged around by the flywheel which they would not have if they were part of a solid flywheel? If the latter argument cannot be discounted, and it really cannot because air is fluid and its heavy ions can migrate, then that presence of air in those tests reported in Refs. 22, 23, and 24 can preclude the antigravitational actions of the flywheel.

This author feels, therefore, that the tests discrediting the Japanese experiment are not conclusive and hopes that someone will go to the trouble of repeating the tests in the same vacuum conditions as used by the Japanese. If the Japanese tests are confirmed in the vacuum situation, then it would be of interest to check what happens if the flywheel is of insulating dielectric material or of metal coated at its rim with such material.

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Résumé

Cet article étend les principes d'une théorie de la gravitation précédente dans laquelle la constante de gravitation G *avait été déduite en terme d'une théorie des gravitons basée sur l'électrodynamique. On y discute des effets gravitationnels anormaux démontrables et reproductible au laboratoire, qui révélent la possibilité d'action anti-gravitationnelle. On montre que la théorie inclut des caractéristiques qui peuvent expliquer les effets anti-gravitationnels observés. L'action conduit à des fluctuations d'énergie du vide produites par la désintegration et la regénération de graviton. La perte de poid qui accompagne la rotation gyroscopique sans précession est aussi expliquée.*

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