ENERGY SCIENCE REPORT NO. 6

POWER FROM SPACE: INERTIA AND GRAVITATION

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POWER FROM SPACE: INERTIA AND GRAVITATION

Introduction

This Energy Science Report is one of a series concerned with new energy technology and the fundamental energy science that is involved. Much of that science is of record in published papers that lay dormant on the shelves of those university libraries that have kept abreast of the source tributaries that might eventually flow into mainstream physics.

However, for some mysterious reason that science historians will one day need to explain, the physics community has built a dam which blocks much that could flow more rapidly into the knowledge stream. In particular it stands aloof and ignores evidence which tells us there is energy in abundance in a real space medium that regulates the quantum world. Those few scientists that have become aware of the enormous energy resource pervading the universe and extending into our immediate environment have, in the main, failed to see its technological potential.

Being a pioneer who has researched this subject for more than forty years, and published comprehensive theoretical accounts of the way in which the vacuum field energy governs gravitation, inertia and determines all the fundamental constants of physics, this author has become well accustomed to 'peer review' rejection. Institutional interests fend off the intruder who does not want to build on their sinking foundations and who points to better ground on which to build. And so, those who profess to be the scientific establishment hold firm in their beliefs, not expecting the Earth to shake in any way which may force them to rebuild on a new base.

This somewhat cynical introduction is presented in the hope that it will make readers pay more attention and cause them to help in bringing the world to its senses on just a few points about physics, before we are swept along by a tidal wave of technological change involving us in 'free energy'.

The author, some time ago decided to arrest the research on his theory, realising that no one really cared and that the only way forward was for that research to await the emergence of a related technological breakthrough which could help mankind generally.

Mankind has been made well aware of the genius of Albert Einstein and the importance of the relativistic equation $E = Mc^2$, which says that energy E has mass M provided one is able to 'see', with the constant speed c of light referenced on one's own self, what it is that has that mass. There are those who know why $E = Mc^2$ is relevant to

nuclear power, but the scientific genius of those 'expert' even in that field has not yet solved the mysteries of the true causal nature of gravitation and the property of inertia.

Occasionally, of course, there are those who claim to understand inertia and confront us from time to time with their interpretation of their solution to that great mystery. Yet, always it seems, the opinions which penetrate the 'peer review' are those which 'conform' to tradition and go out of their way to comply with what is termed 'Lorentz invariance', which fits too closely in the Einstein mould and accounts for his failed attempts to explain inertia.

It is because a group of scientists (Haisch, Rueda and Puthoff: Physical Review A **49** pp. 678-694, 1994) have now claimed attention by asserting a new Lorentz-invariant account of inertia in terms of the universal energy background and implying prospect for tapping that energy resource that this author feels obliged to write this Report.

Why is Inertia Important?

Inertia is the property which relates mass and motion, just as gravity is the property by which mass is drawn to other bodies by a force of mutual attraction. Ignoring the imaginary 'quarks', electricity is a property possessed by all truly fundamental particles of matter, in equal measure, represented by a universal unit of charge e, and we know that like polarity charges interact by mutual repulsion, whereas opposite polarity charges interact by mutual attraction.

Inertia, gravitation and electricity are properties that are absolutely basic in Nature. They are the manifestation of energy that has suffered disturbance and is in search of equilibrium, whether seeking to avoid redeployment or seeking to become redeployed.

One can always start with Einstein's ideas, but then do remember that he tried and failed to discover the unifying links between electricity, inertia and gravitation.

One can heed what is said about the inertial theory of Haisch, Rueda and Puthoff by Robert Matthews writing in Science, vol. **263**, pp. 612-613, 4 February 1994 under the title: 'Inertia: Does Empty Space Put Up the Resistance?'. Matthews discusses Einstein's failure in this quest and goes on to say:

> "Now three researchers think they have found the source of inertia - and it turns out to be much closer to home. Inertia, they say, comes from the apparently empty space that surrounds us all - or rather, from the buzz of activity that, according to quantum theory, fills even a perfect vacuum, where sub-atomic particles are being created and annihilated in the blink of an eye. It is this ever-present sea of energy that the researchers believe resists the acceleration of mass, and so creates inertia."

So, we have our attention drawn to the notion that that sub-quantum sea of energy in space is the underlying essential activity that endows a particle with its inertia.

One has to imagine a particle, when accelerated, being pushed and shoved by that sea of energy in space with the result that it exhibits a property of preserving its motion and evidences inertial 'resistance' when accelerated.

Now, it is this author's experience, based on the development of his own theory, that Nature prefers the simple life and does not, as it were, ever 'put the cart before the horse'. Whatever fills that empty space with energy will, at least so far as simple physics requires, have itself to comprise component particles. It is no use talking about 'radiation' when one does not understand 'energy' and one can hardly preach knowledge concerning 'energy' without nucleating that energy on a 'particle'. Remember, we are talking about 'motion' and, to say something moves, that something has to have a position and an existence. 'Fields' are expressed as mathematical symbols and exist in man's thoughts, but Nature has no way of knowing what we mean by a 'field'. Nature builds on particles and their motion and that then leads us to recognize what we call 'energy'.

So, how can we really expect the particle to derive its inertial property from a background that is nothing other than other particles?

No, the inertial nature of a particle has to be something intrinsic to that particle!

What else is intrinsic to that particle? It has an electrical charge. We then can argue that the particle has form and is bounded so that that electric charge is confined into a limited volume of space centred on the particle. That gives it a measure of intrinsic energy, by the teachings of electrostatics, without us yet having spoken about motion.

The word 'motion' if expressing speed or velocity is meaningless unless we can refer to a frame of reference. Such a frame, as an electromagnetic reference frame, is not intrinsic to the particle. If the 'motion' is an acceleration, a rate of change of velocity, then, and only then do we have a property intrinsic to that particle, because that electric charge in its confined state suffers internal disturbances as its electrical energy adapts to the accelerated motion. Such disturbances, as measured within the body form of the particle, are undoubtedly propagated within that body at a finite speed, which we denote c, and so, still intrinsic to the particle, we have energy E and speed c.

We need something else to take our understanding forward and so we ask the question of how we would ourselves respond if Nature made us a single particle in a mystery environment that we could not see or sense.

The answer, or at least this author's answer, is that we would do everything possible to resist our destruction. In short, we would conserve our energy. Nature must prescribe, therefore, that the third and governing element affecting that particle under normal conditions is that it will conserve its energy unless physically transmuted, as by breaking into three particles and sharing energy with a newly created particle pair.

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What does that particle have to do to conserve its intrinsic energy, as opposed to the other energy we think it has because it is moving relative to some external frame of reference? (This latter energy is 'kinetic energy').

The answer is that it must not shed energy by radiating disturbances through the empty space surrounding it.

We now begin to see the link with quantum theory, not one where quantum theory explains the inertial property, but one where the particle's own conservative property can explain quantum theory, the latter being a feature imparted to the particle population constituting at least some of that background sea of energy in space.

Physicists will now tell you that Larmor derived a formula which 'proved' that an electron when accelerated must radiate energy. Yet, if those wise physicists read up on the subject they will see that there is no 'proof' because the derivation is based on unproven assumptions. There are two assumptions. One is that energy is, in fact, capable of being 'radiated' as a wave or 'field' disturbance. Note that we now think of energy transfer in terms of particles (photons). The other assumption is that the particle is 'accelerated' by unspecified means or means, which if specified, are promptly eliminated from the analysis by relying on the energy supposedly radiated to the remote wave zone where the accelerating cause is not to be seen. The latter puts even further emphasis on the first assumption.

Now, what this means is that we, in looking for the real truths, have substituted for the Larmor assumptions the simple attribute of 'energy conservation' and so denied the energy 'radiation' possibility. We can then rework Larmor's analysis and keep in place the influence of other charge which has to be present and influential in promoting the acceleration of the particle under study.

Readers who perform this calculation (see Appendix A) using the correct formula relating electric energy E (proportional to e^2) and the particle radius confining that charge e, find that there need be no energy transfer across that boundary of charge confinement. There is, however, a condition which emerges from the analysis. This is that the accelerating force, as known from the local action of the accelerating field, necessarily factored into the field energy equations, must be 'resisted' by the particle in a measure formulated by an expression in which E/c^2 relates force and acceleration.

Mass becomes a <u>derived</u> inertial property as does the formula $E = Mc^2$, and both stem from the simple fact that Nature allows each and every particle in the universe to act conservatively in preserving its existence by denying radiation of energy.

So, inertia is understood in the simplest possible way and $E = Mc^2$ owes nothing to Einstein's imagination and everything to energy conservation principles. The background sea of space energy is <u>not</u> a party essential to give account of this basic property. The latter only features in the collective actions and particle collision processes as energy is pooled by electrodynamic activity.

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Concerning the latter, note that collections of charged particles sharing oscillations, as in a radio antenna, involve mutual effects. For N charges e, accelerated together, the intrinsic conserved energy accounting for the mass of N particles relates to Ne, whereas the mutual interaction in electrical energy terms, given an overall confining space for the cluster of charge, is proportional to $(Ne)^2$. It follows, therefore, that since we do not think in terms of the mass properties of mutual interactions, or 'mutual acceleration energy', we confront three prospects:

(a) The radio antenna can be a transmitter of energy as a function of charge acceleration, but only in proportion to N(N-1) and <u>not</u> in proportion to N^2. However, since N is measured in countless billions, this poses no practical problem and shows why one can dare to challenge the Larmor formula without upsetting the radio physicists.

(b) The 'mutual acceleration energy' of a cluster of like polarity charges must add to the inertia of that cluster, but note that the particles have a very small radius whereas the cluster is relatively very large, which diminishes the inertial contribution.

(c) When particles are part of a vast sea of action characteristic of space, in a neutral mix of positive and negative polarities, they must involve energy that one might classify as 'mutual acceleration energy' subject to fluctuation and yet, somehow, form part of a system in which equilibrium is preserved. Given that inertia is dependent upon action intrinsic to a particle, one can then contemplate mutual actions as giving a base frame for collective reference of electric actions. In other words it seems probable that the locally applicable frame of electromagnetic reference is that set in a frame associated with the collective energy activity of a local sea of vacuum particles, otherwise known as the 'zero-point background field'.

In summary, the property of inertia is not dependent upon interaction with the vacuum field and the energy in space as suggested by Haisch, Rueda and Puthoff. That space energy background is, however, likely to play its role in determining the frame of reference for the energy of motion (speed) of a particle. This becomes a probability when one brings to bear the argument that the energy added to a particle owing to its motion is energy added in creating its satellite companions in the nearby field. This activity takes the form of a statistical presence of created particle pairs, leptons, typically electrons and positrons, which can become quite prolific and add enormous supplementary mass as a core particle acquires a speed close to that of light. The so-called 'relativistic mass' increase with speed then becomes an attribute of inertia possessed not by the core particle or by the zero-point energy background but by its satellite companions in their individual form.

From a practical energy viewpoint, the author sees no route to tapping 'free energy' by this link between the inertial property of particles and the sea of energy in space. The only link which can give access to that energy is via the quantum coupling of that medium,

its so-called 'Zitterbewegung' or jitter motion, with electrons in atomic orbits and particularly with ferromagnetism. The latter is the subject of the 'Power from Magnetism' studies in this Energy Science Report series.

Creation of Matter

The fact that the basic particles, protons and electrons, which form matter exist and have inertia and mass in compliance with $E = Mc^2$ means that Nature has its own way of giving up energy to create those particles.

Is this really a one way process? The proton and the electron are not listed in particle data as having a finite lifetime. Do they really live for ever? If so, then one can think of the universe being created once and only once and not existing in a background seething with energy that keeps some kind of equilibrium with matter whilst fluctuating transiently to shed and recapture energy as some of that matter is created and annihilated.

Given that we can 'see' that when matter is created it comes to us in two 'stable' forms of different charge polarity, the electron and the proton, of greater mass by a factor of 1836, we have the clear evidence that Nature sheds energy which is seen to materialize in these particular forms, presumably only because they have the longer chance of survival than the myriad of other particle forms that one could conceive.

It is only logical, and involves very little thought, to recognize that if the proton and the electron were to decay and return their mass energy to the background activity in space, so, in immediately reasserting energy equilibrium as between matter and that background, those particles would be recreated. They may not be created in the first instance as a proton-electron pair, but they could develop from a kind of chemistry of reactions involving leptons in various forms, and particularly muons, and in the end the stable particle forms of proton and electron must emerge.

In short, one must accept that the proton and the electron do have their own characteristic lifetimes. They need not be created and annihilated in paired relationship because the electron will undoubtedly decay and be recreated numerous times between events involving proton creation.

Given that this is the case, the question of energy radiation by an accelerated electron might seem to be of no importance and merely an academic issue. One then finds, using the Larmor formula already mentioned, that if it were applicable to the electron in orbit in an atomic electron shell and if the intrinsic self-energy of the electron were to be radiated, the lifetime of the electron would be of microsecond order. Yet the electron lifetime is most certainly of the order of 10^{-13} seconds, as can be inferred from its ability to 'tunnel' through potential barriers as if such a time factor has meaning. It 'tunnels' through that barrier by the expedient of decaying on one side of the barrier and finding it desirable energy-wise to reappear by creation on the other side of the barrier.

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However, if we use this argument to discount the need for challenging the derivation of the Larmor formula, so we lose that physical basis for understanding inertia as expressed by $E = Mc^2$. It is a trap we must avoid falling into, because understanding inertia is so important as it is the stepping stone for the onward understanding of the physical connection with gravitation.

In particular, by deriving the property of inertia as having a 'first principle' dependence upon the energy conservation response of a discrete electric particle when subjected to external influence, we know that all such discrete charge forms, if truly fundamental, will exhibit a mass property.

It follows that the background sea of energy in space must have mass and yet we cannot sense that mass directly in the usual way, which is by its weight. The energy in free space has, therefore, some unusual properties in a gravitational sense.

A factor in this is the consideration of form. A body having weight we can measure in a laboratory has shape and is bounded in some way. It has a centre of gravity that can be identified. Boundary conditions are important when calculating gravitational interactions. As with an electric charge within a uniform continuum of charge, the forces exerted on that charge when displaced a unit distance depend not just upon the charge density of that charge but upon the shape of whatever it is that limits its boundaries. A charge displacement in a spherically bounded charge continuum is subject to one third of the restoring force rate of a charge bounded between two planar surfaces of virtually infinite extent. Who, however, is ready to say how that background continuum of the world of zero-point energy is bounded?

It does matter, because a 19th century theorem bearing the name Earnshaw has well established the fact that the aether cannot comprise electrical particles in a neutral combination whilst exibiting any stable form that could define a structure. Yet, the latter is needed to give basis for determining the universal constants and particularly the fine-structure constant. The one form that eludes Earnshaw's theorem is that for which the particles in the structure all have like polarity and are set in a background continuum charge of opposite polarity.

The boundary conditions limiting the space energy are, in this author's opinion, planar and each such plane defines the separation between domains of 'space' and 'anti-space' in the sense that protons and electrons predominate on one side, whereas positrons and antiprotons predominate on the other side.

Proceeding, from this we need to understand how gravity comes into the picture, but our starting point is that there is a mass property throughout empty space and, for some reason, we cannot sense the linear momentum property. It is almost as if one is dealing with a perfectly incompressible fluid in which energy can be stored by motion but transfer to matter of a net linear momentum is impossible, though spin of a spherical body of the fluid can occur with energy storage and angular momentum.

What is the Cause of Gravity?

It is extremely easy for the author to carry on in this style and give account of the nature of gravity but there is little point in rewriting what is of record in refereed and published scientific periodicals.

Suffice it to say that, just as no mechanic could contemplate building a machine which failed to take account of dynamic balance, so Nature in providing a dynamic sea of energy subject to that 'Zitterbewegung' oscillation could not possibly avoid also providing the counterbalance feature.

That counterbalance feature is provided by a population of particles dedicated to that objective. The quasi-stable structured background of space gives the firm basis on which Nature builds to determine the fundamental constant of action we name after Max Planck, but that is merely a catalyst regulating the interplay between the background space energy and matter. The space energy is mainly seated in mu-mesons, which are quite distinct from the particle system that defines the vacuum structure. However, the third essential part of this space 'machine' system is the graviton population which provides that dynamic balance in a way that involves minimal distortion of that lattice structure.

That 'distortion' is small because the gravitons have greater mass than protons and so displace only a minute amount of continuum charge, but as they have motion spaced away from the main lattice, the latter determining the frame of electromagnetic reference, so, in measure related to the mass they balance dynamically, they give rise to forces of mutual electrodynamic attraction, namely a 'force of gravitation'.

This is an extremely simple account of the nature of gravitation, the real challenge being that of showing how the precise value of the Constant of Gravitation G can be derived to conform with the theory. Of course, one could not come to this picture of the underworld of space without thinking as a mechanic with some electrical skills. The mathematicians who dominate physical theory and seek to develop equations displaying properties of symmetry and having aesthetic properties are not thinking of a real world in which the 'balance' is inertial and not necessarily symmetrical.

One has only to take note of the blind reliance which mathematicians place upon Maxwell's wave equations to realise how easy they have found it to wander away from and out of the real world. How can an electric wave displacement propagate through space by its lateral oscillations if the field has energy and so mass and yet do this without that counterbalance? Where in the Maxwell equations do we see the formulation of the dynamic counter-balance, the wave which must accompany the propagating primary wave as an anti-phase partner?

If one says it is not necessary then one is not thinking in terms of a real physical environment but indulging in fantasy by presenting a form of mathematics which may seem to work in some limited situations but yet fails to give that physical account needed to understand why it is that the universe holds together. Without the dynamic balance in

energy transfer across space and in energy storage in space and, indeed, without the consequent property of gravitation, the violent universe, like any violent out-of-balance machine, would break up into chaos devoid of form. As it is the universe gives us Planck's constant and the Constant of Gravitation and these are very easily explained and derived, once we have found the secret of why a particle has inertia.

At least, this author has found that task somewhat easy, in the formal analytical sense. What has been enormously frustrating and excessively difficult has been the obstructive effect of the Einstein doctrine and the related disbelief in the existence of a aether.

It is, to this author, quite remarkable to see so many errors perpetuated by so many scientists who live in the belief that the vacuum is empty of energy, that Maxwell's wave equations have sufficient meaning without there being something missing to explain dynamic balance and go even further in thinking that a photon can convey energy at the speed of light, when a particle travelling at the speed of light has infinite energy!

It is incredible that the scientific community has been willing to tolerate the so-called 'wave-particle duality' problem, thereby giving up on resolving why it is that waves promote energy transfer in a sea of energy, as if carried by a particle travelling with the wave through space from A to B. Surely everyone should realize that the wave disturbance is all that 'travels', whereas the energy background absorbs energy quanta at A and sheds energy quanta at B, as if that energy has moved at the speed of light.

If one takes away the energy background, the aether, and then finds that particles of photon energy have to travel at the speed of light one has immediately been inconsistent in ignoring the fact that mass energy becomes infinite at that speed. On the other hand, if one thinks of a wave as a disturbance of the energy in space but not as a transporter of energy, so the photon becomes an event in demise at A and an event in creation at B, and the question of the Larmor radiation of an accelerated charge is solved ab initio. There is no energy radiation and the $E = Mc^2$ expression for inertia then emerges as a derived expression based on energy conservation, which was our starting point.

A discerning reader might see the 'mechanic' as being in trouble in building his model of the vacuum energy machine with three major components, a structured electrical particle array moving inertially in counterbalance with a graviton system and an intermediate virtual mu-meson system occupying the inertial intermediate position. How can there be electrodynamic interaction from the gravitons and not from the charged structure? Well, the answer to that is again simple. The inertial frame is that in the intermediate position and the frame of reference having physical effect is that determined by the moving charged structure.

In physics we have assumed that the inertial frame and the electromagnetic frame are one and the same, but we have not proved it. On the contrary, though experience on a macroscopic scale and Einstein doctrine tell us that there is something in common between these two frames, there is other evidence linked to Heisenberg's Uncertainty

Principle and quantum theory. This has been interpreted as a situation where the motion and position are both uncertain but they relate in a manner connected with Planck's constant. Imagine the 'structure', which we take to be the frame we sense electromagnetically, to move in a quantum orbit around the inertial centre, dynamically in balance with that graviton system. The 'structure' has a position that is uncertain in measure related to that orbital radius and a momentum that is uncertain in measure related to speed in orbit. That speed and that radius when multiplied together is a finite and fixed quantity; it is certain, yet position and momentum are uncertain! The 'mechanic' knew this when he built the machine and Heisenberg suspected the design 'principle' without realising that this very point is the real clue to the nature of gravitation!

The 'mechanic' can also be seen to have built a universal timekeeper in that the orbital motion has to be one that is synchronous on a universal scale, as otherwise the structure that is moving will be distorted and will break up. Therefore, time itself is woven into the fabric of the space energy background and, again, one wonders how it is that 'time dilation' based on different observers in relative motion can be tolerated in physical theory and why Lorentz invariance has become a law unto itself.

The author can but hope the reader will research this subject in his or her own way, beginning by reference to the few of the author's papers appended to this report. Whether or not the reader accepts what is said is of little consequence, provided, however, that the reader has at least seen a glimmer from that raging quantum inferno of energy that is there in our immediate space environment. Such a reader will, it is hoped, then be ready to be attentive to claims made by those now working in the 'free energy' field when they come to declare 'Eureka'.

Personal Footnote by the Author

The above account about the Haisch, Rueda and Puthoff inertia theory began by referring to the article in 'Science' by Robert Matthews who writes for the Sunday Telegraph in London, England. It was of interest to me to read in that article:

> "Their argument draws on a curious quantum vacuum phenomenon first described by the British physicist Paul Davies (now at the University of Adelaide in Australia) and William Unruh of the University of British Columbia in the mid-1970s. If you move at a constant speed through the quantum sea of virtual particles, it looks the same in all directions. But as soon as you start to accelerate through it, theory predicts that the vacuum gives the appearance of being a tepid 'sea' of heat radiation."
>
> "Cosmologist Paul Wesson of the University of Waterloo, Canada, an authority on the links between the subatomic and cosmic worlds, is 'glad that someone is trying to return to the question of inertia again'. But he is concerned about 'the astrophysical and cosmological implications of the work'. Wesson's concern centres on the cosmological constant, best known as the add-on to Einstein's

equations of general relativity that endows free space with extra energy and gives it a gravitational effect."

So here we have two authorities on the subject, one declaring that the energy of the vacuum appears hotter 'from the viewpoint of a particle' simply because that particle accelerates, and the other who is 'concerned' and is 'glad' that someone is trying to explain inertia.

Much of what I have described in the above Report is the subject of my 1972 book 'MODERN AETHER SCIENCE'. It was Paul Davies, I believe, who at that time was called upon to review that book, branding it as 'Physics in Fairyland'. Yet I would say that it would indeed be a 'fairyland universe' if it were seen to glow with heat when someone sitting on an accelerated particle is looking at it but yet appear to cool suddenly if that acceleration ceases. If Davies is right it would seem that all we need to do to extract heat by allowing the vacuum medium to shed energy by cooling is to cause matter to oscillate and become a receiver of energy!

This I do not believe, but I do believe, as I have explained on page 116 of 'MODERN AETHER SCIENCE' that "when a charge is set in motion it will have to find its own equilibrium via the catalytic action of the aether, exchanging energy with other free charge present ... the net effect being that the catalytic action can transfer kinetic energy between the charges, a phenomenon we well know from the behaviour of the electrical transformer."

It is my contention that before we waste time trying to understand imagined apparitions of heat deployment in space, we should first explain how, in the laboratory, energy devoid of the independent observer as a local carrier of the action, finds its way from an electrical circuit into the vacuum medium as electrical inductance and then comes back again when we switch off the current.

There is no point in scientists thinking they can explain the cosmology of the universe when, as is blatant fact, they cannot explain the nature of the energy processes involved in electrical inductance. The explanations on offer are empirical, just as if there were no such thing as 'cosmology' but only observation of stellar objects. If inductance requires acceptance of a real aether medium and not just a mathematical four-space formulation, so much of cosmology, with its reliance on symmetry and invariance, is open to question. One needs, as said above, to avoid forcing an argument forward by putting 'the cart before the horse'.

Paul Wesson, I remember as a young scientist who had read about my theory and came to my home to discuss it even before beginning his graduate research study. I recall that he was impressed by my account of gravitation and tried to pursuade his academic supervisors at Cambridge to allow him to pursue the theory as his Ph.D. thesis subject, a request which was firmly denied!

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So, should Paul Wesson come to read the above account, having stated that he is "glad that someone is trying to return to the question of inertia again", I send my greetings and invite him to look up and reread my account of inertia that was in my 1966 book 'THE THEORY OF GRAVITATION'. It is still the same, 28 years on, as a theory which says that an accelerated charge does not radiate energy, leading, as equation (1.18) on page 15 of that book, to:

$$\text{Electric field energy} = \text{mass of the field times } c^2$$

followed immediately by the words: "The realization that an electric field has the property of inertia is fully supported by the derivation of that equation".

I have provided in Appendix A an extract from pages 80 - 84 of my 1980 book 'PHYSICS UNIFIED' to show the reader the formal analysis by which $E = Mc^2$ is derived as an account of inertia based on energy conservation by accelerated charge.

I have in APPENDIX B, by my paper 'A Theory of Proton Creation': Physics Essays, **1**, 72-76 (1988), shown how the mu-meson energy sea in space is active in creating the proton.

Similarly in APPENDIX C, by my paper 'The Theory of the Gravitation Constant': Physics Essays, **2**, 173-179 (1989), I show how G is determined by the space energy medium.

Then, to round off the subject of this Report, I present by APPENDIX D, my paper 'Instantaneous Electrodynamic Potential with Retarded Energy Transfer': Hadronic Journal, **11**, 169-176 (1988).

This latter paper solves a problem I struggled with for many years as I sought to deduce the full physical basis for steady-state electrodynamic interaction and explain how there could be balance of action and reaction forces in the electrodynamics that connects with gravitation. The propagation of action at the speed of light with all the mystery of the retarded 'solutions', the mathematical equations which confound textbooks on the subject and are never applied in practice, is clarified by this paper.

Written in 1988 the paper complements my efforts to advance my earlier research into hadron electrodynamics, meaning my interest in the anomalous energy behaviour of heavy ions in electric discharges.

However, for the general reader I commend study of the paper, having in mind the age-old question about action-at-a-distance forces and Newtonian interaction versus the propagated action that features in Einstein's theory.

The action is summed up in the title of the paper. There is instantaneous action-at-a-distance with spontaneous energy transfer both at the action source and at the seat of the distant reaction, but that action is with the local space energy medium and is followed by

a retarded adjustment of energy in the zero-point energy background as equilibrium of that sea of energy takes its time to recover.

I conclude by thanking the Editors of Physics Essays and Hadronic Journal for permission to reproduce the appended papers.

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APPENDIX A

The Energy-Mass Formula

In the printed version of this Energy Science Report No. 6, published in 1994, this Appendix comprised a copy of a section of text between pages 80 and 84 of the author's 1980 book 'PHYSICS UNIFIED' published by Sabberton Publications, the distributers of this Report. It begins with a four-line quote from Einstein's 1905 basic paper. However, in this 2003 PDF version of the Report, it suffices to provide a link to those book pages as they are of record, also in PDF form, on the author's website. To see those five pages use the link below:

http://www.aspden.org/books/Pu/pupp80to84.pdf

APPENDIX B

'A Theory of Proton Creation'

In the printed version of this Energy Science Report No. 6, published in 1994, this Appendix comprised a copy of a paper printed in the Canadian periodical 'Physics Essays'. This paper, published in 1988, presented the updated version of one of the primary themes of the author's theoretical work. Understanding the creation of the proton in the onward progress of our understanding of the physics which governs our universe. It is a key feature now included as Chapter 4 in the author's new work: 'The Physics of Creation', which now (June 2003) appears in full on the author's website www.aspden.org. However, here the object is to provide, for the record, a copy of Energy Science Report No. 6 and this Appendix, to be complete, requires access to that 'Physics Essays' paper.

To see that paper in PDF format use the link below:

http://www.aspden.org/books/Asp/1988c.pdf

APPENDIX C

'The Theory of the Gravitation Constant'

In the printed version of this Energy Science Report No. 6, published in 1994, this Appendix comprised a copy of a paper printed in the Canadian periodical 'Physics Essays'. A mention of 'energy in transit' in the copy of this paper that was included in that printed version of Report No. was marked with an asterisk drawing attention to an added footnote. This footnote was:
[* 'Energy in transit' has to be seen as a ripple in a large pool of energy. Just as a ripple in a pool of water travels at the wave velocity, so the energy ripple travels at the speed of light, but neither the water in the pool nor any energy moves at that wave velocity.]

This related to the discussion of the electrodynamic action in the context of its relevance to gravitation, it being essential for energy to deploy in the field medium, which, absent an aether as such, requires energy to travel at the speed of light, whereas matter travelling at that speed would need to have infinite mass. The presence of the aether as an energy medium is essential if one is to interpret the empirical evidence in a way that makes sense in physical terms.

To see that paper in PDF format use the link below:

http://www.aspden.org/books/Asp/1989b.pdf

APPENDIX D

'Instantaneous Electrodynamic Potential with Retarded Energy Transfer'

In the printed version of this Energy Science Report No. 6, published in 1994, this Appendix comprised a copy of a paper printed in the U.S. periodical 'Hadronic Journal'. At the time this paper was written, it was deemed by the author that understanding electrodynamic interaction as between particles of matter and their associated graviton accompaniment was vital to an in-depth understanding of the true nature of gravitational force. Although the author has, in the new book 'The Physics of Creation' mentioned in Appendix B above, given reason for modifying his opinion on the role of electrodynamics in gravitational action, this paper warrants consideration and needs to stand on the published record of the author's work. Note also that it was written at a time when the author had been distracted by some fascinating observations by E. W. Silvertooth (now deceased) who had claimed to sense motion through the aether. This was mentioned on pp. 312 and 313 of that paper, but, nevertheless, in presenting the paper as Appendix D of Report No. 6, the author had reason to include the following footnote as an addition at the end of that paper:

[* Although the author has anxiously waited for the Silvertooth Experiment to be confirmed or disproved, there has been no final clarification reported. Therefore, at the time of writing this Report (April, 1994), the author has decided to consolidate his theory, adhering to the position expressed on the EM (electromagnetic) reference frame in his book 'Physics Unified']

The latter book is now of record in PDF form on the author's website www.aspden.org whereas the paper, the subject of this Appendix, can also be seen in PDF form by using the following link:

http://www.aspden.org/books/Asp/1988a.pdf