# Replacing Einstein's SR and GR

A Unified Classical Theory of the Electric, Magnetic and Gravitational Forces

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## Abstract

The work of Lorentz is corrected and completed to produce a logically consistent relativity based on the existence of a local background though which light travels at a constant speed. Magnetic fields generated by currents are consistent with the individual electric fields of electrons coexisting in space and we propose that the electric fields of all individual elementary charged particles coexist in space forming a background against which the electromagnetic interactions take place. This leads to a real Lorentz contraction of matter and fields producing real slowing of clocks and increase in mass. We see that inertial mass is purely electromagnetic in origin.

The coexisting electric fields possess an internal stress which minutely distorts space resulting in energy transfers which generate gravitational forces. This leads directly to predicting the effect of gravitational potential on matter and light. Using the concepts of classical physics we are able to produce a unified theory of action at a distance, inertia, electricity, magnetism and gravity which correctly predicts the effects of near light speed and gravitational potential on clocks and rulers. Gravitational redshift and the bending of light by gravity are correctly accounted for.

The difference between these theories and Einstein's relativities are discussed and determining experiments proposed.

## Introduction

I am an "amateur theoretical physicist". Though I once graduated in physics, I earned a living teaching mathematics. Now I have the time to pursue my love without any employer or peer group to censure my work.

Theoretical physics is like doing a jigsaw in the dark with only some of the right pieces and many pieces from other jigsaws. It cannot be separated from personal beliefs and philosophy. My own prejudice is that we live in a universe designed by God. The theoretical physicist treads in the footsteps of God solving the same problems that God had to solve to make it work. It is a path I dare to follow only in the belief that God wants man to tread it and has littered the way with clues.

The most important tool of the theoretical physicist is the waste paper bin. When I started to write this paper, I thought I had all the answers, but in putting an alternative theory of gravity under the microscope of mathematical rigor, I saw its beauty and had to bin many pages before developing a synthesis of the two theories.

I take issue with much of modern physics because, while it may enable us to predict what happens, it does not provide a description of viable working processes which God could have incorporated into his universe.

## History

Physics is a vast subject and only a small part of it can be packed into a university syllabus. It is all too often poorly presented by disinterested lectures who package it in a way more appropriate to religious dogma than real science. Just why the equations of relativity are named after Lorentz remains a mystery lost in time.

Einstein's part in the development of the special theory of relativity is grossly exaggerated. He wrote a paper in 1905 reproducing the ideas of Lorentz and Poincaré adding only a derivation of the transverse Doppler effect and the assertion that "the stationary system" was superfluous. As late as 1915, relativity consisted of studying the papers of Lorentz, Poincaré and Minkowski with no mention of Einstein. Central to everything is the Michelson Morley Experiment. Its null result meant one of two things, either the aether was dragged along by the earth or else Fitzgerald's suggestion that the apparatus contracted in the direction of motion was correct. Lorentz combined Maxwell's wave equation with Poisson's equation and using Gauss's law as a boundary condition, proved that matter consisting of electric charges would contract in the direction of motion. This proof is at most 7 lines long, yet it is not taught. Lorentz with suggestions from Poincaré and others had worked out the details of relativity and derived the Lorentz transforms by 1904. Motion through the aether directly caused an increase in inertial mass and a physical contraction. These combined to affect all time dependent processes and clocks slowed.

Lorentz however thought that his transforms only worked in going from the aether to the laboratory. In early 1905, Poincaré showed that they formed a group and applied between any two inertial frames. In his 1906 lectures at Columbia University, Lorentz ignorant of Poincaré's contribution acclaimed Einstein.

Relativity as taught today is mostly about trains and clocks and gravity, with only postgraduate students learning about relativistic electrodynamics, but for Lorentz, Poincaré, Einstein and Minkowski, It was the electrodynamics and the theory of electrons which was emphasised. Lorentz's relativity was closely related to his theory of the electromagnetic mass of the electron. Lorentz's moving electron was surrounded by a magnetic field containing its kinetic energy and the work that had to be done to create it resulted in its inertia. A number of factors militated against Lorentz's relativity. The experimental data available to him was in error supporting the analysis of mass increase derived by Max Abraham. He had not understood Poincaré's group theory. A powerful struggle waged in Germany by pure mathematicians to take control of theoretical physics aided the reception of Minkowski's geometry. Many including Lorentz had theories of gravity based on electromagnetic theory, but Einstein's search took him into the realm of pure mathematics and was gladly received. Generations of aether theorists had failed to produce a viable theory. Einstein's interpretation required no aether and at once appealed to the pure mathematicians.

An error in Lorentz's interpretation of the effect of the contraction lead to the prediction that the energy content of its electric field also increased. While Lorentz ignored this, Poincaré added internal stress to the electron. Einstein regarded the magnetic field as an artefact of observation and subtracted its energy from that of the electric field to produce a "Lorentz invariant quantity". The final blow to any hope of resurrecting Lorentz's relativity came with the discovery of the neutron.

Right or wrong, Einstein's theories have been taught for the best part of a century and have become an incontrovertible fact in eyes of Journal editors and referees.

## Replacing the aether

According to dogma, there is no electric field surrounding a wire carrying a current. We might do some mathematics and describe the electric field of each electron and each proton, but we are taught that outside the wire they add together to give no electric field. But somehow, the electric current is able to generate a magnetic field in the space beyond the wire. The law of Biot-Savart defines this and over a hundred years of

electrical engineering have failed to find a case where it is violated. We can rewrite the equation in terms of the motion of the electric fields of the individual electrons and protons[1].

$$\vec{H} = \int \frac{i\, d\vec{l} \wedge \hat{r}}{4\pi r^2} = \sum_i \frac{q_i \vec{v}_i \wedge \hat{r}_i}{4\pi r_i^2} = \sum_i \vec{v}_i \wedge \vec{D}_i$$

This is prima facie evidence that the individual electric fields coexist in space and that magnetic fields are generated by their motion through each other. We can divide the elementary charged particles within the wire into two sets, the conduction band electrons whose movement constitutes the current are in one set and all the other elementary charged particles within the wire are members of the other set. We might at first attribute the generation of the magnetic field to the movement of the electric fields of the conduction band electrons through the fields of the other charges in the wire, but this would imply that the speed of light passing close to matter would change and this is not the case. We therefore conclude that the electric fields of all elementary charges particles coexisting in space form the background against which the motion of individual charges generates a magnetic field.

It is unreasonable to suppose that the strength of the magnetic field depends on the number of elementary particles in the universe, so their effect must be averaged in some way. That is to say that some measure of the strength, or whatever of an individual field determines its contribution. Electric field strength and electric potential are candidates and we can write:

$$\vec{s}_E = \frac{\sum E_i \vec{v}_i}{\sum E_i} \quad \text{or} \quad \vec{s}_\phi = \frac{\sum \phi_i \vec{v}_i}{\sum \phi_i}$$

The background is not constant, but varies from place to place and is described by the vector field $\vec{s}$. It is convenient to call this "stasis". Those familiar with aether theories will note that the $\vec{s}_E$ model is similar to a dragged aether model and the $\vec{s}_\phi$ model similar to a galactic aether model. Detailed analysis has been carried out for the $\vec{s}_E$ model and it was found that at the earth's surface, the stasis vector $\vec{s}_E$ has a component of 15.9 m/s back along the earth's orbital path due to the influence of the sun and a second component, pointing west, equal to half the surface speed due to rotation.

While the $\vec{s}_E$ model would be nice because it allows superluminary space travel, there are serious problems in accounting for changes in kinetic energy of space probes. It seems more likely that the $\vec{s}_\phi$ model applies. It is possible that this model might be able to account for frame shifting and galactic rim velocities.

## Shaving the electron

In classical theory, the electron is a spherical mass with charge stuck to its surface. The electric field $\vec{E}$ emanating from that charge polarises space such that the surface is coated with an equal and opposite layer of positive charge. The self energy of the electron may be thought of either as residing in the polarisation of space, or in the self energy of the mutual repulsion of the charge elements on its surface.

If we apply Occam's razor, we can equally well construct an electron from nothing but a polarisation of space ending in a "raw edge" of negative charge. This implies that the electron is first and foremost a stable form in which energy can deposit itself. The electron should not be thought of as a point or a finite sphere, but as an extended entity reaching out from its surface towards infinity. This solves the problem of action at a distance. The action now becomes local. One electron exerts a force on another because the surface charge of the other sits within its polarisation field. This action is reciprocal.

The classical physicist holds out his test charge $\delta q$ and it sits within the electric field of each and every

[1] S.I. units are used throughout and the field descriptors take their microscopic form.

elementary charged particle in the universe and each exerts a force on it. These force add mechanically to give the force $\vec{F}$ and he assumes the presence of an electric field $\vec{E} = \frac{\vec{F}}{\delta q}$. This is conceptually wrong: $\vec{E}$ is not a real entity, just a mathematical artefact. (More precisely, when we write $\vec{E} = \sum \vec{E}_i$, the $\vec{E}_i$ are real, but $\vec{E}$ is a mathematical artefact.)

## The Lorentz contraction

Lorentz's derivation is simple to follow. We start with Poisons's equation and Maxwell's wave equation in terms of electric potential.

$$\nabla^2 \varphi = \frac{\rho}{\varepsilon_0} \qquad \nabla^2 \varphi - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\varphi = 0$$

These two equations are combined to form a single differential equation:

$$\nabla^2 \varphi - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\varphi = \frac{\rho}{\varepsilon_0} \qquad (a)$$

In the absence of any charge, $\rho$ is zero and it becomes the wave equation of light. In the absence of any change with time, it becomes Poisson's equation. Because of the way in which differential equations like this work a solution to this equation is any form of linear combination of solutions to Poisons's equation and the wave equation.

Lorentz used a very neat piece of analysis when he argued that in a system of charges which is in uniform motion with velocity $v$, the rate of change in $\phi$ with respect to time will be solely due to the motion of the system and we can write:

$$\frac{\partial}{\partial t} = v\frac{\partial}{\partial x}$$

By making this substitution into the previous equation and simplifying, we can obtain the equation which applies to the moving system.

$$\left(1 - \frac{v^2}{c^2}\right)\frac{\partial^2}{\partial x^2}\varphi + \frac{\partial^2}{\partial y^2}\varphi + \frac{\partial^2}{\partial z^2}\varphi = \frac{\rho}{\varepsilon_0} \qquad (b)$$

Lorentz then argued that in any attempt to calculate the positions of charges relative to one another as in the structure of a lump of matter, the solutions which ultimately depended on the equation (a) now depend on equation (b) and can be solved by making the substitution :

$$x' = \frac{x}{\sqrt{1 - \frac{v^2}{c^2}}}$$

This reduces equation (b) to the form of (a) and the solutions which gave matter its structure now show matter contacted in the direction of motion.

This was a mathematical proof of the validity of Fitzgerald's explanation for the null result of the Michelson Morley experiment. Lorentz then introduced the experimental fact that the charge on the electron remains constant and applied Gauss's law: that the integral of $\vec{D} \cdot d\vec{A}$ over a surface surrounding an electron must be $4\pi$ times its charge of $-e$.

$$\int \vec{D} \cdot d\vec{A} = -4\pi e$$

This showed that both the surface of the electron and its electric field as described by $\vec{D}$ are contracted and allowed him to correctly calculate the effects of near light speed on the mass of the electron.

## Correcting Lorentz

Lorentz made one big mistake! He assumed that the electric field descriptors $\vec{D}$ and $\vec{E}$ are related by the equation $\vec{D} = \varepsilon_0 \vec{E}$ and must always be parallel.

However, the Lorentz contraction was deduced using the concept of electric potential $\phi$. The electric field strength can also be written in terms of $\phi$ as $\vec{E} = \nabla\phi$. The electric field strength $\vec{E}$ must also be everywhere perpendicular to the equipotential surfaces of $\phi$ and this implies that while $\vec{D}$ is rotated away from the line of motion towards the perpendicular, $\vec{E}$ is rotated towards the line of motion. This leads to the energy content of the electron's electric field being invariant.

The energy content of the electric field is the volume integral of $\frac{1}{2}\vec{D} \cdot \vec{E}$. The Lorentz contraction caused by motion in the $x$ direction increases the $y$ and $z$ components of $\vec{D}$ and the $x$ component of $\vec{E}$ by a factor $\gamma$ and reduces the capacity of the volume element $d\tau$ by the same factor.

$$\int \frac{1}{2}\vec{D}' \cdot \vec{E}'\, d\tau' = \int \frac{1}{2}\begin{pmatrix} D_x \\ \gamma D_y \\ \gamma D_z \end{pmatrix} \cdot \begin{pmatrix} \gamma E_x \\ E_y \\ E_z \end{pmatrix} \frac{1}{\gamma} d\tau = \int \frac{1}{2}\vec{D} \cdot \vec{E}\, d\tau$$

Poincaré's correction based on internal stresses of the electron was also wrong. He assumed the electron was like a miniature version of a charged metal sphere. But a negatively charged metal sphere has a surplus of electrons each with a field radiating in all directions. The electron cannot be further subdivided. Its electric field extends radially outward from its surface and its surface elements do not sit in each other's electric fields.

Thus the only self energy of the electron lies in its electric field and this is invariant.

## Inertia

The discovery of the electron also implied the existence of positive charges within the atom and Lorentz assumed that his theory of the electron's electromagnetic mass would also apply. This was invalidated with the discovery of the neutron, but in the late 60s the quark theory was developed in which a proton consisted of three quarks with charges $+\frac{2}{3}$, $+\frac{2}{3}$ and $-\frac{1}{3}$ and the neutron consisting of $+\frac{2}{3}$, $-\frac{1}{3}$ and $-\frac{1}{3}$. Matter could once more be regarded as consisting of spherical charged particles.

Considering the electron to be a spherical charge moving through the aether, Lorentz showed that the energy content of the magnetic field of a slow moving electron was $\frac{\mu_0 q^2}{12\pi a} v^2$ where $q$ is its charge and $a$ its radius. This could be equated with its kinetic energy giving $\frac{1}{2} m v^2 = \frac{\mu_0 q^2}{12\pi a} v^2$. For a fast electron it becomes $\frac{\mu_0 q^2}{12\pi a} \gamma v^2$ where $\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$.

Lorentz avoided the problems with the energy content of the electric field by using the concept of electromagnetic momentum $\vec{G} = \int \vec{D} \wedge \vec{B}\, d\tau$ showed that $mv = \frac{\mu_0 q^2}{6\pi a} v$.

We note that both equations yield the result $$a = \frac{\mu_0 q^2}{6\pi m} = 1.8786 \times 10^{-15}\,\text{m}$$

Lorentz then proved that the whole of the mass of the electron must be electromagnetic. His method was however a fudge because a full analysis would take into account the increase in the energy content of the

electric field which was then believed to be caused by the Lorentz contraction. The fudge was accomplished by using electromagnetic momentum rather than energy.

With the correction to the effect of the contraction on the electric and magnetic fields, Lorentz's original derivation is vindicated.

## Inertia under linear acceleration

Lorentz's work is not usually taught. I only discovered he had written a book by chance and only obtained a copy through great effort. I was greatly relieved to find that his method of derivation was different from mine, but then went on to discover that I too had neglected the increase in energy content of the electric field. However the solution to the problem left my derivation based on Faraday's law still valid.

When the electric current in an inductance changes, an emf. is generated opposing the change. Could a similar process generate an electrical field which exerts the inertial force upon the charge of an electron resisting its acceleration? If we draw a half plane from the electron's line of motion to infinity and integrate the magnetic flux density over its area, we find that the electron is surrounded by an infinite quantity of flux $\mathbf{\Phi}$.

$$\mathbf{\Phi} = \int \vec{B} \cdot dA = \infty$$

Clearly any change in its velocity should generate an infinite electric field resisting the acceleration. As this is not the case, we conclude that $\mathbf{\Phi}$ is not a good descriptor of the "bulk" of the magnetic field. If however, we consider the "substance" of a magnetic field to be its energy and instead calculate a volume integral, the total energy is finite.

This calls for us to modify our concept of magnetic flux. We still retain the descriptors $\vec{B}$, $\vec{H}$, $\mathbf{\Phi}$, $A$ and $\vec{A}$ but take a holistic view that these are only descriptors of the magnetic field which is more than any one of them. Indeed, we must define two new descriptors[2]; "magnetic energy density" $Q = \frac{1}{2}\vec{B} \cdot \vec{H}$ and the "magnetic energy density vector" $\vec{Q} = \frac{1}{2}\vec{B}H = \frac{1}{2\mu_0}B\vec{B}$. In this new concept, the substance of the magnetic field is energy existing in space in response to a magnetic intensity $\vec{H}$. As we saw, this magnetic intensity $\vec{H} = \sum_i \vec{v}_i \wedge \vec{D}_i$ is the direct result of the action of the moving electric fields of elementary charged particles.

If we make a series of diagrams in which we draw lines of $\vec{B}$ flux for a cross section of a solenoid; as the current it is increased, we see that the movement of the lines of flux is such that they never cut the turns of wire. What happens is that flux emerges from the surface of each turn, but is then subject to shear so that it appears as if individual circles of flux move outwards from the wire only to be cut and and rejoined with neighbouring circles to form the loops of flux which pass through the whole length of the solenoid. This is inconsistent with the theory of the inductance that an emf. is generated by the $\vec{B}$ flux cutting the turns[3]. However, the calculations used by electronics engineers bypass this part of the theory and work out the induced voltage from the work done by the current in forming a field of given energy content. From this we can conclude that we are quite justified in saying that movement of magnet flux as a field grows or shrinks is correctly described as a flow of energy. Using the principles which we are about to follow, it is possible to model the behaviour of an inductance from first principles and derive the well known classical equations. [1]

The theory of inertia was developed over several years in three stages. First for linear acceleration of slow electrons, next for centripetal acceleration and then finally for the general case including the effect of near light speed. The assumption we have to make in the first instant is that the movement of energy within

[2] Elsewhere, I use the symbols $Q_m$ for magnetic energy density and $Q_e$ for electric energy density.

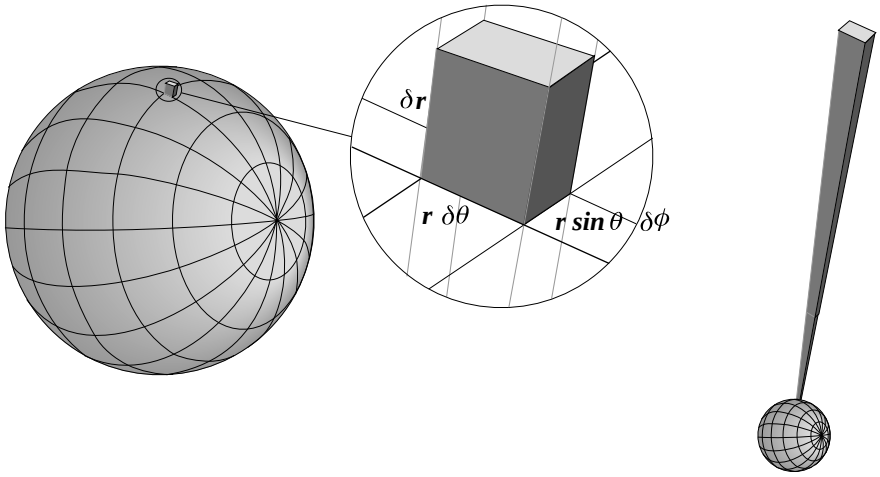
[3] While it is true that lines of $\vec{B}$ behave in this way, continuity is preserved and $\nabla \cdot \vec{B} = 0$.

the magnetic field is parallel to the electric field(s). (Where more than one charge is involved in generating the magnetic intensity, each makes a "personal" contribution to the energy and its personal contribution moves within its electric field.)

It is best to picture (Fig. 1) an electron with a conical tube drawn parallel its electric field extending outward from a surface element of solid angle $\delta\omega$.

If $Q_r$ is the energy density at a distance $r$ from the centre of the electron and the radius of the electron is $r_0$, then the energy content of the tube is $\int Q_{m,r}\, dr\, \delta\omega$. This may be integrated by writing the energy density as a function of $r$ giving $\frac{1}{2}\, r_0\, Q_{r_0}\, \delta\omega$. The actual analysis is quite tedious running into several pages. [2]

Fig. 1




Differentiating it with respect to time gives the rate of change of the energy content and dividing by $Q_{m,r_0}\, \delta\omega$ gives the velocity with which the magnetic flux emerges from the surface as equal to $\frac{r_0}{v}\, a$ where $a$ is the acceleration and $r_0$ the radius of the electron.

Using Faraday's law with this velocity and the magnetic flux density $\vec{B}$ we can calculate an induced electric field at the outer face of the surface of the charge. If the surface is of finite thickness and the flux is generated within the surface, then a factor $\frac{1}{2}$ must be include to give the average field acting on the surface element of charge $\frac{q}{4\pi}\, \delta\omega$.

Finally we integrate over the surface of the electron to get the inertial force.

$$\vec{F} = -\frac{\mu_0\, q^2}{6\, \pi\, r_0}\, \vec{a}$$

This derivation not only gives us the inertial mass of the the electron, but it also constitutes a derivation of Newton's 2nd law of motion.

## Inertia, the general case

Centripetal acceleration does not alter the energy content or form of the magnetic field surrounding an electron, but rotates it. Explaining how this generates centrifugal force was a very difficult problem to solve. Twice I though I had a solution only to re-examine it a year of two latter and discover a fudge and bin months of work.

We must make a further assumption about the nature of magnetic energy density flux: that it has the

directional property of its flux density $\vec{B}$. We are thus forced into using a vector like quantity $\vec{Q} = \frac{1}{2\mu_0} B\vec{B}$ and discovering how it behaves when changing its magnitude and direction. Here it is essential that the reader grasps the concept of the holistic nature of the magnetic field. To understand it we must be mindful of the behaviour of all its descriptors. $\vec{Q}$ has magnitude and direction and fits the strict definition of a vector, but is unlike a vector in that it does not obey the laws of vector algebra. We cannot use the normal methods of calculus!!!!!!

We can resolve $\vec{Q}$ into orthogonal components $Q_x\hat{i}$, $Q_y\hat{j}$, and $Q_z\hat{k}$, but their magnitudes add: $Q = Q_x + Q_y + Q_z$. We have met this kind of behaviour in physics before in the kinetic theory of gases where the kinetic energy of a molecule behaves in this way resulting in a factor $\frac{1}{3}$ in the pressure exerted by a gas. [3] Whereas we use the direction cosines to resolve a vector into its components, we must use their squares to resolve an energy density into its components:

$$A_x = A\cos^2\alpha, \qquad A_y = A\cos^2\beta \ \ldots \qquad Q_x = Q\cos^2\alpha \ \ldots$$

In differentiating a vector $\vec{A}$ from first principles we see that the increment $\delta\vec{A}$ must be resolved onto two components parallel and perpendicular to $\vec{A}$. Then $\delta\vec{A}_{\parallel}$ causes a change in the magnitude while $\delta\vec{A}_{\perp}$ causes a change in direction. The same principle applies to $\vec{Q}$ in that the increment $\delta\vec{Q}$ has a component parallel to $\vec{Q}$ which changes its magnitude and a perpendicular component which changes its direction. However, we cannot represent this with a vector triangle because the laws of vector addition are invalid for $\vec{Q}$. We achieve the differentiation from first principles knowing that the direction of $\vec{Q}$ must match the differentiation of the flux density.

$$\text{Given that } \vec{Q}_m = \frac{1}{2\mu_0} B\vec{B} \qquad \text{then} \qquad \frac{d}{dt}\vec{Q}_m = \frac{1}{2\mu_0} B\frac{d}{dt}\vec{B}$$

Returning to our picture of an electron with a conical tube drawn parallel its electric field, the conic tube is fixed in direction and as the magnetic field rotates, so both the magnitude of its energy density within the tube and its direction change. Mirrored on the other side of the electron is a similar tube in which equal and opposite charges are taking place so that the energy content of the magnetic field is unchanged. If we simply calculate the change in energy alone without taking directional properties into account, the predicted magnitude of the centrifugal force is too small.

The analysis is even longer and more tedious, [2] but follows the pattern for linear acceleration. The energy density flux which we must generate at the electron's surface is no longer parallel to the magnetic field surrounding it, but using the corresponding flux density $\vec{B}$, we can again calculate an electric field and integrate over the electrons surface.

The relativistic effects of increased inertial mass are best dealt with using a mixture of contracted co-ordinates and real values for the parameters describing the electric and magnetic fields. This was the method used by Lorentz. This introduces an error in that the real volume elements are Lorentz contracted resulting the predicted force being $\gamma$ times its real value. The final result

$$\vec{F} = -\frac{\mu_0 q^2}{6\pi r_0}\gamma\begin{pmatrix}\gamma^2 a_x\\ a_y\\ a_z\end{pmatrix}$$

is a derivation of the relativistic inertial mass of the electron and the relativistic form of Newton's 2nd law of motion. Note that we can no longer use the acceleration $\vec{a}$ as a simple vector, but must increase its component in the direction of motion by a factor $\gamma^2$ to account for the work which must be done increasing the relativistic mass.

The addition of kinetic energy is such that the KE of a moving system is equal to the sum of the KEs of its components in its centre of mass inertial frame plus the KE of a single equivalent mass. This means that while we have calculated the inertial mass of a single electron, it is representative of the behaviour of a chunk of matter ( a mass). The energy contained in the magnetic fields surrounding its electrons and quarks (partons) will be the sum of internal KEs of the atom, their thermal energy and lastly the KE of the lump of matter. Individual partons will be subject to acceleration from internal motion within the atom, thermal motion and the motion of the mass. The accelerations are addative and so are the inertial forces.

## Lorentz v Einstein's SR

In the previous sections, we have seen how weaknesses in Lorentz's theory can be overcome to give what in all fairness should be called Lorentz-Poincaré-Harvey relativity. The aether has been replaced by a background consisting of the presence of the electric fields of all elementary charged particles. Lorentz's derivation of the contraction has been clearly explained. Lorentz's interpretation of electromagnetic mass has been vindicated and proved with greater rigor connecting the generation of inertial force to electromagnetic induction.

There is a physical connection between the Lorentz contraction and the mass increase. The contraction increases the components of a charge's electric field perpendicular to its motion which results in a stronger magnetic field due to its motion. The increase in mass directly slows all time dependent processes by a factor $\gamma$.

If we have an inertial system moving through the background and try to establish synchronisation of clocks by say moving a clock backwards and forwards along the line of motion, we would notice that after returning to the origin, it would have lost time. So we correct for that and repeat the journey. Now, the clock is slowed more when it moves in the direction of motion and less when it moves opposite to the direction of motion. The result is that clocks synchronised with it will not be in "true" synchronisation in a Newtonian sense. The effects of the contraction, slowing of "local time" and incorrect synchronisation of clocks results in measurements of the speed of light all giving the same answer.

Einstein's SR also derives the same four physical effects of contraction, increase in mass, clocks slowing and differences in clock synchronisation. The difference is cause. Einstein failed to distinguish between the slowing of clock and the slowing of time. Lorentz referred to "local time" maintaining the distinction.

In his paper of 1905, Einstein assumed no background and a universal speed of light. An observer setting up an inertial reference frame with measuring rods and clocks will have no choice but to synchronise clocks using a light pulse. He imagined two observers in relative motion doing this by timing the there and back journey of a light pulse, dividing by 2 and using this to synchronise their clocks. Einstein showed that the synchronisation of clocks in the two observer's systems will be different. He then showed that because of this lack of synchronisation, any attempt by one observer to measure the length of an object which is at rest in the other observer's system will result in it appearing contracted. Similarly clocks in the others system appear to run slow.

Einstein then used the effects on "time" and "length" to derive the law of composition of velocities:

$$V = \frac{v + w}{1 + \frac{v\,w}{c^2}}$$

Later authors would use this and the principle of conservation of momentum, to demonstrate an increase in mass, but Einstein took the far harder path of examining the effects on electric and magnetic fields, then tackled the problem of electromagnetic mass deducing the mass increase.

All of Einstein's effects are reciprocal and are artefacts of his method synchronisation. All of Lorentz's effects are real physical effects of motion relative to some background.

All derivations of Einstein's relativistic effects involve a fudge! The fudge in his 1905 paper is to allow one observer to regard his system as stationary and thus temporarily giving it properties which come from being at rest in the aether. Bondi's k-calculus [4] derivation claims different shaped triangle to be similar. Over the years many derivations including Einstein's railway car method have been devised.

The gaping hole in Einstein's SR is the slowing of clocks which Einstein called time dilation. Einstein said it was reciprocal, but every effect recorded experimentally is real and one way. Opponents argued that a twin who travelled at near light speed to the nearest star and back would age less than his brother because of his velocity through the aether. If there was no aether, why should this twin be younger and not his brother. The answer we are told is because of acceleration. I suggested in the relativity news group that we put this to the test with a casio digital watch and a spin-drier. Without any aether, how would the watch know it was not on the twin's space craft.

## The synchronisation paradox

Einstein's special relativity is based on the impossibility of synchronising remote clocks. From this he says that the universe knows no absolute synchronisation of time.

Now in special relativity, each inertial observer constructs a Cartesian co-ordinate system using rods of unit length. In a universe obeying Lorentz, motion relative to the background would cause a contraction in the direction of motion, but Einstein insists this is not so. His co-ordinate systems are rigid. He insists that the observed contraction is reciprocal and results from the use of clocks to determine a moment in time when the positions of the ends of a moving rod are recorded so that the distance between them can be measured.

If we return to Newton's concept of universal time, any body in uniform motion will enable us to measure time from its change in position. If the universe obeys Einstein, then as one observe sees the grid lines of the others co-ordinate system pass his origin, he sees that they beat out time. If he moves to his x=1 grid line, he will see the other observer's grid lines crossing his x=1 line. Since the relative speed between the two co-ordinate systems is the same, a grid line will pass his origin at exactly the same moment as the next (or previous) one crosses his x=1 line. As their grid lines cross each other they beat out universally synchronised Newtonian time, but only in a universe obeying Einstein's special theory of relativity. In the real universe, co-ordinate systems made of measuring rods, or inscribed on solid objects suffer real Lorentz contractions and will not beat out synchronised Newtonian time unless they just happen to be moving with equal and opposite velocities through the background.

Just why this has not been commented on before is an interesting question. Does the fact that this will not work in a universe obeying Lorentz's relativity have anything to do with it?

## Gravity

If inertial mass is electromagnetic, then how does gravity work? In classical physics, we thought of mass as some "mysterious property" which atoms possessed giving them inertia and enabling them to exert gravitational forces on each other. Now we have a rational explanation for inertial mass, we must look for a similar explanation of gravitational mass in terms of the electric nature of matter. Einstein attempted the task and came up with a theory of no gravity! That is to say, the presence of "mass = energy" in spacetime causes it to bend. Photons and more massive bodies naturally move through space time along straight lines, but the

resulting curvature of spacetime means that they appear to follow curved paths in space. This we attribute to a force of gravity, but the force of gravity only exists when we try to oppose a body's natural motion, for instance by placing a book on a table. The weakness in Einstein's theory is that there is no causal mechanism to generate the curvature of spacetime other than a divine command.

A number of electromagnetic theories of gravity have been developed over the years and we can identify two types; those based on slightly unequal electrostatic forces from positive and negative charge and those seeking to imitate GR. The former all fail to show why the ratio of inertial to gravitational mass should be constant for atoms of different atomic number and nucleon count. The latter usually fail to justify the effect of mass on space.

The problem is that the energy and consequently the inertial mass of an electron (U or D quark) is determined by its size. If God were to say "let all electrons be half their present size", they would double in mass and energy, but their distant electric fields would remain unaltered. How then is the electric field to convey to the universe beyond that the electron now exerts twice the gravitational force. The theory we are about to examine is similar to a series of theories by H A Wilson (1921), R H Dicke (1954) and Hal Puthoff (1989) which link gravity with variations in the fundermental properties $\varepsilon_0$ and $\mu_0$ of space. What is original is the identification of a process by which the variations of $\varepsilon_0$ and $\mu_0$ are induced by the presence of matter.

Atomic clocks are slowed by gravitational potential and have to be recalibrated for the altitude of their location after dispatch from the factory. This means that there is a property of space equal to gravitational potential. It is quite easy to demonstrate that electric potential is a property of space. Experimental evidence comes from the experiments of Reiss and Kohlrausch in which a parallel plate capacitor is charged and connected to an electrostatic voltmeter. As the distance between the capacitor plates is varied, the voltmeter shows changes in the potential. Nothing in the wires, in the plates, or on the surfaces of the plates changes. The electric field in the air gap between the plates remains unchanged, yet the voltmeter pointer moves. How does the voltmeter sense the change in the distance between the plates. The only possible explanation is that the electric potential is a real physical entity extending through space. Thus we are faced with the fact both electric and gravitational potential are real physical entities.

## The Dicke, Puthoff inheritance

The "Polarisable Vacuum" theory first ventured by Wilson, [5] developed by Dicke [6] and then interpreted and developed by Puthoff [7] seeks to replace the abstract mathematics of GR with a physical understanding. We might say that the two theories start at opposite ends of the problem and overlap in the middle. GR starts with the mathematics of curved four dimensional space time and ends by describing physical consequences. The PV theory starts with the assumption that the gravitational field results from the effect of matter on the permittivity of space $\varepsilon_0$ and moves from there to showing that measuring rods and clocks are effected in the way described by GR. It then shows that as we observe the universe with our affected rods and clocks, our observations fit the Schwarzchild metric and the mathematics of GR.

Dicke assumed that gravitational potential[4] $\Phi = -\frac{GM}{r}$ changes the value of $\varepsilon_0$ to $\left(1 + 2\frac{|\Phi|}{c^2}\right)\varepsilon_0$ which he wrote as $K\,\varepsilon_0$ introducing the number $K = \left(1 + 2\frac{|\Phi|}{c^2}\right)$. From the invariance of the fine structure coefficient $\alpha$, he deduces that $\varepsilon_0$ and $\mu_0$ must both increase by a factor $K$. This gives a slowing of the speed of light to $\frac{1}{K}c$. Both Dicke and Puthoff argue that all atomic dimensions including the radius of the electron are reduced by a factor $\sqrt{K}$. This partly compensates for the energy lost through the increase in $\varepsilon_0$ with the result that the energy in the electron's electric field is reduced by $\sqrt{K}$. Rather than use a Lorentzian definition of inertial mass, Dicke uses $E = mc^2$ taking the altered value of $c$ and concludes that the mass increases by $K^{\frac{3}{2}}$.

4 Some authors are sloppy in the use of $\Phi$ which is negative as if it were positive. Using the absolute value sign eliminates confusion.

Hal Puthoff gives an improved explanation of these effects and shows how they offer a better way of understanding general relativity. The paper is a kind of Trojan horse which gets past the referees by not challenging GR directly, but opens the way to theories which can replace GR by a causal theory in which the presence of matter is able to influence the permittivity of space. The change in permittivity will affect our metrication of the real world so that our measurements will fit those of GR. In a further paper Puthoff [8] advances a theory of how the presence of matter affects the permittivity of space $\varepsilon_0$. In the very simplest of terms, "the ZPF (Zero point energy fluctuations) jiggling of charged particles and subsequent interactions between them causes correlations in their continued jiggling, and this correlation energy we interpret as gravity."

To find a difference between the predictions of GR and Hal Puthoff's theory, we would need to wonder into a black hole. Hal's theory does not predict singularities. This is because in GR the term $1 - 2\frac{|\Phi|}{c^2}$ can become zero, but in Hal's theory it is replaced by $e^{-2\frac{|\Phi|}{c^2}}$ which can never be zero. The true value of $K$ is:

$$K = \frac{1}{e^{-2\frac{|\Phi|}{c^2}}} = \frac{1}{1 - 2\frac{|\Phi|}{c^2} + \ldots} = 1 + 2\frac{|\Phi|}{c^2} - \ldots$$

There is nothing in the Dicke Puthoff theory which is incompatible with the GR understanding of the Schwarzchild metric which in its weak field form is written in isotropic spherical polar co-ordinates as:

$$ds^2 = \left(1 - 2\frac{GM}{c^2\, r}\right)dt^2 - \left(1 + 2\frac{GM}{c^2\, r}\right)\left(dr^2 - (r\, d\theta)^2 - (r \sin\theta\, d\phi)^2\right)$$

The interpretation is that clocks run slow and rulers shrink compared with their state in the absence of a gravitational field. This is confirmed by experimental evidence in the form of the increased transit times of radar and radio signals passing close to the sun confirming correctness of this form of the solution to within a few percent. [9] The behaviour of atomic clocks, both on the ground an in space is in good agreement with the predicted effect. It must be emphasised that away from black holes, these effects are small. For an aluminium meter ruler, the earth's gravitational potential is responsible for a contraction of 5 atom spacings in length. The ruler will also bend, stretch or compress under its own weight. Hung from one end, it will stretch by 1½ atom spacings. If stood on end, it will be compressed by the same amount. (These effects are too small to measure, particularly when we realise that a change in temperature of $3 \times 10^{-5}\,°C$ will produce the same 5 atom spacings change in length.)

Hal Puthoff's representation must be regarded as superior to GR in that it is able to predict the effect of gravitational potential in detail with great simplicity while GR struggles through vast calculations needing extra assumptions. By contrast, we can replace the whole edifice with less than half a page of elegant mathematics.

## Some new mathematics

There is a little practised branch of theoretical physics called dimensional analysis. Maxwell [10] used it to show the the relationship between electromagnetic and electrostatic units was indeed a velocity. All physical quantities can be expressed in terms of the basic dimensions of mass $M$, length $L$, and time $T$ plus one electric parameter say current $I$. Thus we can write for force $F = M\,L\,T^{-2}$. If equations are written properly in a consistent set of units[5], they will be dimensionally consistent. What is more, any change in the size of the basic units of measurement can be accommodated by calculating a constant from the dimensions. (So from fps units to SI units, we simply need to multiply $0.4536 \times 0.3048 = 0.1383$ to find how the unit of force is affected)

[5] Which is seldom the case in modern physics.

Expressing the effect of a gravitational potential $\Phi$ through the notation of a mapping from a region $R_0$ where $\Phi = 0$ to a region $R_\Phi$ where it is nonzero.

$$R_0 \rightarrow R_\Phi : \qquad M \rightarrow K^m M, \qquad L \rightarrow K^l L, \qquad T \rightarrow K^t T, \qquad I \rightarrow K^i I$$

The Dicke Puthoff theory attributes the gravitational force to an increase in the permittivity of space which we write.

$$\varepsilon_0 \rightarrow K\,\varepsilon_0 \qquad M L^3 T^{-4} I^2 \rightarrow K^m M \left(K^l L\right)^3 \left(K^t T\right)^{-4} \left(K^i I\right)^2 \qquad \Rightarrow m + 3l - 4t + 2i = 1$$

and equate powers of $K$ to obtain the equation $m + 3l - 4t + 2i = 1$. We now need another three physical quantities whose behaviour is known: radar time delay; the invariance of charge and the loss of energy suffice.

$$\begin{array}{lll} c \rightarrow \frac{1}{K} c & L T^{-1} \rightarrow L^m L \left(T^t T\right)^{-1} & \Rightarrow l - t = -1 \\ q \rightarrow q & T I \rightarrow K^t T K^i I & \Rightarrow t + i = 0 \\ \mathscr{E} \rightarrow \frac{1}{\sqrt{K}} \mathscr{E} & M L^2 T^{-2} \rightarrow K^m M \left(K^l L\right)^2 \left(K^t T\right)^{-2} & \Rightarrow m + 2l - 2t = -\frac{1}{2} \end{array}$$

Solving these four equations, $m = \frac{3}{2}$, $l = -\frac{1}{2}$, $t = \frac{1}{2}$ and $i = -\frac{1}{2}$ gives the mapping.

$$M \rightarrow K^{1.5} M, \qquad L \rightarrow K^{-0.5} L, \qquad T \rightarrow K^{0.5} T, \qquad I \rightarrow K^{-0.5} I$$

The effect on any physical quantity can now be found from its dimensions with the greatest of ease.

$$\mu_0 = M L T^{-2} I^{-2} \Rightarrow m + l - 2t - 2i = \tfrac{3}{2} - \tfrac{1}{2} - 1 + 1 = 1 \Rightarrow \mu_0 \rightarrow K \mu_0$$

Equating the energy liberated from a particle of energy $E = m c^2$ with its loss of potential energy:

$$m \left|\Phi\right| = m c^2 - \frac{1}{\sqrt{K}} m c^2 \qquad \Rightarrow \qquad K = 1 + 2\frac{|\Phi|}{c^2}$$

However, if we consider how energy is liberated as a massive body is assembled, each additional particle has the effect of reducing the existing energy content and field potential by a fraction. Their action is not addative, but multiplicative and the combined action is of the form $(1 - \alpha)^n$ rather than $1 - n\,\alpha$. Since $n$ is very large and $\alpha$ very small, this becomes $e^{-n\alpha}$ and we should write $K = e^{2\frac{|\Phi|}{c^2}} = 1 + 2\frac{|\Phi|}{c^2} - \ldots$

For weak fields[6] , this leads directly to he Schwarzchild metric.

$$ds^2 = \left(1 - 2\frac{GM}{c^2 r}\right) dt^2 - \left(1 + 2\frac{GM}{c^2 r}\right) \left(dr^2 - (r\,d\theta)^2 - (r \sin\theta\, d\phi)^2\right)$$

**<u>Quad erat demonstrandum</u>** (as Euclid would have said, only in Greek)

This method is a very powerful tool. Dimensional analysis has a long pedigree. Every correctly written equation in physics has to be dimensionally consistent and a mapping of the form

$$S \rightarrow S' : \qquad M \rightarrow a\,M, \qquad L \rightarrow b\,L, \qquad T \rightarrow c\,T, \qquad I \rightarrow d\,I$$

simply renders them from one system of mensuration to another where they are equally valid. The mapping

$$S \rightarrow S' : \qquad M \rightarrow K^m M, \qquad L \rightarrow K^l L, \qquad T \rightarrow K^t T, \qquad I \rightarrow K^i I$$

is simply a special case.

If calculations in $S'$ are more difficult than in $S$, we can simply map them onto $S$, perform the

[6] Any gravitational field away from the immediate vicinity of a black hole is a weak field.

calculations and then map the answer back. The accuracy of this process will depend only on the constancy of *K* within the region. This means we can happily use the mapping for laboratory calculations, but for calculating the delay in the radar signal between planets, we simply include the function of *K*. We can illustrate this by considering the time taken for a radio signals.

$$\text{In the laboratory:} \qquad t = \frac{1}{c_0}\int dr \qquad\qquad t' = K\frac{1}{c_0}\int dr = K\,t$$

$$\text{Between planets:} \qquad t' = \frac{1}{c_0}\int K(r)\,dr$$

Let us consider radar signals between Earth and Venus. Their orbits can be described very accurately using the concepts of Newtonian time and Euclidean space. The faster orbital speed of Venus causes the line of sight between the two planets to move relative to the sun. As the radar signals pass closer and closer to the sun, the "radar distance" between Earth and Venus increases by up to about 30 km. A very small part of this effect is due to the path of the light being bent by a few seconds of arc. GR takes the view that space time is curved and that this curvature can only be understood in terms of a "metric" which describes how to calculate an "absolute" "distance" between two events from their co-ordinates on the assumption that the curvature causes the distances between the grid lines of the co-ordinate system to vary. This is such an abstract concept that it is very difficult to understand, let alone subject it to rational thinking. Instead of just saying that the speed of light is slowed by gravitational potential, GR says that space and time are altered so that measuring rods are contracted and clocks slowed (which is true), but then goes on to identify this behaviour with a change in space time. As physics, this interpretation is nonsense.

GR is mathematics, not physics, and so it can get away with its lunacy so long as it is homomorphic to a mathematics which describes the true physics. The true physics is that "space" in the mathematical sense is an abstract thing which exists only in the separation of material objects. As, such its metrication is an abstract mathematical exercise, which we do, so as to be able to think about it. So we take three non-coplanar vectors and construct a grid forming Euclidean space. We find space to be full of rotating objects and from their motion, we derive the concept of Newtonian time which again is an abstract concept. Having got these two mathematical concepts, it makes sense to talk about the effects of some unknown on our rulers and clocks. A radar signal is no more than a combined clock/ruler and its passage through space is a physical metrication of space. It is affected by gravitational potential as the line of sight between Earth and Venus gets closer to the sun, we have a choice between thinking in terms of Euclidean space and Newtonian time, or radar space and time. Since the orbits of the planets are unaffected by the closeness of the line of sight to the sun, it would appear that Euclidean space and Newtonian time offer a better conceptual basis for understanding nature.

If I think in terms of GR, I am forced to think of space contracting only to make distances greater. That is great if I don't understand the meaning of my thoughts, or have a religious predisposition to mystery. If I think in Newtonian-Maxwellian-Lorentzian terms, I say that the gravitational potential has an effect on electrons and their fields with associated physical effects. I can quite simply describe the effect on matter and fields against the background of Euclidean space and Newtonian time. GR may be illogical, but its mathematical description is internally consistent because the mathematical relationship between the co-ordinates of space time and "the metric" is the same mathematical relationship which describes the effect on real rods and clocks in the real Euclidian-Newtonian universe. The only difference is which we consider to be absolute. GR chooses to assert that curved space time is the greater reality. Nature prefers Euclid and Newton.

The real weakness of GR is its failure to identify a physical process by which matter bends space time. Wilson first came up with the answer that it was through an effect on the permittivity of space. Dicke described how that worked and Hal Puthoff explained it more clearly. Now we have a powerful investigative

tool in the form of dimensional analysis

The four equations we obtained can be written in matrix form $[M][D] = [R]$

$$\begin{bmatrix} 1 & 3 & -4 & -2 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 2 & -2 & 0 \end{bmatrix} \begin{bmatrix} m \\ l \\ t \\ i \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \\ -\frac{1}{2} \end{bmatrix}$$

If $[M]$ is non singular $(|M| \neq 0)$, then a solution can be found. This is ideally suited to a spreadsheet application that includes matrix functions. ( Fig. 2 ) The only real work lies in transcribing the the dimensions of quantities into matrix rows. Energy is $M L^2 T^{-2}$ which becomes $[\ 1\ \ 2\ \ -2\ \ 0\ ]$. In the spreadsheet below, the entry B36: =MATSOLVE(C31..F34,G31..G34,H31..H34) causes the equation $[M][D] = [R]$ to be solved and a second multiplication in cell B37 : =MATMULT(C4..F29,H31..H34,H4..H29) then calculates the power of K for every physical quantity.

The power of this method lies in the ability to copy data from the definition lines to the matrix multiplication block and alter the set values. Suppose we copied the permeability condition from row 24 to row 34, the matrix would become singular and cell B36 would report an error. The task of identifying sets of four quantities which might determine the transformation takes only minutes for each. We can also alter the conditions and see immediately what the effect is. This gives us a powerful investigative tool.

We might question Dicke's assertion that energy is reduced $E \rightarrow \frac{1}{\sqrt{K}} E$. Say we thought it might change as $E \rightarrow \frac{1}{K} E$, all we need to do is to enter a -1 in cell G34 and recalculate. The changes to the values in column H to those shown in the box beside the spreadsheet. The resulting metric would be

$$ds^2 = \left(1 - 4\frac{GM}{c^2 r}\right)dt^2 - \left(dr^2 - (r\,d\theta)^2 - (r \sin\theta\, d\phi)^2\right) \qquad \text{✘}$$

Which we might consider wrong because it does not fit our definitions of the unit of length in terms of the wavelength of light, nor does it fit the observed behaviour of clocks.

One of the great strengths of this mathematical method is that it removes the possibility of confused thought. With arguments based on words, there is always the possibility of getting confused between the effect of gravitational potential on physical quantities, measurements of them and the units of measurement. Being able to see the result of a different effect almost instantly as the spreadsheet recalculates, rather than have to wade through hours of error spattered calculations makes evaluation of the Dicke Puthoff theory much simpler.

Indeed: it emerged that the whole Dicke Puthoff interpretation could be derived with the greatest of simplicity from experimental data:

- The time delay for radar signals between planets equates to a slowing of the speed of light.
- Atomic clocks run slow with greater gravitational potential.
- Charge is invariant.
- The kinetic energy acquired by falling bodies must be equal to the loss of energy.

Leads to the matrix solution:

$$\begin{bmatrix} 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 2 & -2 & 0 \end{bmatrix}^{-1} \begin{bmatrix} -1 \\ 0.5 \\ 0 \\ -0.5 \end{bmatrix} = \begin{bmatrix} 1.5 \\ -0.5 \\ 0.5 \\ -0.5 \end{bmatrix}$$

$$M \rightarrow K^{1.5} M, \qquad L \rightarrow K^{-0.5} L, \qquad T \rightarrow K^{0.5} T, \qquad I \rightarrow K^{-0.5} I$$

The effect on a number of physical quantities is given in the table below as powers of $K$. ( Fig. 3 )

Fig. 3

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mass | 1.5 | Density | 3 | Current | -0.5 | Mag. mom. | -2 |
| Length | -0.5 | Ang. Mom. | 0 | Charge | 0 | B | 1 |
| Time | 0.5 | MI | 0.5 | Potential | -0.5 | H | 0 |
| Speed | -1 | force | 0 | E | 0 | Inductance | 0.5 |
| Ang. Vel. | -0.5 | energy | -0.5 | D | 1 | Capacitance | 0.5 |
| Acc. | -1.5 | torque | -0.5 | Permittivity | 1 | h | 0 |
| Ang. Acc. | -1 | stress | 1.5 | Permeability | 1 | | |

We can see from this that the effect on permittivity and permeability are those proposed by Dicke. The only important point to make is that in the interpretation of the mapping, physical quantities such as the vector field $\vec{B}$ and the scalar field $\phi$ are mapped onto the values at their corresponding positions. If we had a God given ruler not subject to contraction which we used to define position within the magnetic field, we would find $\vec{B}$ invariant and $\vec{H} \rightarrow K^{-1} \vec{H}$.

As a further test, if we define Energy, Length, Time and Charge as a new set of dimensions. Putting the same conditions, and solving we find the same powers of $K$. This shows that the analysis is independent of the system of units, provided they are properly defined. It is to be noted that not all sets of units used in textbooks are properly defined. In Jackson[7] [11] we find the classical electron radius defined as $\frac{e^2}{m c^2}$ in Gaussian units. In SI units this would be $\frac{e^2}{4 \pi \varepsilon_0 m c^2}$ which is dimensionally correct. The Gaussian units set $\varepsilon_0$ to 1 and omit it from equations, but it still has dimensions of $M^{-1}L^3T^2C^{-2}$ (where charge $C$ replaces current $I$). Texts on GR generally set the speed of light to 1 and loose its dimensions. So while it is true to say this analysis is independent of the system of units used, an analysis based on equations casually taken from textbooks is likely to yield false results.

## A unified theory of inertia and gravity.

The Dicke theory, lacks a causal process by which the presence of large bodies influences the permittivity of space. While Hal Puthoff has an explanation, it is not a classical theory. A true classical theory will identify an interaction between electric fields and space and show that this will result in gravitational force.

I developed a two dimensional mechanical analogue to understand how gravity might work. Springs are attached by frictionless pulleys between two parallel rails. ( Fig. 4 ) If the rails bend under the forces exerted by the springs, it results in sideways forces which pull the springs together. Analysis shows that if a single spring causes a distortion $x = \frac{F}{\lambda} f(r)$, where $f(0) = 1$ and $f(r)$ gives the shape of the distortion as a function of the distance from the spring, then the force between springs is

[7] A standard text for post graduate students.

$$F = \frac{1}{2\lambda_c} F_a F_b \frac{d}{dr} f(r)$$

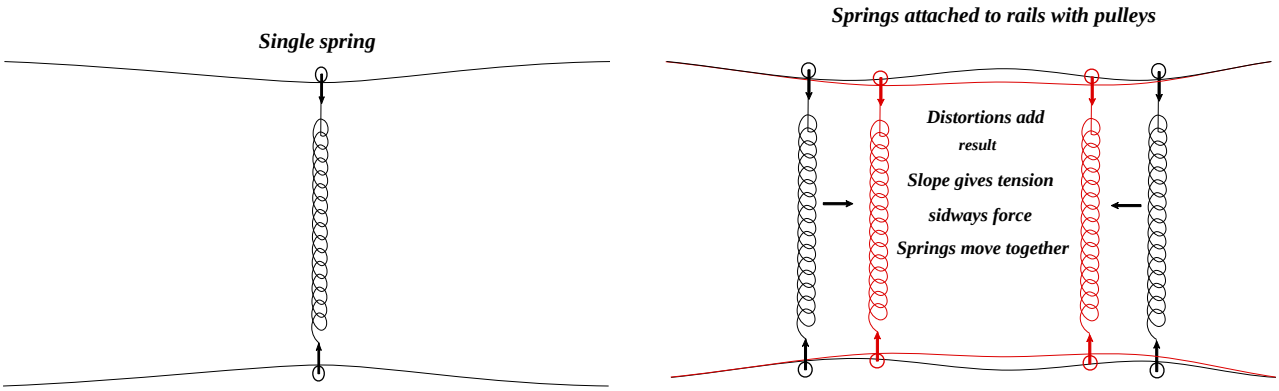



Fig. 4

We find that the distortion patterns add so that when the springs are very close together, the distortion is twice that caused by an individual spring. As the springs move together, they do work part of which is adsorbed by friction and the rest changed into kinetic energy. When we calculate the changes in energy, we find that the energy stored in the distortion of the rails is that same as the work done. These two lots of energy came from the springs. Thus we see that the process is one of energy transfer. Could this be extended to the internal stress of electric fields in three dimensional space?

Classical physics [12] tells us that an electric field in a dielectric produces an internal stress $\frac{1}{2}\vec{D}\cdot\vec{E}$. Solid dielectrics suffer measurable strains under this stress. Can we identify such an effect in the vacuum? Is it possible to identify a squeezing of space which somehow creates a gravitational field?

So long as we think of space as being three dimensional, it is impossible to envision a geometrical or physical process which will be able to mimic the two main properties of the gravitational field: dependence on mass and an inverse law of force. The mechanical analogue works because it has an extra dimension. To make such a process produce forces in three dimensional space, we need a fourth dimension. The distortion of the rails in the analogue is mimicked in GR by the distortion of spacetime, but that is no more than a mathematical illusion.

Our hypothesis is that space has a fourth dimension in which electric potential $\phi$ exists. We shall call this the "phi" dimension and represent it by the symbol $\varphi$. This is a non-extended dimension in the sense that we cannot wonder around in it as we do in space. The distortion of space by the internal stress of electric and magnetic fields compresses space in its $\varphi$ dimension. Gravitational potential $\Phi$ also exists in the $\varphi$ dimension as the resulting loss in electric potential $\phi$.

Let us first consider the effect of an isolated charged particle on space within its own field. (Fig. 5 ) The internal stress $\frac{1}{2}\vec{D}\cdot\vec{E}$ squeezes every volume element $d\tau$ of the electric field so that its energy content $\frac{1}{2}\vec{D}\cdot\vec{E}\,d\tau$ is less than it otherwise would be if space were perfectly rigid. Since $\vec{D}$ is determined by the charge, $\vec{E}$ is very very slightly reduced. Within the field, energy content, energy density, field strength and potential are all interacting so that the total energy, the potential $\phi$ and the electric field strength $\vec{E}$ are all reduced by the same factor (which is of the order magnitude of about $10^{-44}$). To represent this diagrammatically, we have to exaggerate the scales somewhat! To understand how the distortion is proportional to mass rather than charge, we have to comprehend a two way process. The squeezing effect of the internal stress of the field working inwards from infinity towards the surface of the charge reduces the energy content and determines the reduction in potential at the surface. Then the continuity of the field

transmits this effect outward. So that associated with this single charged particle is a distortion of space in its $\varphi$ dimension as shown on the left of the diagram.

The mechanical analogue requires energy to be stored in the distortion, but the dimensional analysis shows (a) that this cannot be so and (b) that the charge and its field suffer a reduction in size. We must interpret this in two ways. That a distortion in a dimension which is not not in R3 cannot be associated with a work = force × distance type action. That the squeezing due to the distortion affects the equilibrium condition which determines the size of the electron. Though we do not know the equation governing this, it is subject to the laws of dimensional analysis. In the real universe with more than one charge, the squeezing effects combine and the distortions in $\varphi$ add to form a gravitational field. This field is a physical distortion of space in its $\varphi$ dimension and is of the order of $10^{-9}$ at the earth's surface. The action of the field on charges is to reduce the energy density of electric and magnetic fields. The effect of this on electrons and quarks is seen in a reduction in their electric potential $\phi$, energy content and radius. For strong gravitational fields, we must be more explicit about the addative process. Each successive electric field reduces the existing potentials by the same proportion so that the combined effect is $(1 - \alpha)^n$ rather than $1 - n\,\alpha$. Since $n$ is very large and $\alpha$ very small, this becomes $e^{-n\alpha}$.

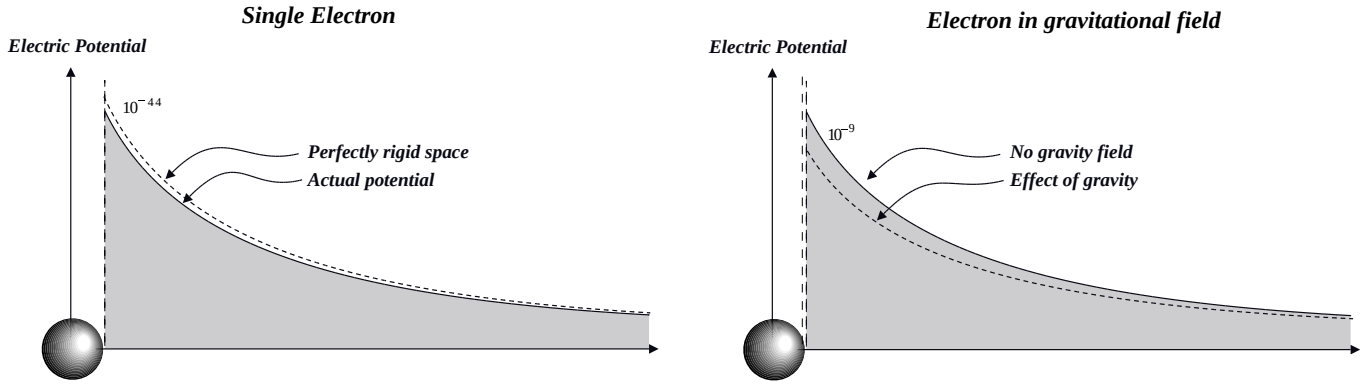



Fig. 5

In classical physics, the gravitational field has negative energy. In this theory, positive energy is drawn from the fields of the electrons and quarks of the matter responsible for its formation.

If we consider the effect on a mass brought from deep space where gravitational potential is zero to the earth's surface where it is $\Phi$. As it descends, energy is lost from the electric fields of its electrons and quarks. This is available to do work and results in the force of gravity. Both electric and magnetic fields exert an internal stress and both suffer loss of energy as a result of the distortion of space which forms the gravitational field.

## E = m c² and all that

Much has been made of the fact that the electromagnetic mass as derived by Lorentz is too big to fit Einstein's famous $E = m\,c^2$. The inertial mass of the Lorentz electron is $\frac{4}{3}\frac{\mathscr{E}_e}{c^2}$ where $\mathscr{E}_e$ is the energy content of its electric field. All attempts to reconcile this with the gravitation theory have failed. The dimensional analysis makes it possible to try all sorts of combinations of energy loss and other factors and none of them fit. We are therefore forced to the conclusion that the fraction of the electron's energy which is lost has to be governed by the equation.

$$m\,\Phi = m\,c^2 - \frac{1}{\sqrt{K}}\,mc^2 \qquad \text{where} \qquad mc^2 = \frac{4}{3}\,\mathscr{E}_e$$

In addition to the energy $\mathscr{E}_e$ which partakes in the generation of the magnetic field, another $\frac{1}{3}\mathscr{E}_e$ of energy has to be somehow associated with the energy content of the electron.

A number of issues related to the effect of gravity on photons and radio waves remain unanswered. We are forced to take the view that they do not feel the effect of gravity and would appear to have zero gravitational mass. If this is indeed the case, then the bending of light by gravitational fields is explained by the gradient in the velocity of light. Gravitational redshift does not involve a loss or gain of energy in passage, but are accounted for by the differences in energy levels of the atoms emitting photons in regions of different gravitational potential. This is equivalent to the time effect because time is defined in terms of the frequency of light.

## Determining experiments

- The one way speed of light between ground stations on an east west line with GPS synchronised ground station clocks will reveal the same difference in the velocity of light as is demonstrated by the Sagnac effect.
- A watch subject to acceleration in a centrifuge does not undergo the same progressive slowing predicted by SR for a watch on an interstellar flight.
- Centripetal acceleration, linear acceleration and gravity have different effects and we can determine wether our closed laboratory is being subject to centripetal acceleration, by variation in direction of the apparent gravitational force; to linear acceleration by the continued change in clock speed relative to the radio emissions received from pulsars or gravity by the absence of these effects.

## Conclusion

The success of Einstein's two theories of relativity lay not in his genius, but in the fact that classical physics contained some crucial errors and had yet to make some vital discoveries.

By asserting the coexistence in space of the individual electric fields of all elementary charged particles, we see that the motion of an individual electric field against this background presence generates magnetic intensity. This gives us the background required by Lorentzian Relativity.

By realising that the Lorentz contraction was derived from potential equations, we see that it applies to the surface, $\vec{D}$ and $\phi$ fields of the electron rendering the energy stored in its electric field invariant. By further realising that as the smallest element of charge, an elementary charged particle has an electric field emerging normal to its surface so that there is no interaction between surface elements, we see that the electric energy is invariant.

By taking the U, D quark theory of nucleons back in time, we are able to overcome the objection to electromagnetic momentum posed by the discovery of the neutron.

These three changes to classical physics allow Lorentzian relativity and Lorentz's theory of inertia to become natural extensions of classical physics.

The insights gained from the analysis of the mechanism for generating inertial forces allow us to explain "magnetic forces" in terms of an energy transformation process whereby changes in the motion of an electron result in a changes to its contribution to the generation of the magnetic field and require "magnetic energy" to be generated or adsorbed accounting for the force generated.

We are also able to form a classical theory of gravity based on the principle that matter consists of nothing but electric fields. The internal stress of the fields of all the elementary charged particles has an effect which is addative and distorts space in some way reducing the energy content of the fields and liberating energy to do work *mgh* as a mass falls into a gravitational field. We conclude that space has a fourth dimension $\varphi$ in which electric and gravitational potential exist as real physical entities. The gravitational field consists of a compressing of the $\varphi$ dimension reducing all electric potentials $\phi$. Gravitational potential manifests itself in the magnitude of the reduction. That the loss in energy from the fields of all elementary charged particles affects the equilibrium which determines their surface radius with the result that they are reduced in size. The result of energy and potential changes in the fields results in a real physical contraction of matter and a slowing of time dependent processes.

The speed of light in a gravitational field is slowed, but the effect on rulers and clocks renders this locally undetectable. Mass as currently defined increases, but mass defined as energy divided by the universal speed of light is decreased.

Assuming that the laws of physics hold in regions of gravitational potential, we can use the methods of dimensional analysis to investigate the effect of gravitational potential. We find that from

- The slowing of radar signals between planets;
- The slowing of atomic clocks;
- The assertion that charge is invariant;
- The kinetic energy acquired by falling bodies must be equal to the loss of energy;

we can derive the effect of gravitational potential on all physical quantities. In particular, the basic dimensions of mass length, time and current are effected. Where $K = e^{2\frac{\Phi}{c^2}} = 1 + 2\frac{\Phi}{c^2} - \ldots$ the effect can be described by the mapping:

$$M \rightarrow K^{1.5} M, \qquad L \rightarrow K^{-0.5} L, \qquad T \rightarrow K^{0.5} T, \qquad I \rightarrow K^{-0.5} I$$

There are associated changes in permittivity and permeability of space ; $\varepsilon_0 \rightarrow K \varepsilon_0$ and $\mu_0 \rightarrow K \mu_0$ affecting the speed of light: $c \rightarrow \frac{1}{K} c$.

The effect on length and time is that given by the Schwarzchild solution in isotropic spherical polar co-ordinates:

$$ds^2 = \left(1 - 2\frac{GM}{c^2 r}\right) dt^2 - \left(1 + 2\frac{GM}{c^2 r}\right) \left(dr^2 - (r\, d\theta)^2 - (r \sin\theta\, d\phi)^2\right)$$

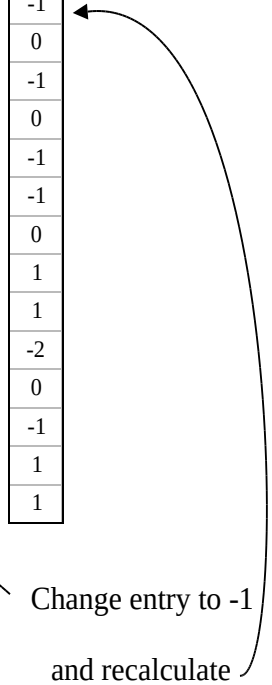
But now we place a different interpretation on the metric.

Space is Euclidean. Time is Newtonian. Matter is electric in nature and its dimensions are determined by electric field properties. The fields of matter and electromagnetic radiation existing within Euclidean space and Newtonian time suffer a slowing of time and contraction in length such that the Schwarzchild metric must be used to relate local measurements made with real rulers and clocks to Euclidean space and Newtonian time.

This paper supports the current laws of physics and the Dicke Puthoff theory adding to its representation and providing a causal explanation of its mechanism, but there are still aspect which I am not completely happy with. I might in further papers go on to examine the laws of electromagnetism replacing *v* with $c_0\left(\frac{v}{c}\right)$ so that velocity in the context of electromagnetic interactions is a ratio to the speed of light. It would be nice to be able to define our units such that mass remained proportional energy.

Fig. 2

| | B | C | D | E | F | G | H | |
|---|---|---|---|---|---|---|---|---|
| 2 | | | Dimensions | | | power of K | | |
| 3 | | m | l | t | i | desired | calculated | |
| 4 | Mass | 1 | 0 | 0 | 0 | | 1.5 | 1 |
| 5 | Length | 0 | 1 | 0 | 0 | | -0.5 | 0 |
| 6 | Time | 0 | 0 | 1 | 0 | | 0.5 | 1 |
| 7 | Speed | 0 | 1 | -1 | 0 | -1 | -1 | -1 |
| 8 | ang vel | 0 | 0 | -1 | 0 | | -0.5 | -1 |
| 9 | acc | 0 | 1 | -2 | 0 | | -1.5 | -2 |
| 10 | ang acc | 0 | 0 | -2 | 0 | | -1 | -2 |
| 11 | density | 1 | -3 | 0 | 0 | | 3 | 1 |
| 12 | ang mom | 1 | 2 | -1 | 0 | 0 | 0 | 0 |
| 13 | MI | 1 | 2 | 0 | 0 | | 0.5 | 1 |
| 14 | force | 1 | 1 | -2 | 0 | | 0 | -1 |
| 15 | energy | 1 | 2 | -2 | 0 | | -0.5 | -1 |
| 16 | torque | 1 | 2 | -2 | 0 | | -0.5 | -1 |
| 17 | stress | 1 | -1 | -1 | 0 | | 1.5 | 0 |
| 18 | current | 0 | 0 | 0 | 1 | | -0.5 | -1 |
| 19 | charge | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| 20 | potential | 1 | 2 | -3 | -1 | | -0.5 | -1 |
| 21 | E | 1 | 1 | -3 | -1 | | 0 | -1 |
| 22 | D | 0 | -2 | 1 | 1 | | 1 | 0 |
| 23 | permitivity | -1 | -3 | 4 | 2 | 1 | 1 | 1 |
| 24 | permeability | 1 | 1 | -2 | -2 | 1 | 1 | 1 |
| 25 | mag mom | 0 | 2 | 0 | 2 | | -2 | -2 |
| 26 | B | 1 | 0 | -2 | -1 | | 1 | 0 |
| 27 | H | 0 | -1 | 0 | 1 | | 0 | -1 |
| 28 | inductance | 1 | 2 | -2 | -2 | | 0.5 | 1 |
| 29 | capacitance | -1 | -2 | 4 | 2 | | 0.5 | 1 |
| 30 | | | | | | | | |
| 31 | permitivity | -1 | -3 | 4 | 2 | 1 | 1.5 | |
| 32 | Speed | 0 | 1 | -1 | 0 | -1 | -0.5 | |
| 33 | charge | 0 | 0 | 1 | 1 | 0 | 0.5 | |
| 34 | energy | 1 | 2 | -2 | 0 | -0.5 | -0.5 | |
| 35 | | | | | | | | |
| 36 | =MATSOLVE(C31..F34,G31..G34,H31..H34) | | | | | | | |
| 37 | =MATMULT(C4..F29,H31..H34,H4..H29) | | | | | | | |



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### Further reading

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