An Approach to Gravity Modification as a Propulsion Technology

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Abstract. Gravity modification as a portable non-mass effect is feasible. Contemporary experiments such as HFGW and LIGO require mass to model gravitational acceleration and gravitational waves. A different approach to gravitational acceleration, and thus space propulsion technologies is presented here. This paper proposes that gravitational acceleration on any particle is the effect of the deformation of the shape and mass of the particle due to non-inertia transformations present in that local region of the gravitational field. The analytical formulation and numerical integration has led to the discovery of a new formula for gravitational acceleration, $g = \tau c^2$, that is neither a function of the mass of the gravitational source nor a function of gravitational waves; where τ is a function of the time dilation present in the local gravitational field. This formula has been tested and verified to be correct in the gravitational fields of the nine planetary bodies in our Solar System, and the Sun; mechanical acceleration, and electromagnetic fields. Thus leading to the inference that $g = \tau c^2$ is the generic formula for all non-nuclear force fields. The true power of this definition of gravitational acceleration lies in the fact that it now lends itself to a portable technology, as mass is no longer required to derive acceleration. This new relationship for acceleration, describes how an electron moving in a magnetic field causes a force on the electron, and explains why the electron velocity, magnetic field and resulting force relationship is orthogonal. This electron model would be the basis for future propulsion technologies.

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INTRODUCTION

The paper takes a different approach to modeling gravity by revisiting established experimental results. If General Relativity models gravity as the change in the shape of spacetime, the curving of spacetime, to cause the effect of gravity (Schultz, 2003), one could propose an equivalent shape change on a particle; that the change in the shape of spacetime in the local region of the particle is mirrored by an identical change in the shape of the particle. The resulting deformation of the particle's shape is experienced as velocity and/or acceleration.

Dividing gravity into three parts, the mass source, the field, and the field effect or acceleration, this analysis is limited to how acceleration is produced at that specific point where the particle exists. Properties of gravitational fields as curvatures or even how mass generates the gravitational field is outside the scope of this analysis. This new approach has some benefits from a technology development perspective. It is the effects of the external environment in the region of the particle that causes acceleration. Since acceleration is local any field effect technology need only be applied to the local region. This paper derives and tests the mass-independent equation for gravitational acceleration, and shows it is the universal description of acceleration for all non-nuclear forces. Therefore, gravity modification as a portable non-mass technology is feasible. The objectives of this paper are to derive the new mass-independent relationship for gravitational acceleration, and show that this new relationship applies to gravitational, mechanical and electromagnetic forces. In so doing, propose how gravity modification based propulsion technologies can be realized.

THE LOCAL FIELD MODEL

A local inertia field is that local region of spacetime where acceleration is not present, because only inertia transformations $\Gamma(v)$ are present. The Greek letter capital Gamma Γ is used to represent a transformation. A local non-inertia field, a small section ($\leq 10^{-9}$ m^2) of gravity, is that local region of spacetime where acceleration is present because non-inertia transformations $\Gamma(a)$ are present. This paper proposes that gravitational acceleration on any particle is the effect of the deformation of the shape of the particle due to non-inertia transformations present in the local region of the gravitational field such that the spacetime transformations $\Gamma_{s(x,y,z,t)}$ are concurrently reflected as particle transformations $\Gamma_{p(x,y,z,t)}$ or,

$$\Gamma_{p(x,y,z,t)} = \Gamma_{s(x,y,z,t)} \quad (1)$$

This is the logical extension of the Lorentz-Fitzgerald transformations $\Gamma(v)$ as length contraction along the axis of relative motion is symmetrical and linear with respect to space. Gravitational field transformations $\Gamma(a)$ are non-linear with respect to space and one expects non-linear shape deformation along the axis of acceleration. The Lorentz-Fitzgerald transformation $\Gamma(v)$ governs time dilation, length contraction and mass increase, presented concisely as,

$$\Gamma(v) = 1/\sqrt{(1 - v^2/c^2)} = x_0/x_v = t_v/t_0 = m_v/m_0 \quad (2)$$

Similarly, in gravitational fields (Schultz, 2003) and (Green, 2005), Newtonian transformations, $\Gamma(a)$, govern time dilation, space contraction and mass increase, presented concisely as,

$$\Gamma(a) = 1/\sqrt{(1 - 2GM/rc^2)} = x_0/x_a = t_a/t_0 = m_a/m_0 \quad (3)$$

$1/\sqrt{(1-2GM/rc^2)}$ is based on Newtonian mechanics and for ease of discussion I have labeled it such. The Einsteinian (Schultz, 2003) equivalent $\Gamma(r)$ is more sophisticated. For our discussion here the Newtonian version is sufficient. A body falling in a gravitational field from infinity has both acceleration a and velocity v. If the gravitational time dilation derived from the Newtonian transformation $\Gamma(a)$ produces the correct instantaneous free fall velocity when plugged into the Lorentz-Fitzgerald transformation $\Gamma(v)$ then these transformations are equivalent in some manner. Table 1 (Solomon, 2001) presents the results of these calculations for the ten bodies in the Solar System.

TABLE (1). Comparison of gravitational acceleration time dilation with velocity time dilation.

Object	**Mass at Surface**	**Radius**	**Gravitational Acceleration**	**Gravitational Escape or Free Fall Velocit**	**Gravitational Time Dilation**	**Lorentz-Fitzgerald Equivalent Velocity**	**Velocity Error**
			$g = GM/r^2$	$v_e = \sqrt{2GM/r}$	$t_v = t_\infty/\sqrt{(1-2GM/rc^2)}$	$v_f = c/\sqrt{(1-t_\infty^2/t_v^2)}$	$v_e - v_f$
	M (kg)	r (m)	g (m/s^2)	v_e (m/s)	t_v (s)	v_f (m/s)	(%)
Sun	2.00E+30	6.90E+08	274.98	621,946	1.00000215195969	621,946	0.0000000%
Mercury	3.59E+23	2.44E+06	3.70	4,431	1.00000000010922	4,431	0.0000153%
Venus	4.90E+24	6.07E+06	8.87	10,383	1.00000000059976	10,383	0.0000018%
Earth	5.98E+24	6.38E+06	9.80	11,187	1.00000000069626	1,187	-0.0000080%
Mars	6.58E+23	3.39E+06	3.71	5,087	1.00000000014395	5,087	0.0000245%
Jupiter	1.90E+27	7.14E+07	23.12	59,618	1.00000001977343	59,618	0.0000002%
Saturn	5.68E+26	5.99E+07	8.96	35,566	1.00000000703708	35,566	-0.0000002%
Uranus	8.67E+25	2.57E+07	7.77	21,201	1.00000000250060	21,201	-0.0000005%
Neptune	1.03E+26	2.47E+07	11.00	23,552	1.00000000308580	23,552	-0.0000019%
Pluto	1.20E+22	1.15E+06	0.72	1,178	1.00000000000772	1,178	0.0001586%

The experimental evidence shows that non-inertia Newtonian transformation $\Gamma(a)$ is equivalent to inertia Lorentz-Fitzgerald transformation $\Gamma(v)$ because for any point-sized location in spacetime, the two different transformations produce identical velocities, as the errors, column 8 of Table 1, are trivial. One infers that time dilation, length contraction, mass increase, the associated velocity, and acceleration are dependent on the nature of the transformations present. For any range of real non-relativistic velocities v, $(|v| \ll c)$ and accelerations a ignoring special cases such as black holes, one can generalize that the transformations present in spacetime are such that, given any local environmental transformation $\Gamma(e)$ space contraction, time dilation and mass increase obeys equation (4). The type of motion is a function of the type of transformation present; non-linear $\Gamma(a)$ yields acceleration, and linear $\Gamma(v)$ yields velocity.

$$\Gamma(e) = x_0/x_e = t_e/t_0 = m_e/m_0 \quad (4)$$

Conversely, knowing the time dilations and space contraction present for any set of points in spacetime, gives sufficient information to determine the velocity and accelerations in that region of spacetime.

LOCAL ACCELERATION ANALYTICAL MODEL

Under the influence of gravity the shape of any particle would deform such that its near-side (to the gravitational source) would be flatter than it far-side, resulting in an asymmetrical ellipsoidal-like deformation. Note that assuming a spherical particle shape is a convenient simplification for now. With a completed model one can test for effects of a particle's shape and mass distribution on gravitational acceleration. Simultaneously, the mass of this particle should obey an equivalent transformation, being denser on the near- than on the far-side per equation (3). Therefore the first step (Step A) is the development of a shift in the center of mass model for gravitational acceleration. The center of mass, CM_0, of a particle at rest is given by,

$$CM_0 = \int_{-L}^{+R} xy^2 \rho_v dx \Big/ \int_{-L}^{+R} y^2 \rho_v dx \tag{5}$$

Assume that mass density ρ_v across the particle is uniform or does not vary. When inertia motion is present $0 \leq |v| \leq c$ and $|a|=0$ transformation based deformation is symmetrical, and equation (5) evaluates to zero. That is, when acceleration is not present there is no shift in the center of mass of the particle. In a gravitational field Φ the moments $M_{\Phi i}$ of the mass $m_{\Phi i}$ of slice i with a non-linear mass density behavior $\rho_{\Phi i}$ is given by equation (6) and the particle's center of mass CM_Φ in the gravitational field Φ is given by equation (7) i.e. the standard center of mass equation (5) modified to handle the non-linearity induced by gravitational spacetime.

$$M_\Phi = \int_{-L}^{+R} \left[\int_0^x \frac{dx}{\Gamma(x)} \right] \pi y_i^2 \rho_{\Phi i} dx \tag{6}$$

$$CM_\Phi = \int_{-L}^{+R} \left[\int_0^x \frac{dx}{\Gamma(x)} \right] y^2 \Gamma(x) dx \Bigg/ \int_{-L}^{+R} y^2 \Gamma(x) dx \tag{7}$$

where

$$\Gamma(x) = 1 / \sqrt{1 - 2GM/(r+x)c^2} \tag{8}$$

Equation (7) presents the shift in the center of mass of a particle as a function of the gravitational acceleration. The subsequent steps would be, (Step B) to solve this equation and invert the relationship so that gravitational acceleration is presented as a shift in the center of mass; and (Step C) to relate this shift in the center of mass to shape distortion $\Gamma_{p(x,y,z,t)}$. The solution (Solomon, 2008) to equation (7) runs into several pages and is not presented here as it is not a simple, elegant solution.

LOCAL ACCELERATION NUMERICAL INTEGRATION MODEL

To solve the gravitational acceleration, center of mass, and shape distortion relationship, a numerical integration model was constructed by slicing a particle into 2,000 disc-shaped slices, with a 1,000 disc-shaped slices on each side of the particle in relation to the center of the particle and the gravitational source. From the calculated time dilation, mass and thickness of each slice, the shape and mass of the particle was determined by assembling all 2,000 slices. The moments of each slice was calculated to determine the new center of mass of the deformed particle. The mass m_{si} of a slice i of the particle a distance, x_i, from its center and r from the gravitational source, with density ρ_i and thickness q_i is given by equation (9). In a gravitational field, mass density ρ_i and slice thickness q_i of slice i are given by the Newtonian transformations $\Gamma(a)$ equation (10).

$$m_{si} = \pi y_i^2 q_i \rho_i \tag{9}$$

$$1/\sqrt{1 - 2GM/(r+x_i)c^2} = \rho_i/\rho_0 = q_0/q_i \tag{10}$$

The distance of the center of the *ith* disk from the center of particle is the summation of the thickness of all previous disks, from *1* to *i-1*, plus half of the *ith* disk, given by,

$$x_i = \left(\sum_i q_{i-1} \right) + 0.5 q_i \tag{11}$$

Therefore, the numerical formulation for the center of mass, *CM*, per Step A, for a given shape function, *y*, is,

$$CM = \sum \left[\left(\sum_i q_{i-1} \right) + 0.5 q_i \right] y_i^2 q_i \rho_i \Big/ \sum_i y_i^2 q_i \rho_i \tag{12}$$

LOCAL ACCELERATION NUMERICAL INTEGRATION MODEL RESULTS

To test for effects of particle shape and mass distribution 1,190 numerical integrations were evaluated for 7 particles sizes from 10^{-21}m, smaller than an electron (Kane, 2000), up to 10^{-3}m, a small pin head; modeled in 10 gravitational fields, with 17 shapes or mass distributions. Table 2 depicts 10 of the 1,190 numerical integrations results. Regressions (R^2 ranged between 99.998% and 99.999%) on the 1,190 results by each type of mass distribution produced three formulae.

TABLE (2). Center of mass shift under different gravitational fields for a 10^{-11}m spherical particle.

Planet	Gravitational Acceleration, g (m/s^2)	Shift in the Center of Mass (m)	Time Dilation (s)	Change in Time Dilation Across the Particle	Particle Size in the Gravitational Field
	$g = GM/r^2$	Numerical Integration Results	$t_{x=0}$	$\delta t = t_{i=-L} - t_{i=+R}$	$S_Z = \Sigma_{i=-L}^{i=+R} x_i$
Pluto	0.6054524	1.6904307E-41	1.000000000007740	6.7298299E-29	9.9950000E-12
Mercury	4.0235485	1.1233798E-40	1.000000000109230	4.4723246E-28	9.9950000E-12
Mars	3.8205065	1.0666902E-40	1.000000000144100	4.2466358E-28	9.9950000E-12
Uranus	8.7588541	2.4454830E-40	1.000000002504600	9.7357940E-28	9.9950000E-12
Venus	8.8738716	2.4775960E-40	1.000000000599320	9.8636402E-28	9.9950000E-12
Saturn	10.5630450	2.9492154E-40	1.000000007040030	1.1741220E-27	9.9950000E-12
Earth	9.8028931	2.7369800E-40	1.000000000695870	1.0896282E-27	9.9949999E-12
Neptune	11.2651702	3.1452496E-40	1.000000003095940	1.2521658E-27	9.9950000E-12
Jupiter	24.8686161	6.9433487E-40	1.000000019756420	2.7642398E-27	9.9949998E-12
Sun	280.3020374	7.8260679E-39	1.000002151965680	3.1156754E-26	9.9949785E-12

Per Step B, the gravitational acceleration g is governed by equation (13) the change in center of mass χ where k_d is some constant. The change in the center of mass χ of a particle is a function of the change in time dilation δt across the particle, for a specific particle size S_z per equation (14). Per Step C, one notes that the two constant terms k_d and k_m are sufficient to parameterize any shape and mass distribution of a particle. The result of this three step analysis is that gravitational acceleration g is governed by equation (15) the change in time dilation δt across a particle of size S_z, where k_c is some constant.

$$g = k_d \chi / S_z^2 = GM / r^2 \tag{13}$$

$$\chi = k_m \delta t S_z \tag{14}$$

$$g = k_c \delta t / S_z = GM / r^2 \tag{15}$$

The range of the evaluated center of mass shift was as large as $1\text{x}10^{-22}$m to as small as $3.3\text{x}10^{-61}$m. Equation (15) can also be derived from equations (13) and (14) per Table (3). The numerical value of k_c is within 0.049% of the numerical value of the square of the velocity of light c^2 or $8.9875517873681764\text{x}10^{+16}$. And since S_z is the change in the distance δr from the gravitational source, in the limit as $\delta r \rightarrow 0$, equation (15) becomes,

$$g = c^2 dt / dr = \tau . c^2 = GM / r^2 \tag{16}$$

Since this gravitational acceleration model works for any particle size the precision of measure of a particle's size is not critical. It appears that Nature has figured out how to get around Heisenberg's Uncertainty principle at the macro level. Table 3 depicts the values of k_d, k_m and k_c for the 17 different particle shape and mass distributions described in column 1 per Step C. Table 3 shows that k_d and k_m change to compensate for any particle shape or mass distribution such that $k_d.k_m = k_c = c^2$. The inference is that there is Internal Structure Independence as equation (16) shows that gravitational acceleration is external to and independent of particle shape or mass distribution within the particle.

TABLE (3). Regression results on 1,190 numerical integration output to determine the value of the constant terms.

Mass Distribution	($\chi = k_d \delta t S_z$) k_d	($g = k_m \chi / S_z^2$) k_m	($g = k_c \delta t / S_z$) k_c	$k_m k_d$
Cube	4.1853921213E-02	2.1484226203E+18	8.9919903936E+16	8.9919911081E+16
Gaussian 3D/3S	7.0282538609E-03	1.2794061350E+19	8.9919067374E+16	8.9919911081E+16

Line	4.1853921213E-02	2.1484226203E+18	8.9919067374E+16	8.9919911081E+16
Sphere	2.5130987253E-02	3.5780492893E+18	8.9919067374E+16	8.9919911081E+16
2D Multivariate Normal	1.3257171674E-02	6.7827371698E+18	8.9919067374E+16	8.9919911081E+16
3D Multivariate Normal (Product)	9.6884143131E-03	9.2811793732E+18	8.9919067374E+16	8.9919911081E+16
3D Multivariate Normal (Distance)	4.2911146520E-02	2.0954907611E+18	8.9919067374E+16	8.9919911081E+16
Crown	4.9180742581E-02	1.8283561077E+18	8.9919067374E+16	8.9919911081E+16
Hollow Sphere	4.5512134958E-02	1.9757348488E+18	8.9919067374E+16	8.9919911081E+16
Photon (1Wavelength)	1.3636149279E-02	6.5942304710E+18	8.9919067374E+16	8.9919911081E+16
Photon (3Wavelength)	1.3636149279E-02	6.5942304710E+18	8.9919067374E+16	8.9919911081E+16
Flat 2D/3S Normal	1.3636149279E-02	6.5942304710E+18	8.9919903936E+16	8.9919911081E+16
Gaussian 3D/20S	1.6778290618E-04	5.3592085948E+20	8.9919067374E+16	8.9918359284E+16
Gaussian 3D/1S	3.1906623418E-02	2.8181722053E+18	8.9919067374E+16	8.9918359284E+16
2D/3S Normal 1 Wavelength	2.5130987253E-02	3.5780492893E+18	8.9919067374E+16	8.9919911081E+16
2D/3S Normal 7 Wavelengths	2.5130987253E-02	3.5780492893E+18	8.9919067374E+16	8.9919911081E+16
Sphere without Mass	-2.4896875342E-02	-3.6116323051E+18	8.9919067374E+16	8.9918359283E+16

To confirm the validity of equation (16), Table 4 presents the calculated gravitational acceleration on the surface of each body in the Solar System and compares this result with the Newtonian formula. For equation (16) *dr* is the distance between the left edge *L* and the right edge *R* of the particle, at a distance *r* from the gravitational source. The time dilation difference *dt* is the difference between time dilations at the L and R edges of the particle. The error with the Newtonian acceleration is given below the name of the body. Note, though the data presented in Table 4 is only to 30 decimal places, all numerical analyses presented in this paper was conducted to 250 significant digits. The numerical results show that equation (16) is correct, that gravitational acceleration can be derived without reference to its mass source.

TABLE (4). Gravitational acceleration values using Newtonian equation and equation (16), for a particle diameter of 10^{-11}m.

Solar System body and the error (%) in g		**Gravitational Acceleration**		**The far- and near-side distances of the particle edges from center of gravitational source, are determined by** $r+R=r+\Sigma_{i=0}^{i=+R}x_i$**, and** $r-L=r-\Sigma_{i=-L}^{i=0}x_i$**, respectively.**		**Time dilations on the far- and near-side are given by** $t_{r+R}=1/\sqrt{(1 - 2GM/(r+R)c^2)}$ **and** $t_{r-L}=1/\sqrt{(1 - 2GM/(r-L)c^2)}$**, respectively.**
		(m/s^2)		(m)		(s)
Pluto	$g=GM/r^2$	0.605452401	**r+R=**	1150000.0000000000004997499999961284110	$t_{r+R}=$	1.000000000007747051447939917851
0.0500250%	$g=\tau.c^2$	0.605149523	**r-L=**	1149999.9999999999995002500000038715889	$t_{r-L}=$	1.000000000007747051447939917918
Mars	$g=GM/r^2$	3.820506452	**r+R=**	3390000.0000000000004997499999279834963	$t_{r+R}=$	1.000000000144105059780117292718
0.0500250%	$g=\tau.c^2$	3.818595245	**r-L=**	3389999.9999999999995002500000720165036	$t_{r-L}=$	1.000000000144105059780117293143
Mercury	$g=GM/r^2$	4.023548458	**r+R=**	2440000.0000000000004997499999454103311	$t_{r+R}=$	1.000000000109233954602762435823
0.0500250%	$g=\tau.c^2$	4.021535679	**r-L=**	2439999.9999999999995002500000545896688	$t_{r-L}=$	1.000000000109233954602762436271
Uranus	$g=GM/r^2$	8.758854078	**r+R=**	25700000.0000000000004997499987483243260	$t_{r+R}=$	1.000000002504603655997994811634
0.0500243%	$g=\tau.c^2$	8.754472526	**r-L=**	25699999.9999999999995002500012516756739	$t_{r-L}=$	1.000000002504603655997994812608
Venus	$g=GM/r^2$	8.873871553	**r+R=**	6070000.0000000000004997499997004886902	$t_{r+R}=$	1.000000000599322280997788828262
0.0500248%	$g=\tau.c^2$	8.869432414	**r-L=**	6069999.9999999999995002500002995113097	$t_{r-L}=$	1.000000000599322280997788829249
Earth	$g=GM/r^2$	9.802893102	**r+R=**	6380000.0000000000004997499996522346225	$t_{r+R}=$	1.000000000695878694650922876503
0.0500248%	$g=\tau.c^2$	9.797989224	**r-L=**	6379999.9999999999995002500003477653774	$t_{r-L}=$	1.000000000695878694650922877593
Saturn	$g=GM/r^2$	10.56304503	**r+R=**	59900000.0000000000004997499964817446879	$t_{r+R}=$	1.000000007040030688888887596805
0.0500229%	$g=\tau.c^2$	10.55776109	**r-L=**	59899999.9999999999995002500035182553120	$t_{r-L}=$	1.000000007040030688888887597979
Neptune	$g=GM/r^2$	11.26517022	**r+R=**	24700000.0000000000004997499984528012376	$t_{r+R}=$	1.000000003095945506947560010891
0.0500241%	$g=\tau.c^2$	11.25953492	**r-L=**	24699999.9999999999995002500015471987623	$t_{r-L}=$	1.000000003095945506947560012143
Jupiter	$g=GM/r^2$	24.86861607	**r+R=**	71400000.0000000000004997499901267250659	$t_{r+R}=$	1.000000019756428472440154490585
0.0500191%	$g=\tau.c^2$	24.85617702	**r-L=**	71399999.9999999999995002500098732749340	$t_{r-L}=$	1.000000019756428472440154493349
Sun	$g=GM/r^2$	280.3020374	**r+R=**	690000000.0000000000004997489245574647717	$t_{r+R}=$	1.000002151965681928372108336649
0.0493797%	$g=\tau.c^2$	280.1636250	**r-L=**	689999999.9999999999995002510754425352282	$t_{r-L}=$	1.000002151965681928372108367806

CHARGED PARTICLE IN A MAGNETIC FIELD CALCULATIONS

In current electromagnetic theory, the acceleration *a* is a function of tangential velocity *v* electron charge *q* magnetic field *B* and electron mass *m* given by equation (17). The centripetal method is the standard mechanics method, acceleration *a* is a function of the tangential velocity *v* and the radius of circular motion *r* and is given by equation (18). And, given angular velocity *ω* tangential velocity is defined by equation (19).

$$a = q(v \times B)/m \tag{17}$$

$$a = v^2/r \tag{18}$$

$$v = \omega r \tag{19}$$

In the time dilation method, column 7 of Table 5, the tangential velocity is converted to time dilation, and acceleration is calculated using equations (16) and (19) where *dt* is time dilation at velocity *v minus 1* (the time dilation at center of circular motion with zero velocity), and *dr* is the radius of the circular motion. The new electromagnetic force process model (see next section) results are given in column 9 of Table 5. The force field equation (16) agrees with current electromagnetic theory equation (17), centripetal mechanics equation (18) and therefore correct for mechanical, electromagnetic and gravitational forces i.e. equation (16) is the universal description of acceleration for all non-nuclear forces. The new electromagnetic force process (EMFP) model agrees with other methods except in the last row where particle size is > 10^{-4}m. This is could be modeling error or unlike the other methods it does not assume that the effective charge is point-like.

TABLE (5). Acceleration calculated using centripetal method, equation (18), current electromagnetic theory, equation (17), and the new electromagnetic force process (EMFP) model, equation (28).

				Acceleration					
Angular Velocity	**Path Radius (m)**	**Tangential Velocity (m/s)**	**Particle Size (m)**	**Centripetal Method**	**Electro-Magnetic Theory**	**Time Dilation Method**	**c^2.dt/dr Error**	**EMFP Model**	**EMFP Error**
				Equation (18)	Equation (17)	Equations (16)&(19)	(16)-(17)	Equation (27)	(27)-(17)
68	9.85	669.8	1.00E-30	45,546.40	45,546.40	45,546.40	2.4033E-13	45,546.4000003409	-3.4E-07
127	4.07	516.89	1.00E-27	65,645.03	65,645.03	65,645.03	4.1720E-14	65,645.0300002925	-2.9E-07
49	5.01	245.49	1.00E-24	12,029.01	12,029.01	12,029.01	3.2700E-15	12,029.0100000120	-1.2E-08
98	6.13	600.74	1.00E-21	58,872.52	58,872.52	58,872.52	6.0000E-16	58,872.5200003546	-3.5E-07
148	4.75	703	1.00E-18	104,044.00	104,044.00	104,044.00	1.7090E-12	104,044.0000008580	-8.6E-07
116	0.42	48.72	1.00E-15	5,651.52	5,651.52	5,651.52	9.6100E-15	5,651.5200000002	-2.2E-10
96	0.79	75.84	1.00E-12	7,280.64	7,280.64	7,280.64	3.3797E-12	7,280.6400000007	-6.8E-10
2	1.17	2.34	1.00E-09	4.68	4.68	4.68	6.0083E-12	4.6800000000	-5.1E-14
74	1.86	137.64	1.00E-06	10,185.36	10,185.36	10,185.36	2.1640E-14	10,185.3600000812	-8.1E-08
170	4.64	788.8	1.00E-03	134,096.00	134,096.00	134,096.00	7.4337E-13	134,096.0004133690	-4.1E-04

THE NEW ELECTROMAGNETIC FORCE PROCESS MODEL

This new electromagnetic force process model was reversed engineered with careful attention to experimental observations. The magnetic field, Figure 1, causes the upward moving charged particle with velocity *v* to rotate about its center of rotation with an angular rotation *ω* and a path radius *r*. This negatively charged electric field *E* of some radius *dr* is pointing into the particle. Due to the arched path in the magnetic field, the particle will have a small change in velocity *dv* such that the field's left- and right-side velocities along the path radius are given by equations (20) and (21), respectively.

$$v\text{-}dv = \omega(r - dr) \tag{20}$$

$$v + dv = \omega(r + dr) \tag{21}$$

In other words, the ± *dv* shows that just as the electron's path rotates about an external center of rotation of radius *r* the electron's electric field is itself rotating in an anti-clockwise manner about internal center of rotation, with radius *dr*. This anti-clockwise rotation of the electric field is due to the interaction of the electron's radial electric field with the external magnetic field. Solving for velocity using equations (17) and (18), the relationship between velocity, *v*, and radius of arc *r* is given by equation (22). Using equation (19) gives the angular rotation equation (23). By equations (20) and (21) the electron rotation about its own center must be equal to the rotation about its arched path, therefore, the electron field velocity *dv* is given by equation (24).

$$v = (q/m)Br \tag{22}$$

$$\omega = (q/m)B \tag{23}$$

$$dv = (q/m)Bdr \tag{24}$$

Converting $v \pm dv$ at any point in the electric field into time dilations using equation (2) gives equation (25) as t_0 at the center of rotation is 1. Therefore, the difference in time dilations across any two points in the electric field, say points 1 and 2, is given by (26) or (27). And, using equation (16) the acceleration on the electric field is given by (28), its charge q and the external magnetic field B. Using the center of the electron as the first point, the equation (28) reduces equation (29).

$$t_v = t_0 / \sqrt{1 - (v+dv)^2/c^2} = 1/\sqrt{1 - (v+dv)^2/c^2} \tag{25}$$

$$dt = 1/\sqrt{1-(v+dv_1)^2/c^2} - 1/\sqrt{1-(v+dv_2)^2/c^2} \tag{26}$$

$$dt = 1/\sqrt{1-(v+(q/m)Bdr_1)^2/c^2} - 1/\sqrt{1-(v+(q/m)Bdr_2)^2/c^2} \tag{27}$$

$$a = c^2 dt/dr = c^2\left[1/\sqrt{1-(v+(q/m)Bdr_1)^2/c^2} - 1/\sqrt{1-(v+(q/m)Bdr_2)^2/c^2}\right]/(dr_1 - dr_2) \tag{28}$$

$$a = c^2\{1/\sqrt{(1-v^2/c^2)} - 1/\sqrt{1-[v+(q/m)Bdr)^2/c^2]}\}/dr \tag{29}$$

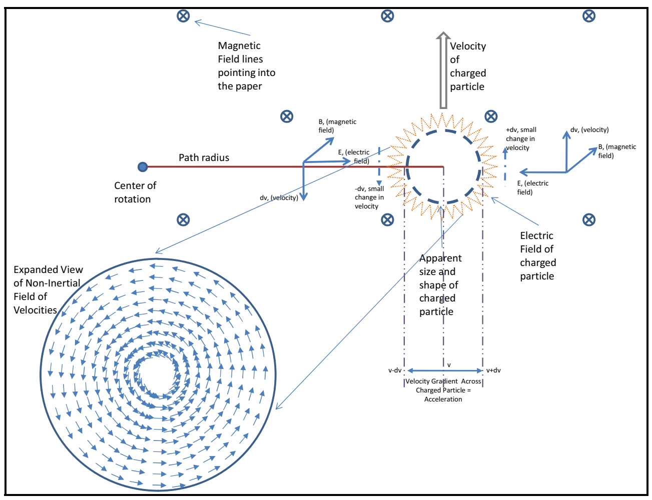

FIGURE 1. Charged particle moving in a magnetic field forms a non-inertia field

For an infinitesimally small piece of the spherical field, it approximates a flat surface. The electric field of a flat surface is $(q/A)/(2\varepsilon_0)$. Thus,

$$dv = (8\pi\varepsilon_0/m)BEdr^3 \tag{30}$$

Introducing the electric field E back into this velocity equation. The vertical velocity, Figure 1, is orthogonal to the horizontal electric field component E_x or $E\cos\theta$, given by

$$dv = (8\pi\varepsilon_0/m)(E\cos\theta)Bdr^3 \tag{31}$$

And in replacing the particle's charge with the electric field equation (29) becomes equation (32).

$$a = c^2\{1/\sqrt{(1-v^2/c^2)} - 1/\sqrt{1-[v+\{(8\pi\varepsilon_0/m)(E\cos\theta)Bdr^3\}^2/c^2]}\}/dr \tag{32}$$

The charged particle's electric field acceleration is presented in column 9 of Table 5. Equation (28) shows that it is the spherical shape of the electrical field that converts the perpendicular velocity of the charged particle with respect to the magnetic field into an orthogonal force. All other orientations of the particle's electric field velocity dv with respect to the magnetic field negate themselves. This process model explains why electromagnetic force is orthogonal to the magnetic field and electron velocity, therefore suggesting that vectors and matrices are elegant mathematical shortcuts in current electromagnetic theory.

RECONCILING OTHER EXPERIMENTERS' RESULTS

Laithwaite (1974; 1994; also see; Solomon, 2005 and 2006) had demonstrated that a spinning disc when rotated would lose weight. A numerical model was constructed to investigate this (Solomon, 2008). The time dilations were calculated for 49,165 points across this disc and converted to acceleration with equation (16). Table 6 presents the results of the averaged acceleration across the disc.

TABLE (6). Numerical simulation model results for upward acceleration of Laithwaite rotating-spinning disc experiment.

Rotation Radius (m) =	1.00		**Spin Radius (m) =**	0.30	
Rotation (rpm)		0	3	7	15
Spin (rpm)	1,000	0.000	0.833	1.944	4.166
	3,000	0.000	2.499	5.833	12.499
	5,000	0.000	4.166	9.722	20.833
Rotation Radius (m) =	0.50		**Spin Radius (m) =**	0.20	
Rotation (rpm)		0	3	7	15
Spin (rpm)	1,000	0.000	0.589	1.373	2.943
	3,000	0.000	1.766	4.120	8.828
	5,000	0.000	2.943	6.866	14.714
Rotation Radius (m) =	0.75		**Spin Radius (m) =**	0.10	
Rotation (rpm)		0	3	7	15
Spin (rpm)	1,000	0.000	0.715	1.668	3.575
	3,000	0.000	2.145	5.005	10.725
	5,000	0.000	3.575	8.342	17.875

These results confirm Laithwaite's (1994; also see; Solomon, 2005 and 2006) original demonstration that a disc spinning at 5,000 rpm and rotating at 7 rpm, with a radius of rotation of at least 1 m, and spin radius of 0.3 m would be almost weightless ($9.8m/s^2 - 9.7m/s^2 = 0.1m/s^2$), if not rise. Equation (33) is the regression of the results in Table 6. The acceleration *a* created by a rotating-spinning disc's three-dimensional time dilation field with spin ω_s, disc radius, *s*, rotational ω_d, rotation radius *d* and hypotenuse *h* formed by *s* and *d* is given by,

$$a = \omega_s \omega_d \sqrt{h} \tag{33}$$

Though Laithwaite demonstrated weight loss, this is a weight change phenomenon as both weight loss and gain are observed. If the sense of the spin and rotation are different, the direction of the acceleration is reversed, as one of the ω's is negative. Hayasaka and Takeuchi (1989) had reported that a gyroscope would lose weight, but Lou *et al.* (2002) could not reproduce this effect. Given their experiments downward pointing spin vector, equation (33) shows that Lou et al were correct. This is because equation (33) requires that acceleration produced be orthogonal to both spin and rotation. Therefore, to observe weight change the spin vector has to be orthogonal to the gravitational field.

CONCLUSION

This paper presents the general force field equation (16) for many different phenomena, gravitational, electromagnetic, and mechanical forces. Gravity modification technology works because gravity and electromagnetic forces exhibit non-inertia field properties. Thus gravitational acceleration is not dependent on its mass source, confirming the theoretical and technological feasibility of gravity modification as a real working technology. Since the immediate local field properties determine the local accelerations, this simplifies technology development to local field modifications, implying that some technology based transformation $\Gamma(s)$ can be applied to the external or environmental field to produce non-inertia motion. There are three keys here. First, the technology transformation $\Gamma(s)$ has to be non-linear with respect to the space along the path of the required acceleration. Second, gravity modification consists of two parts, field vectoring, and field modulation. Third, interstellar travel could be achieved by breaking equation (4) into two transformations, one for space $\Gamma(s_{x,y,z})$ and other for time and mass $\Gamma(s_{t,m})$ so that distances could be shrunk without altering time or mass. The electron process model indicates that the shaped electric field exhibits force in the presence of an external moving magnetic field. From a propulsion technology perspective, the electric field holds force, while the magnetic field is used to power the non-inertia field.

NOMENCLATURE

x_0 = distance at rest, along axis of motion (m)
x_v = distance at velocity, v, along axis of motion (m)
x_a = distance when acceleration is 'a' (m)
t_0 = time interval at rest (s)
t_v = time interval at velocity, v (s)
t_a = time interval when acceleration is 'a' (s)
$\Gamma(v)$ = Lorentz-Fitzgerald transformation at velocity, v
$\Gamma(a)$ = local acceleration, a, based transformation
χ = change in center of mass (m)
L = distance from center of particle to left edge (m)
g = acceleration (m/s^2)
k_d = change in distance (m^2/s^2)
k_m = change in distance (s^{-1})
χ = change in center of mass (m)
δt = change in time dilation (s)
δt = change in time dilation (s)
ω_s = angular velocity of spin (Hz)
s = disc radius (m)
a = acceleration (m/s^2)
y = the radius of the disk formed by rotation at distance x from the center, the shape function (m)
m_0 = mass at rest (kg)
m_v = mass at velocity, v (kg)
m_a = mass when acceleration is 'a' (kg)
r = distance from the gravitational source (m)
G = gravitational constant
M = mass of gravitational source (kg)
x = distance from the center of particle (m)
ρ_v = mass density across the particle (kg/m^3)
m = mass of charged particle (kg)
R = distance from center of particle to right edge (m)
dt = change in time dilation (s)
dr = change in distance (m)
k_c = change in distance (m^2/s^3)
S_z = particle size (m)
δr = change in distance (m)
ω = angular velocity (Hz)
ω_d = angular velocity of rotation(Hz)
r = radius of rotation (m)
h = hypotenuse formed by s and r (m)

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