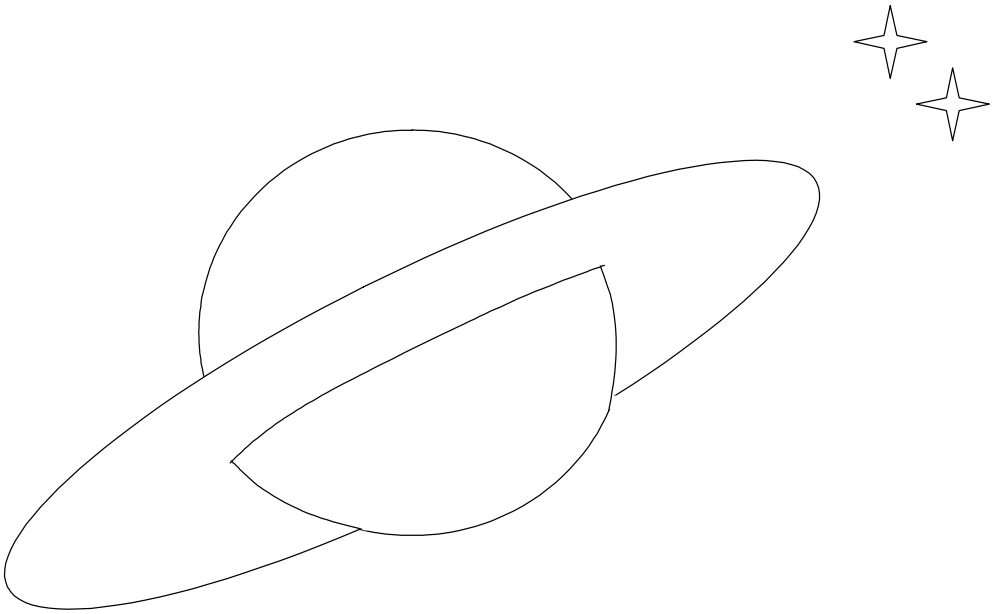
Curvature-Based Vehicular Propulsion

Engineering Principles for Cross-Field Device Technology Development

(Revision 1)



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Executive Summary

New concepts of cosmology & spacetime have proven that both electromagnetism and gravitation are functionally equivalent, and manifestations of spacetime curvature. These concepts are embodied in the ***E***instein-***C***artan-***E***vans-Theory of cosmology. *Fundamentally, magnetic-levitation (mag-lev) technology involves manipulation of spacetime curvature*. It is with us today. For example, it is used to power mono-rail trains. Given the equivalence of electromagnetism and gravitation, it has also been proven that the speed-of-light *is not a barrier* to attainable velocities. The proper use of electromagnetic fields can result in the ability to generate propulsion. Such propulsion systems would not be constrained by the speed-of-light. This has significant ramifications for space travel (i.e. spacecraft propulsion systems), as well as for Earthbound transportation systems.

This document presents scientific principles, which enable such an electromagnetic (i.e. curvature) based propulsion system. The system concept is called Geodesic-Fall. Details of *the geodesic-fall process* are provided herein. Estimates of initial field strength requirements are well within the capabilities of present technology. Some conceptual applications are also provided, to further illustrate the utility and potential of the Geodesic-Fall process. The potential, of the geodesic-fall propulsion system technology, is enormous. Besides the obvious spacecraft applications, such a propulsion system technology could be applied to planetary vehicles (e.g. the automotive industry). This technology might alleviate several concerns, such as emissions, petroleum-dependency, alternative fuel sources, and aspects of global-warming. Additional information is available. Further discussions are welcome.

Obviously, the aerospace industry, and sectors of the transportation industry would be the primary implementers and users of the geodesic-fall technology. They, along with organizations such as NASA, would be most able to advance and promote this technology. The Galactican Group (the research & consulting organization that derived the geodesic-fall concepts), stands ready to assist in the utilization and advancement of the overall ECE device technology, and the Geodesic-Fall propulsion system application.

The payoff potential of this technology is enormous. Multi-$Billions, and *a measure of control of* each of several industrial areas is possible. Such industrial areas include power, aerospace, and automotive. Such payoff could conceivably begin to manifest in approximately 1yr-18 months, after small initial investments ($3M - $3.5M). The initial investment would be used for construction, demonstration, and initial marketing of 1st ECE devices.

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1.0 Introduction

The Einstein-Cartan-Evans (ECE)-Theory is used to establish engineering principles for anti-gravity-based vehicular propulsion systems. The conventional theory of cosmology [1-9], including the General Theory of Relativity, has constraints which limit dynamics. The new ECE-Theory of cosmology [13 -17] is a generally covariant unified field theory, developed by Prof. Myron W. Evans in 2003. A major principle of the ECE-Theory is that electromagnetism and gravitation are both manifestations of spacetime curvature. More specifically, electromagnetism is the torsion of spacetime, and gravitation is the curvature of spacetime. Since torsion can be viewed as spin, one concludes that spacetime has both curvature and spin. The spinning/torsion of spacetime was neglected in Einstein's Theory of Relativity. Einstein also arbitrarily (and incorrectly) assumed c (*the speed of light*) could not be exceeded. The concept that "*the upper limit of possible velocity is the speed of light c* ", has come under question from time-to-time. The idea (*c as the maximum possible velocity*) was proposed by Einstein, in his 1905 Theory of Special Relativity. Since light is electromagnetic radiation, a reasonable postulate is that any events/phenomena (manifesting in excess of c) would appear distorted or ambiguous if observed via electromagnetic radiation. Further, the additional fact that c i*s not* a limiting velocity [10], does not invalidate Special Relativity. It might, however, question original interpretations of his theory. Actually, from the principles of ECE-Theory, c (*at a given point in spacetime*) is shown to depend on the curvature of spacetime *at that point*. These, and other principles established by ECE-Theory, are used to derive a design & engineering framework for anti-gravity-based vehicular propulsion systems. Some simple, current devices [11-12] that can demonstrate ECE-Theory principles are discussed. Anti-gravity-based vehicular propulsion systems would be relatively inexpensive, and would not require internal-combustion. Thus, dependence on fossil-fuels, and other costly (*and possibly dangerous*) energy sources, and their adverse environmental impact, could be eliminated.

1.1 *Objective*

The objective here is to describe/present a new method of, and system for, propulsion. This method is based on utilizing the equivalence of electromagnetism and gravity by inducing local spacetime curvature. This is the lift/anti-gravity phase. The induced curvature results in a geodesic curve. The "propulsion phase" involves a "*fall*" along said geodesic curve. The basic definition for a geodesic is (in the context of gravitational physics), from [1-2]:

- --- *a curve that is straight and uniformly parameterized as measured in each local Lorentz frame (coordinate system at a point of the curve) along its way. (where a "curve" is a parameterized sequence of points)*

- --- *as a general definition, a geodesic is a free-fall trajectory, which is the shortest path between two points, wherein said points are on some metric-space*.

This method is applicable to land/surface vehicles, as well as spacecraft.

1.2 *Background*

The ECE-Theory also shows that coupling between the background potential of spacetime can be established by appropriate electrical and/or mechanical devices. This coupling manifests as amplification of the potential (in volts) of such devices, as said devices

resonate with the background potential energy of spacetime. This phenomenon is called spin-connection-resonance (SCR), [16, 17]. Some engineering principles, for such devices, are discussed in [18]. SCR is exploited to achieve anti-gravity effects for the lift phase. Differential geometry aspects of ECE-Theory, concerning SCR, are given in Appendix-A.

2.0 Basic Concepts

In general, to counter the gravitational field of spacetime (i.e. at a given point in spacetime), the potential energy (Φ) of spacetime, must be increased. Using ECE-Theory, the background potential energy of spacetime (i.e. the scalar potential Φ) is considered.

2.1 *Background Potential Energy of Spacetime Φ*

Conventionally, gravitational potential energy is related to the gravitational force. Gravitational potential energy (K), of an object is;

$$K = mgh$$

Where;➔ m = mass of object
g = gravitational acceleration
h = altitude above earth

If an object's altitude above the earth *decreases* its, K *decreases*. If an object's altitude above the earth *increases* its, K *increases*.

From ECE-Theory, considering that gravitation & electromagnetism are both expressions of spacetime curvature (where gravitation is the curvature of spacetime and electromagnetism is the torsion/twisting of spacetime), $K \equiv \Phi$ can be viewed as related to spacetime curvature. Thus, the gravitational potential energy (at any point in spacetime), can be regarded as the potential energy experienced by an object at that point. The curvature (i.e. gravitational field) of spacetime at any point, determines the geodesic-path and velocity an object (at that point) would experience. If curvature was induced at a point in spacetime, an object at that point could fall along the resulting geodesic, at a velocity dependant on the degree of said induced curvature. This induced geodesic-fall vector would be different from the natural geodesic-fall vector (e.g. normal gravity, in the earth realm). In the earth realm, raising the altitude of an object opposes gravity (i.e. induces spacetime curvature) and increases the object's potential energy. Therefore, by increasing Φ , anti-gravity effects can be induced.

The ECE-Theory shows [16, 17] that coupling between the background potential energy (Φ) of spacetime, can be established with appropriate electrical and/or mechanical devices. This coupling can cause a significant increase in Φ (in the neighborhood of such a device). Thus, gravitation is countered in that device neighborhood. The field equations of ECE-Theory are used below, to show (*analytically*) how this coupling works.

2.2 *Spin-Connection Resonance (SCR)*

ECE-Theory shows that properly designed electric and/or mechanical devices can resonate with Φ . The ECE field equations can be used to define an engineering framework for the design & implementation of devices suitable for coupling with the background potential energy (Φ) of spacetime (i.e. achieving SCR).

2.2.1 *An Engineering Framework* (*for an SCR Capable Device Technology*)

From the form of a general resonance equation (i.e. differential equation) for generalized item $q_i(x)$, where f(x) is the driving function, we have:

$$\partial^2 q_i(x)/\partial x^2 + \zeta_1 \partial q_i(x)/\partial x + \zeta_2 q_i(x) = f(x)$$

From the ECE-Theory field equations (*where* ***boldface*** *denotes a vector quantity*, ∇ is the gradient vector), the following relations are used;

$$\mathbf{E} = -\partial \mathbf{A}/\partial t - \nabla \Phi - \omega^0 \mathbf{A} + \Phi \boldsymbol{\omega}$$
$$\mathbf{B} = \nabla \times \mathbf{A} - \boldsymbol{\omega} \times \mathbf{A}$$

where; ➔
- $\mathbf{A}$ = vector potential of spacetime
- Φ = scalar " "
- ω^0 = " spin connection
- $\boldsymbol{\omega}$ = vector " "

Considering the electrical case, from [18] we let $\mathbf{A} = 0$, which gives the following:

$$\mathbf{E} = -\nabla \Phi + \Phi \boldsymbol{\omega}$$

Using Coulomb Law ($\nabla \cdot \mathbf{E} = \rho/\varepsilon_0$), we have:

$$\begin{aligned} \nabla \cdot \mathbf{E} &= \rho/\varepsilon_0 \\ &= \nabla \cdot (-\nabla \Phi + \Phi \boldsymbol{\omega}) \\ &= -\nabla \cdot \nabla \Phi + \boldsymbol{\omega} \cdot \nabla \Phi + \Phi \nabla \cdot \boldsymbol{\omega} \\ &= -\nabla^2 \Phi + \boldsymbol{\omega} \cdot (\nabla \Phi) + (\nabla \cdot \boldsymbol{\omega}) \Phi \end{aligned}$$

Changing signs, we have;

$$\begin{aligned} &= \nabla^2 \Phi - \boldsymbol{\omega} \cdot (\nabla \Phi) - (\nabla \cdot \boldsymbol{\omega}) \Phi \\ &= -\rho/\varepsilon_0 \end{aligned}$$

The ECE Coulomb Law thus gives the expression:

$$\nabla^2 \Phi - \boldsymbol{\omega} \cdot (\nabla \Phi) - (\nabla \cdot \boldsymbol{\omega}) \Phi = -\rho/\varepsilon_0 \qquad (1)$$

This is a resonance equation for Φ, the scalar potential. The resonant frequency is ($\nabla \cdot \boldsymbol{\omega}$), the divergence of the spin connection [18]. Thus the term *spin-connection-resonance* (SCR), is used. If Φ is the spacetime scalar potential, then at SCR, Φ should be maximized. The effect is to induce spacetime curvature in the maximized potential field Φ. The degree of induced curvature, and the resulting geodesic path are determined by the driving function ($-\rho/\varepsilon_0$). The induced curvature & resulting geodesic path would be different from the *natural* curvature & geodesic path. Thus, natural gravity is opposed. Fundamentally, by increasing (e.g. maximizing) spacetime gravitational potential energy Φ, anti-gravity effects are generated.

2.2.1.1 *Driving Function Principles for SCR Capable Devices & Systems*

From [18], and observation an engineering approach to a device family for coupling with Φ is suggested. Given, that the resonance frequency from eq. (1) is ($\nabla \bullet \boldsymbol{\omega}$), and $\boldsymbol{\omega}$ is a rotation vector of a magnetic field, it is reasonable to consider devices based on rotating magnetic fields. A rotating magnetic field (or two counter-rotating magnetic fields [18]) can be used to achieve resonance, SCR in this case. At SCR, Φ is amplified in the neighborhood of the rotating magnetic fields. Gravitation is countered, and electric energy is available ([18], and appendix b). The remaining focus of this document will be counter-gravitation devices, based on counter-rotating magnetic fields. Such devices can be referred to as ***cross-field devices***.

2.2.1.1.1 Specifics for a Driving Function

The objective of a cross-field device is to couple with the torsion of spacetime, to achieve SCR, and maximize Φ. By definition, $\boldsymbol{\omega}_i$ is the rotation vector of the i^{th} magnetic source, $\mathbf{B}_i(r)$ is the field of the i^{th} magnetic source, and $\boldsymbol{\mu}_i(t)$ is the magnetic moment of the i^{th} magnetic source. From the engineering prospective [18], the use of two counter-rotating magnetic sources suggests a flexible, effective SCR device technology. This is because a simple, straightforward, magnetic torque-based driving function can be defined. We can use the driving function:

$$\boldsymbol{F}_{drv} = \boldsymbol{\mu}_1(t) \times \mathbf{B}_1(r) + \boldsymbol{\mu}_2(t) \times \mathbf{B}_2(r) \qquad (2)$$

Φ is maximized in the region between the counter-rotating magnetic sources, countering gravitational effects in that region. *We define this region between the counter-rotating magnetic sources as the "Bubble"*. This effect is the basis of the Geodesic-Fall propulsion concept, presented below. A benefit of the *"Bubble"* is that inertial forces are neutralized. Thus, easy changes in course & speed are possible in planetary atmospheres. The dynamics of the Levitron device (and of *levitron-like* devices) [11,12] is an example of this effect. By manipulating the variables of $\boldsymbol{F}_{drv}$, the direction and magnitude (*course & speed*) of a Geodesic-Fall propulsion system can be controlled.

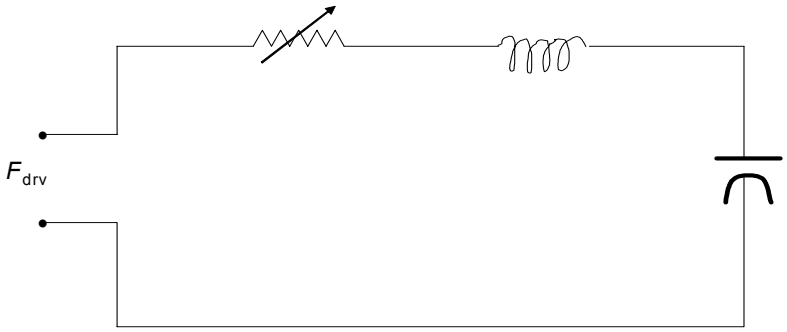
Additionally, as shown in [18], in the "*Bubble*" where $\boldsymbol{\omega}$ changes sign, is a source of voltage. A proper dielectric material, placed at this sign-transition point inside the "Bubble", can transfer voltage (electrical energy) directly from spacetime. Thus, the nearly infinite reservoir of spacetime background potential energy can be effectively exploited as an electrical energy resource.

Note;

It is important to note that if the magnetic moments $\boldsymbol{\mu}_i(t)$ are zero (e.g. $\boldsymbol{\mu}_1(t) = \boldsymbol{\mu}_2(t) = 0$), then no rotation exists, and thus there is no driving function. Thus rotation of magnetic sources, in cross-field type devices, is required if SCR is to be achieved. This factor will come into play as the dynamics of cross-field devices are examined.

3.0 Some Equivalent Circuits (*for Cross Field Type Devices*)

The equivalent circuit for eq. (1), the resonant Coulomb Law, is an undamped electrical oscillator. Fig. 3-1 is such a circuit.



Z_{Mi} ----- generic serial resonant circuit

Fig. 3-1 Basic oscillator circuit

This circuit is used in Fig. 3-2, a general equivalent circuit for magnetic devices such as a Faraday Disk, or a levitron-like device [11, 12]. ZM1 and ZM2 are embodiments of a serial resonant circuit, of the type illustrated in Fig. 3-1.

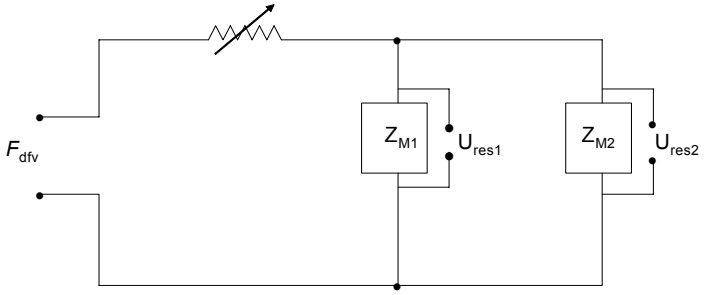


Fig. 3-2 device equivalent circuit (*magnetic devices*)

In Fig. 3-3, the Z_{Mi} elements are replaced by magnetic sources (M_i). For a proper driving function, to achieve SCR, the magnetic sources M_1 & M_2 must counter-rotate. The points U_{res1} and U_{res2} are the energy tapping points.

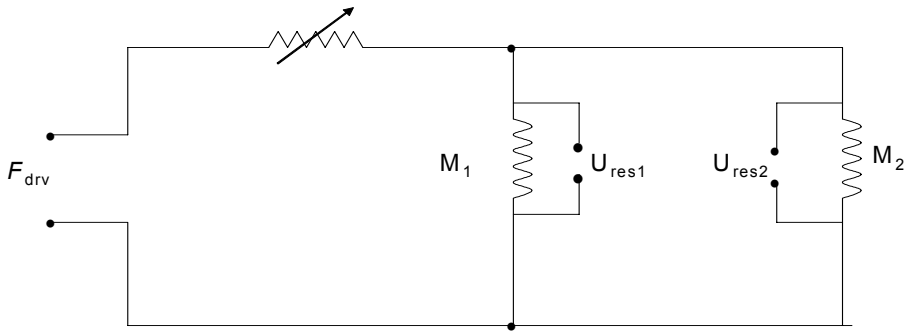


Fig. 3-3 Cross-Field Device *equivalent circuit*

The Levitron can be viewed as an example device, demonstrating these principles. For the cross-field equivalent circuit, M_1 and M_2 can be active electromagnetic elements, and implement the driving function for the resonance equations. These sources (M_1 and M_2) also generate the *electromagnetic "bubble*" of the anti-gravity process. M_1 and M_2 can be configured to both enable energy/power generation, and/or to enable the anti-gravity process (their principal function). Conceivably these energy-generation & induced-curvature processes could be sequential or simultaneous, depending on application factors, and on device structure. During an energy generation process [18], the *electromagnetic "bubble"* would act as the resonate medium, containing the dielectric material to facilitate energy transfer from spacetime. The energy generation process is discussed in Appendix-B.

3.1 *The Levitron™ example*; (*from [12]*)

The Levitron is a small, inexpensive, anti-gravity device consisting of a base magnet and a top with a magnetic ring attached. The spinning top can be made to "*float/levitate*" above the magnetic base. Although the Levitron is viewed by some as a toy, it can be used to demonstrate anti-gravity aspects of ECE-Theory. The ECE-Theory is used to explain the dynamics of levitron-like-devices, including the spin requirement for the top. While the Levitron dynamics have defied quantitative analytical explanation, an attempt was made (circa 1995) by M.V. Berry [11], then of the Wills Physics Laboratory, UK. Without the benefit of ECE-Theory, Berry attempted to focus on mechanical principles to explain Levitron operation. The ECE-Theory however, provides a quantitatively accurate description of a *levitron-like device*, where the base is replaced by a rotating magnetic field [12]. The Levitron is a counter-gravity device, and thus useful as a laboratory-scale ECE-Theory demonstration device, for examining anti-gravity effects..

3.1.1 *Operations Specifics*

The Levitron is a device consisting of a top (s), with an attached ring magnet (M_1), and a magnetic base (M_2). It operates on magnetic-levitation (mag-lev)/counter-gravity principles. It employs a spinning magnet, inside the magnetic field of the base. The spinning top (i.e. the rotating M_1) can float stably above M_2, the magnetic base. This is an example of *mechanical rotation* of a magnet. There is no rotating magnetic field, because the top rotates about its magnetization axis, (Appendix C). However, as discussed in [12], the Levitron (and levitron-like-devices) can aid in examining & demonstrating some ECE-Theory principles, and some device technology such as that of [18]. A generic configuration is illustrated in Figure 3-4 below. Items M_1 (i.e. M_L) and M_2 (i.e. M_B) are magnetic devices. Figure 3-5 shows the precession of the top, as its spin degrades. This precession causes the horizontal component of the top's motion, as its spin degrades.

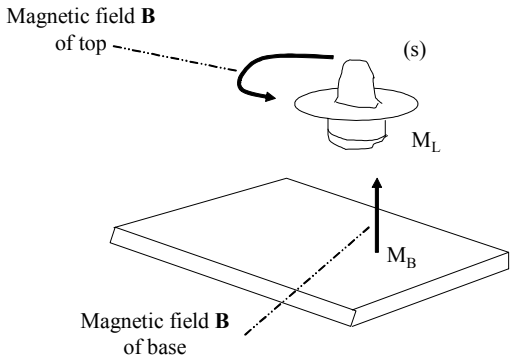


Fig. 3-4 Generic LEVITRON

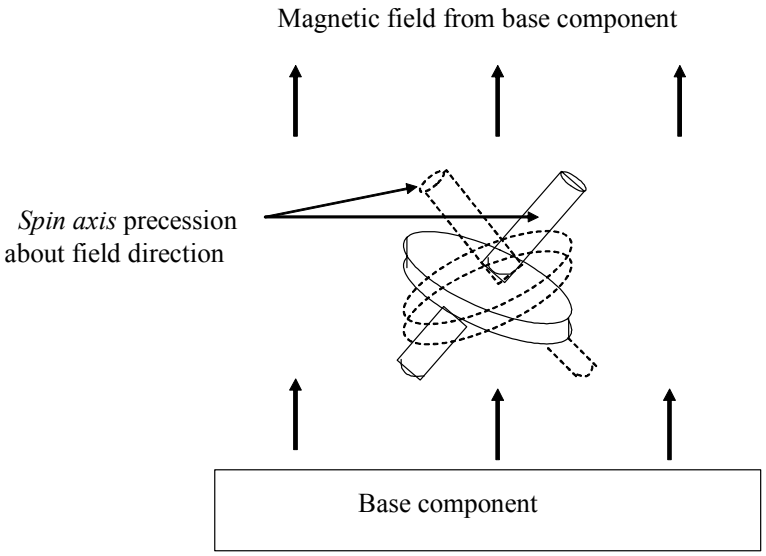


Fig. 3-5 Precession of Top

The dynamics of a *levitron-like device* is a quantitatively accurate explanation [12], utilizing the ECE-Theory. The previous most definitive paper on Levitron dynamics [11], examines *the mechanics* of the device as a rotating dipole, in a magnetic field. Thus, a *levitron-like device* can be viewed as a demonstration-device/tool for ECE-Theory anti-gravity effects. Moving from the Levitron, if the base is replaced with a source for a rotating magnetic field, and a second rotating magnetic field device is added, we have the devices of Figs. 3-6 and 4-1. As the fields are configured to counter-rotate in these devices, anti-gravity effects, and energy-generation effects [[18], Appendix B] can occur.

3.1.1.1 *A Note on Counter-Rotation*

We note once again that, for a *levitron-like device*, M_1 is attached to the top (s), M_2 is the base (a rotating magnetic field). Device operation shows the top must spin to levitate stably above the base. More correctly, M_1 is required to spin.
Let:

$\boldsymbol{v}_{M1}$, $\boldsymbol{v}_{M2}$ → tangential velocities of the magnets
for counter-rotation ($\boldsymbol{v}_{M1} + \boldsymbol{v}_{M2}$) → $\boldsymbol{v}_r$ relative velocity.

If $\boldsymbol{v}_{M2} = 0$, then we have a *levitron-like device* case. For levitation, $\boldsymbol{v}_r$ must be positive. Thus, one argues the top must spin. However, it is M_1 that is required to spin, in the rotating field of the M_2 magnetic device.

It is useful to note that the explanations of the Faraday disk generator [23], are similar to those of this section. The explanations of the Faraday disk (*homopolar*) generator incorporate ECE-Theory. It has been fully explained by ECE-Theory. From above discussions of sec. 2, it is clear that driving function $\boldsymbol{F}_{drv} = 0$, if $\boldsymbol{v}_{M1} = 0$ (i.e. if there is no rotation, then no driving function exists). Thus, ECE-Theory simply, *analytically quantifies* the top's spin requirement for a leviton-like-device.

3.1.2 *Levitron Device Dynamics*

Examining the force on the top, a gravitation (i.e. mechanical) problem and an electromagnetic problem must be solved. Defining Φ_{top} as the scalar potential energy of the top, it is shown (from [11]) that equilibrium is achieved if $\nabla \Phi_{top} = 0$. If $\partial^2 \Phi_{top} / \partial z^2 > 0$, vertical stability is achieved. Horizontal stability is achieved when $\partial^2 \Phi_{top} / \partial x \partial y > 0$. Considering the field equations of the ECE-Theory, we can write them in a simplified Einstein-like form from [14];

$$G_{\mu\nu} = -K T_{\mu\nu} + \ell T^{\lambda}_{\mu\nu}$$

where; --- the torsion/spin $T^{\lambda}_{\mu\nu}$ is accounted for in the ECE-Theory
--- K and ℓ are constants
--- $T_{\mu\nu}$ is the energy-momentum density

If ;

$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu}$, with Ricci tensor $R_{\mu\nu}$ and metric tensor $g_{\mu\nu}$ are symmetric (as defined in the Einstein Theory)

Then (by ECE-Theory);

$T^{\lambda}_{\mu\nu}$ is asymmetric, representing spin. By using $T^{\lambda}_{\mu\nu}$ in the equation for $G_{\mu\nu}$, we then have equivalencies;

$$\boldsymbol{F}_{drv} \approx G_{\mu\nu} \rightarrow \ell T^{\lambda}_{\mu\nu} \approx \nabla \boldsymbol{\mu}(t) \bullet \mathbf{B}(r) = \Phi_{\lambda}$$

Where Φ is the scalar potential amplified by counter-rotation of M_1 and M_2 , and Φ_{λ} is a driving function. The rotation of M_1 contributes to driving function (Φ_{λ}), to amplify Φ. The magnitude of M_1 and its rotation ($\boldsymbol{v}_{M1}$) determine if SCR is achieved. Thus, the spin and magnitude of M_1 can be independently adjusted to achieve maximum SCR. Therefore, spin, $|\mathbf{B}(r)|$, and curvature are related. ***QED***

As shown in [12], a driving function ($\Phi_{\lambda} \approx \boldsymbol{F}_{drv}$) can also be amplified. This could be useful if/when one levitron-like-device is used to power another.

The greater the spin and/or the greater the **B** field strength, the greater the induced curvature caused by these conditions. The top's spin contributes to *driving function* ($\boldsymbol{F}_{drv}$) to amplify Φ (the scalar potential), and thus enhance counter-gravitation between the top & base, at resonance. Fig. 3-6 shows a *levitron-like device*, or (more accurately) a generic cross-field device, levitating a Levitron's top. For the *levitron-like-device* case, M_1 is attached to the top (s), M_2 is the base. A generalization of this concept is an object spinning between the M_1 and M_2 *rotating-magnetic-field* sources. If the object is magnetized (i.e. M_3), one has M_3 rotating relative to M_1 , and M_3 rotating relative to M_2 simultaneously. Thus, counter-rotation of M_3 and M_1 , and

of M_3 and M_2 is realized. This results in levitation of the object. Analytically, from section 1.1 above, where;

$\boldsymbol{v}_{M1}$, $\boldsymbol{v}_{M2}$ → rotational velocities of the magnetic sources
$\boldsymbol{v}_{M3}$ → rotational velocity of the object

If $\boldsymbol{v}_{M1} = \boldsymbol{v}_{M2} = 0$, and $\boldsymbol{v}_{M3} > 0$, anti-gravity regions are produced between (counter-rotating) M_3 and M_1 , and between (counter-rotating) M_3 and M_2 , causing the object to levitate.

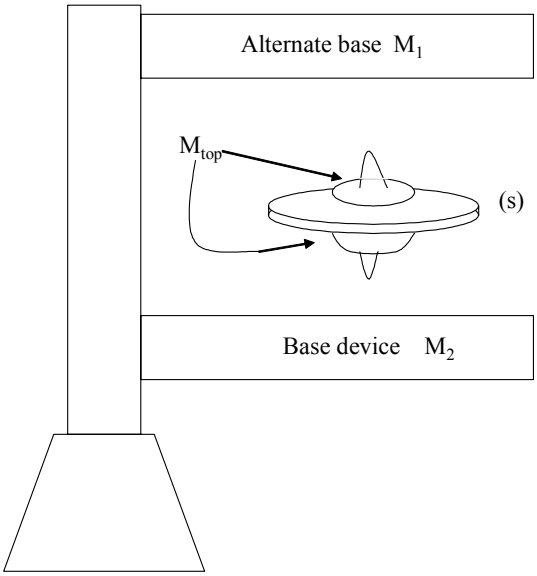


Fig. 3-6 Enhanced Levitron Concept

Here, both base devices (M_1 & M_2) are rotating magnetic field sources, which are configured to counter-rotate. As discussed above (and in Appendix A), a spin component is needed for a levitron-like-device to couple with spacetime torsion, to achieve spin-connection-resonance (SCR). This spin component of the object (e.g. magnetized top) must exceed some β to maintain SCR and stability. Stated more precisely, from above discussions;

$\boldsymbol{v}_r \geq \beta \rightarrow$ stability of top above the base
$\boldsymbol{v}_r < \beta \rightarrow$ instability of top, causing it to fall

If the object's $\boldsymbol{v}_{M1}$ spin/rotation component is less than β, the top *falls away* along a geodesic path induced by the anti-gravity condition caused by the interaction of the object's magnet (M_{top}), and magnetic bases (M_1 & M_2). This *fall away* factor is exploited as a propulsion system concept.

4.0 Cross-Field Device Technology

The generic architecture of the cross-field device technology is given in Fig. 4-1. The magnetic sources (M_1 & M_2) are counter-rotating. They create an anti-gravity region between (M_1 & M_2), which we refer to as the Bubble or Bubble -area.

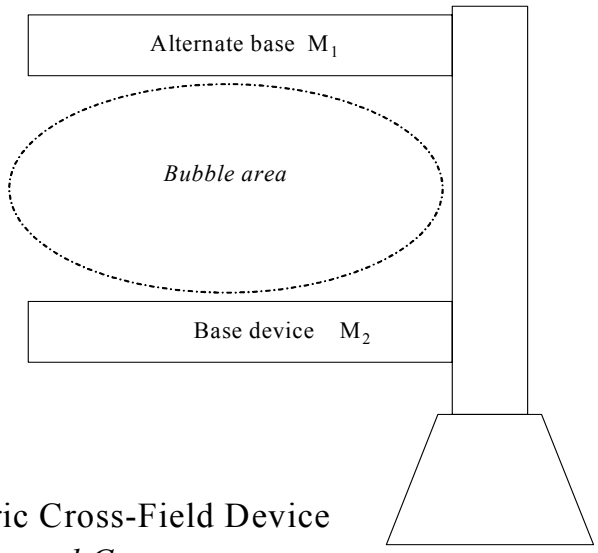


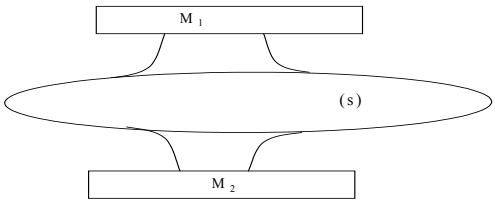
Fig. 4-1 Generic Cross-Field Device
Architectural Concept

The device of Fig. 4-1 is for anti-gravity applications. A device version for electric power generation (more correctly, electric energy transfer), is given in Appendix B. An object in the Bubble will fall away when stability is lost. Stability is lost when the counter-rotation decays below a given threshold. The fall-away path is along a geodesic path that resulted from the induced spacetime curvature produced at SCR. SCR is achieved by the counter-rotating magnetic sources (M_1 & M_2). Thus, there is a levitation (i.e. anti-gravity) process, and a fall-away process. Since the fall-away takes place along a geodesic-path, we term the full process (*lift phase + propulsion phase*) Geodesic-Fall. From Figs. 3-6 and 4-1, the top of Fig. 3-6 is replaced by a vehicle. The magnetic sources (M_1 & M_2) are attached to the vehicle. This provides a generic configuration for a Geodesic-Fall propulsion system. The vehicle exists in the anti-gravity Bubble, created by the counter-rotating magnetic sources.

5.0 Geodesic-Fall

A small-scale (laboratory) observation of geodesic-fall principles can be achieved by examining the dynamics of the Levitron. The Levitron is a toy, but operates on magnetic-levitation (mag-lev)/counter-gravity principles. The 1st definitive paper on Levitron dynamics [11], views the device as a rotating dipole, in a magnetic field. The ECE-Theory based description, of Levitron-like-device dynamics [12], can be useful in demonstrating and observing principles involved in the geodesic-fall concept.

A generic configuration, of a geodesic-fall propulsion system, is illustrated the figure below. Items M_1 (i.e. M_L) and M_2 (i.e. M_B) are electromagnetic devices. The item (s) represents a generic space vehicle. Magnetic sources (M_1 & M_2) are counter-rotating in operation.



Although this technology is focused primarily as a propulsion system for spacecraft, it can *theoretically* be applied to nearly all vehicles. Applications to the automotive industry might aid in reducing environmental concerns, oil-dependency, and safety related issues. The geodesic-fall technology represents a major departure from conventional approaches to vehicular propulsion. *It is an alternative to internal-combustion*. ECE-Theory shows that electromagnetism and gravitation are both manifestations of spacetime curvature, and *functionally* equivalent. Specifically, the ECE-Theory shows gravitation is the *curvature* of spacetime, and electromagnetism is the *torsion* of spacetime. In terms of differential geometry, torsion can be viewed as a form of curvature. Induced spacetime curvature creates geodesic paths that a vehicle can move/fall along. Thus, a propulsion system capability is realized. The velocity, of the *fall* along the induced geodesic path, is not bounded by the speed-of-light. The velocity constraint is the degree of induced spacetime curvature. The *standard* speed-of-light (*c*) can be exceeded with sufficient induced curvature of spacetime.

The geodesic-fall propulsion concept utilizes induced spacetime curvature, similar to a Levitron-like-device's mag-lev process. Thus the device's *instability-behavior* (i.e. the top's *fall* away from the base) is similar to a vehicle under geodesic-fall propulsion. However said vehicle's fall along a geodesic path is controlled, and *not an instability condition*. The parameters governing the instabilities exhibited by the Levitron-like-device, can be properly controlled to provide a command & control method for the geodesic-fall process. Overall, a Levitron-like-device illustrates an application of induced spacetime curvature. It can be used to

better understand the principles governing geodesic-fall. ***It should be clear that magnetic forces are <u>not used "directly"</u> to drive the vehicle.***

5.1 *Overview of Basic Geodesic-Fall Concept*

Gravitation is a manifestation of spacetime curvature. It is shown by the derivation of geodesics in a neighborhood. Gravity and electromagnetism are both manifestations of spacetime curvature. They are respectively the symmetric and asymmetric parts of the Ricci Tensor. The Ricci Tensor is a second order covariant tensor, formed by the contraction of the curvature tensor $ß^{m}_{ikj}$, and usually denoted as R_{ij} . It is used to analytically express the curvature of spacetime, in a specified neighborhood, at a specified time. Dynamic spacetime curvature thus could be viewed as an event in spacetime. If said neighborhood is defined as the immediate vicinity of a vehicle (wherein said vehicle possesses a configuration of electromagnetic devices, such that said devices project an electromagnetic field (i.e. bubble), in/about the neighborhood of said vehicle), the vehicle could move/fall along the geodesic produced by manipulating the curvature of said neighborhood. The process is thus called "geodesic-fall".

The equivalence of gravity and electromagnetism has been established. The process of *mag*netic *lev*itation (mag-lev) is described in [10]. This mag-lev process, where;

M_B **=>** strength of base magnet

M_L **=>** strength of levitation magnet
(usually attached to a vehicle, such as a mag-lev train)

is equivalent to the geodesic-fall process presented in this document. The force between the base (M_B) and the vehicle (M_L) is referred to as the heave-force ***h***, in mag-lev applications. The heave-force neutralizes gravity *locally*. This is a manifestation of spacetime curvature, and one has the following;

$$\boldsymbol{h} = \boldsymbol{h}(M_B , M_L)$$

$$\boldsymbol{h} \approx \boldsymbol{H}, \quad \text{where: } \boldsymbol{H} = \boldsymbol{H}(M_B , M_L)$$

is the vehicle velocity along the induced geodesic path

Before deriving an elementary set of equations-of-motion for $\boldsymbol{H}$ it is useful to summarize the geodesic-fall. In a generalized mag-lev application, the base-magnet M_B and the lev-magnet M_L are both connected to the vehicle undergoing geodesic-fall (***H***).

The process of geodesic-fall is to induce spacetime curvature, and fall along the geodesic resulting from said induced curvature. While under geodesic-fall (***H***) the process continues. At a point i, along the initial geodesic-fall path $\boldsymbol{H}_0$, curvature is induced forming $\boldsymbol{H}_i$ (the i^{th} geodesic-fall path). Thus, between a point-of-origin p_o and a destination point p_d, the vehicular trajectory is a sequence of geodesic-fall vectors $\{ \boldsymbol{H}_i \} \big|_{i \varepsilon N+}$ which are bounded by $\boldsymbol{H}_0$ (the initial geodesic-fall vector) and the vector $\boldsymbol{H}_d$ (the final vector of the sequence). The heave-force ***h*** defines the lift phase of the Geodesic-Fall process. is now used to derive an expression for ***H*** (M_B , M_L) defines the propulsion/geodesic-fall phase. The heave-force ***h*** is now used to derive an expression for ***H*** (M_B , M_L).

The Ricci Tensor (in terms of M_L and M_B) can define the heave-force/induced-curvature of the mag-lev effect resulting from M_L and M_B . From reference [4], (*noting that a vector is a tensor of rank 1*), an expression for induced spacetime curvature is derived. From [5], we have a heave force ***F***, which acts against gravity, and can thus be viewed as an example of induced spacetime curvature.
F (a heave force between two magnets) is defined as follows;

$\boldsymbol{F} = M_L M_B / \boldsymbol{r}^2$ (where r is the distance between magnets M_L and M_B)

$R_{\mu\nu} = -K T_{\mu\nu}$ is the Ricci Tensor, $T_{\mu\nu}$ is the Energy-momentum Tensor, and

$\mu\nu$ describe *translation* and *rotation* aspects.

If ***F*** and $R_{\mu\nu}$ are both expressions of spacetime curvature, one has the following;

$$M_L M_B / \boldsymbol{r}^2 \approx -K T_{\mu\nu}$$

$$\approx R_{\mu\nu}(M_L, M_B)$$

$$= \boldsymbol{H}$$

With an expression for ***H*** in terms of M_L and M_B , it is possible to define a set of "*equations-of-motion*" for the geodesic-fall process.
Definitions:

$\boldsymbol{H}$ --- the (M_L and M_B induced curvature) geodesic path velocity of a vehicle

$\int \boldsymbol{H}\, dt$ --- position (along the induced curvature) geodesic path

$d\boldsymbol{H} / dt$ --- acceleration (along the induced curvature) geodesic path

The curvature induced by M_L and M_B is equivalent to the heave-force ***h*** (i.e. mag-lev effect) induced by M_L and M_B . This defines a simple set of equations-of-motion for geodesic-fall.

5.2 *Equations-of-Motion Basics*

Gravitation and Electromagnetism are respectively the symmetric and asymmetric parts of the Ricci Tensor, within a proportionality factor. Gravitation and electromagnetism are both expressions of spacetime curvature. Thus the mag-lev heave-force is also an expression of spacetime curvature, and ***h*** and $\boldsymbol{H}$ are components of the vehicular propulsion process. Also it is important to note that $\boldsymbol{H} \approx \boldsymbol{H}(\boldsymbol{F}_{\mathrm{drv}})$ shows the dependence of $\boldsymbol{H}$ on the driving function. Arguably, these concepts can be applied to planetary vehicles, as well as spacecraft.

Obviously, a more rigorous derivation can lead to a fully comprehensive set of equations-of-motion for geodesic-fall. The purpose here was to further illustrate the geodesic-fall process, and to illustrate that process in an experimental (laboratory-scale) framework [12].

6.0 Applications of Geodesic-Fall Propulsion

From ECE-Theory and [10], we know that neutralization of gravity involves inducing spacetime curvature in such manner as to eliminate the normal curvature inherent in the operational neighborhood of a Levitron-like-device. If one extends this concept outside of the laboratory-scale (e.g. where the device's top is replaced with a vehicle), the same general result could *theoretically* be expected, with proper magnetic alignments and field strengths. Additionally, both M_1 and M_2 can provide a radiation shielding effect for the vehicle, via the Bubble, by deflecting cosmic radiation. Fig. 6-0 illustrates this concept for spacecraft (*s*).

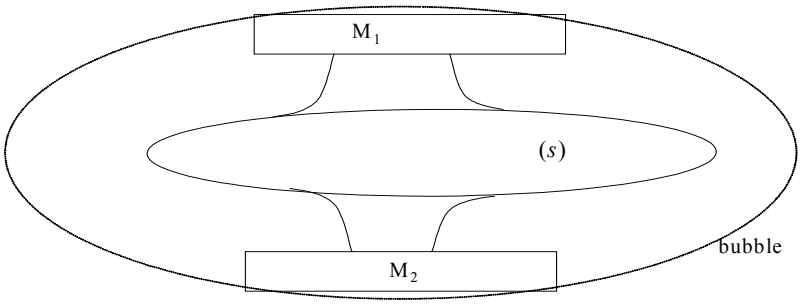


Fig. 6-0 Generic anti-gravity configuration

(*Magnetic sources attached to levitated object/ship*)

6.1 *Planetary Vehicular Propulsion*

Regarding Fig. 6-1, a configuration for a planetary (e.g. amphibious) vehicle is illustrated. The concept of operation is as follows for M_1 and M_2 ;

M_2 **=>** gravitational field planetary body (e.g. the Earth)
M_1 **=>** rotating/spinning magnetic field
(*For example, implementations of the counter-rotating magnetic fields could range from an actual spinning magnet, to an electromagnetic array that is sequentially excited so as to produce the effect of a spinning magnet*.)

Although, M_2 is stationary relative to M_1 , counter-rotation is achieved by the rotation of the M_1 magnetic source attached to vehicle (s). This counter-rotation concept is discussed in sec. 3.1.1.1 above. This levitation process is similar to Levitron-like-device dynamics [12].

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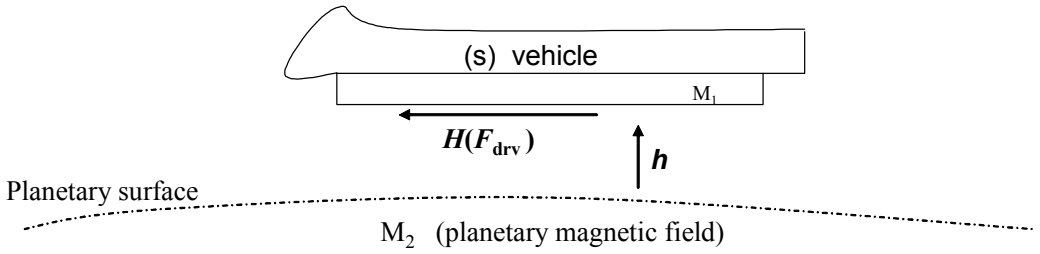

Fig. 6-1 Planetary/Amphibious Vehicle

On the practical level, we note that present hovercraft technology can achieve similar results. However, geodesic-fall propulsion does not require internal combustion or conventional fuels. But our purpose here is to provide a conceptual introduction of the geodesic-fall process.

6.2 *Atmospheric Vehicular Propulsion*

Atmospheric vehicles (e.g. aircraft) would use the same geodesic-fall principles as surface/planetary vehicles. Additionally, an optional (M_3) magnetic source could be used for additional *lift-phase* capability. M_3 would counter-rotate with M_1 to achieve a "combination" geodesic-fall operation, using planetary propulsion, plus (*low powered*) space propulsion. This concept is illustrated in Fig. 6-2.

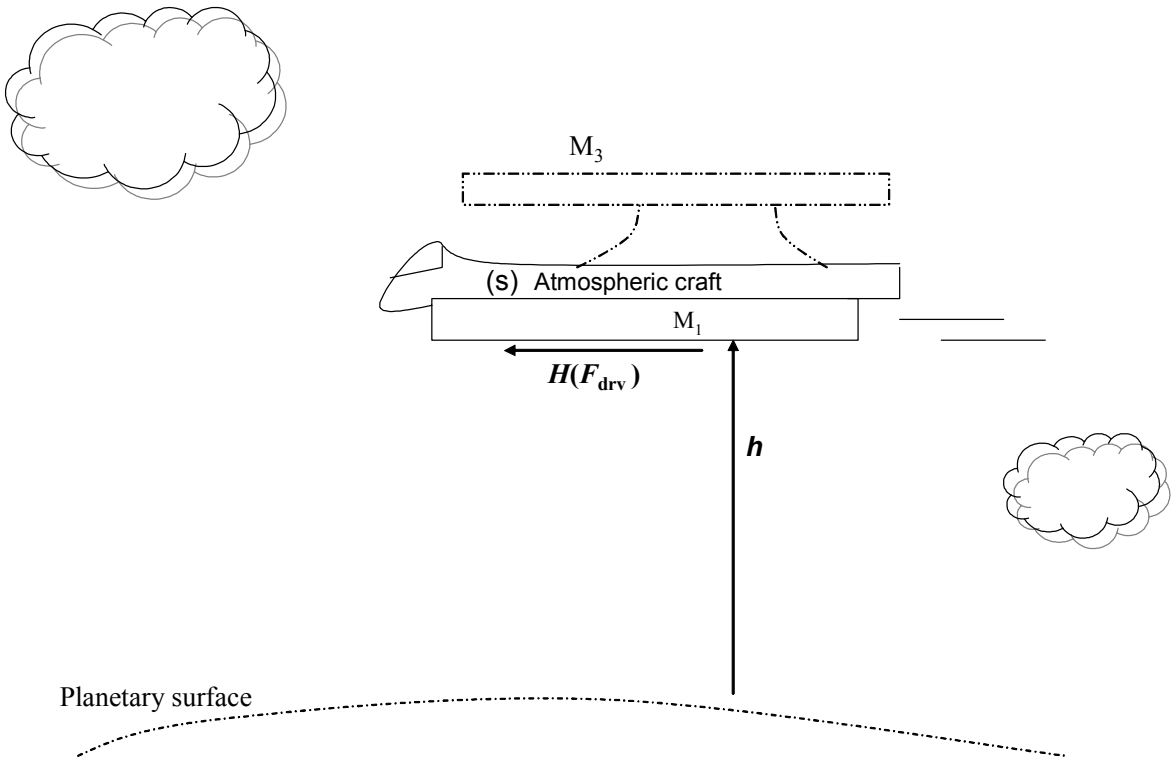

Fig. 6-2 Aircraft type vehicle M_2 (planetary magnetic field)

The atmospheric application would involve aircraft *in the Earth realm*. The propulsion system does not require internal combustion. Thus, neither jet fuel nor propeller-engine fuel is required. Additionally, air-flow requirements could be eliminated. This includes such aviation problems of turbulence, fowl air (e.g. volcanic-ash, bird-strikes, etc.), need for airstrips. Commercial aviation could become a productive, cost-effective industry, when fuel costs are eliminated by Geodesic-Fall propulsion technology.

6.3 *Spacecraft Propulsion*

Spacecraft propulsion was the initial focus of the geodesic-fall derivation. The spacecraft application is fully described in sec. 5, above.

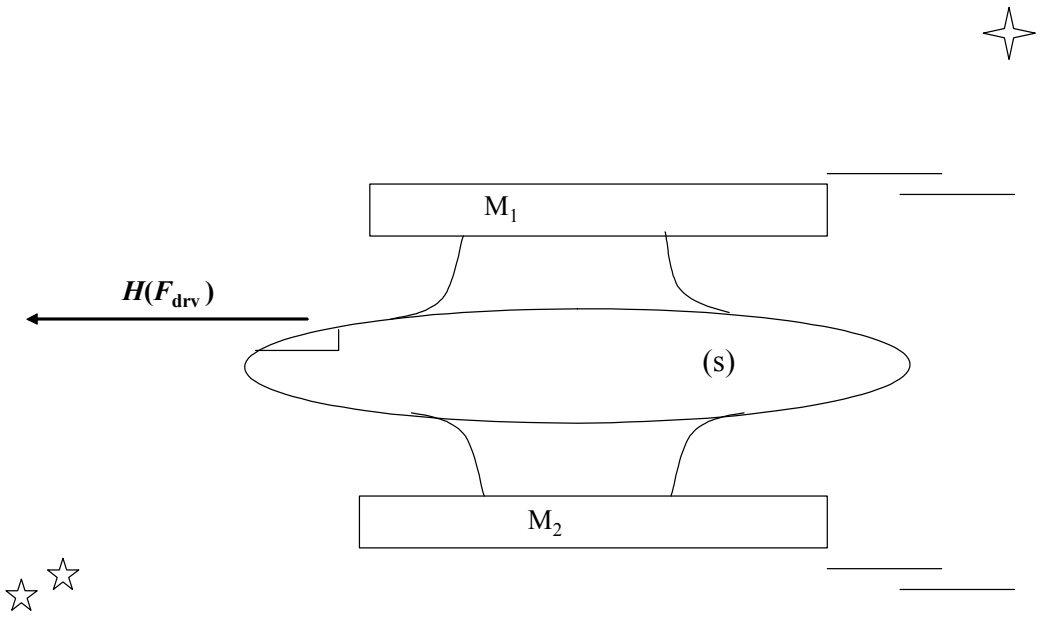

Fig. 6-3 Generic Spacecraft Configuration

For all geodesic-fall propulsion system applications, $\boldsymbol{H} \approx \boldsymbol{H}(\boldsymbol{F}_{drv})$. The magnitude & direction of the geodesic-fall vector $\boldsymbol{H}(\boldsymbol{F}_{drv})$ depends on the driving function ($\boldsymbol{F}_{drv}$). Therefore, control of the driving function defines a generic engineering framework for command & control, and navigation of vehicles using Geodesic-Fall propulsion.

6.3.1 *Advanced Configuration*

As an advanced configuration, one considers the concept of a rotating dipole (M_3) between counter-rotating magnetic fields (M_1 and M_2). The proper use of (M_3) can control the configuration of the bubble, and thus the resulting geodesic path. Thus, (M_3) is a mechanism to control direction, attitude, and speed components of vehicular motion. Fig. 6-4 shows the fundamental advanced configuration. Fig. 6-5 shows a tactical view of the advanced configuration.

6.3.1.1 *Rotating Dipoles*

The rotating dipole (M_3) is a principal component of an advanced Geodesic-Fall/Curvature-Drive propulsion system. For conceptual clarity, we again consider that magnetism and gravitation are both manifestations of spacetime curvature. Thus, creating a gravity-neutral region is, by definition, inducing spacetime curvature opposite to that of Newtonian gravity. Levitation results from/in the induced gravity-neutral region. Now considering a generic dipole (rotating clockwise or counter-clockwise) between counter-rotating magnetic fields (M_1 & M_2). The rotating dipole M_3 is either counter-rotating with M_1 and co-rotating with M_2 or counter-rotating with M_2 and co-rotating with M_1.For this discussion we will consider the clockwise case. Here, M_3 and M_1 are counter-rotating, producing a *sub anti-gravity region* between M_3 and M_1. This *sub anti-gravity region* can alter the geodesic curve induced by the main counter-rotating magnetic fields (M_1 & M_2). The rotating dipole M_3 is a means to control the configuration of the anti-gravity region (i.e. “Bubble”) produced by the main counter-rotating magnetic fields (M_1 & M_2). By the principles and process defined in [17,18], the rotating dipole can provide a means for directional control of a Curvature-Drive propulsion system.

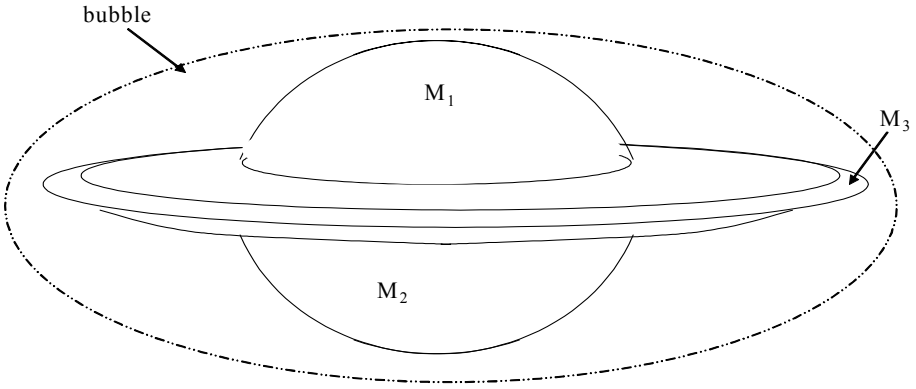

Fig. 6-4 Advanced Spacecraft Architecture

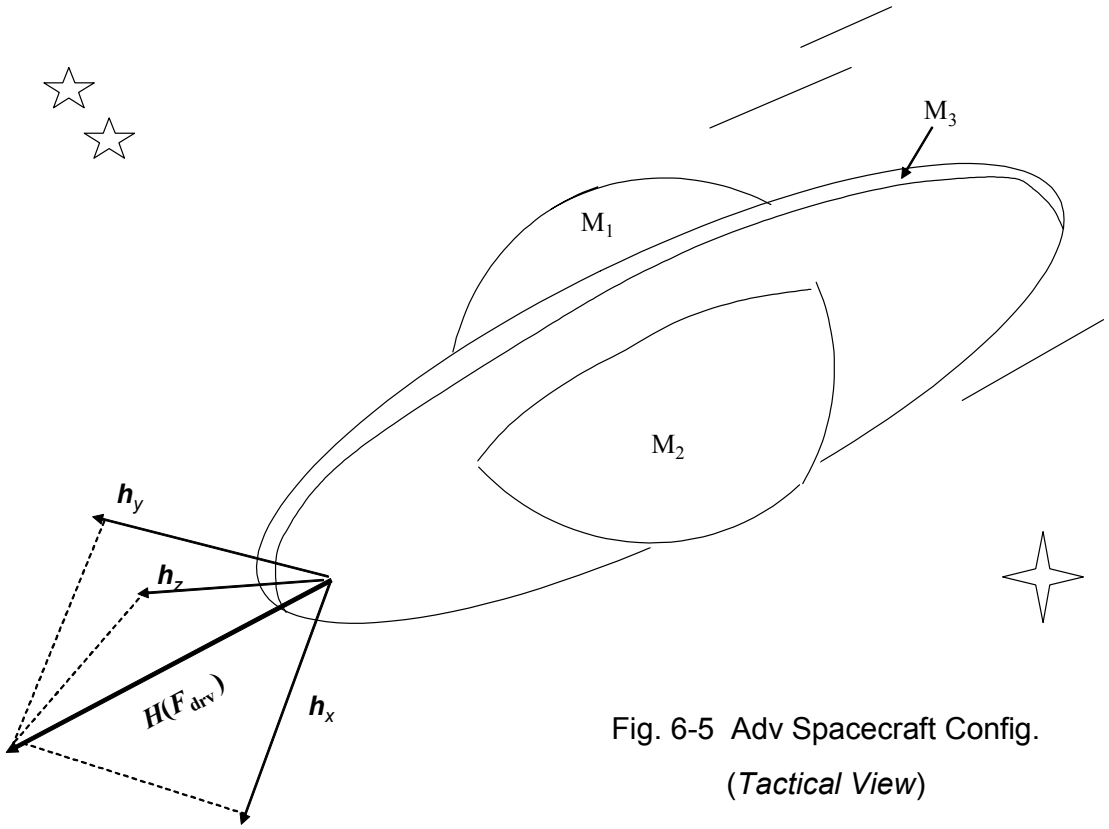

Fig. 6-5 Adv Spacecraft Config.
(*Tactical View*)

6.3.1.1.1 *Directional Control* (*Basic Principles*)

This section is a brief analytical discussion of using the rotating dipole M_3 for propulsion system control.

Let;

$\Phi \rightarrow$ The amplified scalar potential due to counter-rotation of M_i and M_j

$M_k \rightarrow$ A third rotating magnetic field, between M_i and M_j

Then;

The rotation and magnitude of the $M_\zeta \big|_{\zeta = I, j, k}$ determines a driving function Φ_λ , with which to amplify Φ . The amplification results from SCR. From the above driving function analysis, we have the following;

$$(\nabla \boldsymbol{\mu}_i (t) \bullet \mathbf{B}_i (r) + \nabla \boldsymbol{\mu}_k (t) \bullet \mathbf{B}_k (r)) = \Phi_i$$
$$(\nabla \boldsymbol{\mu}_1 (t) \bullet \mathbf{B}_1 (r) + \nabla \boldsymbol{\mu}_k (t) \bullet \mathbf{B}_k (r)) = \Phi_j$$

The total driving function is $\{ \Phi_\lambda + \Phi_i + \Phi_j = \Phi_{tot} \}$

$$\boldsymbol{F}(\Phi_{tot}) = \boldsymbol{F}_{drv} \approx \Phi_{tot}$$

$$\boldsymbol{F}_{drv} = \nabla \boldsymbol{\mu}_i (t) \times \mathbf{B}_i (r) + \nabla \boldsymbol{\mu}_1 (t) \bullet \mathbf{B}_1 (r) \pm \nabla \boldsymbol{\mu}_k (t) \times \mathbf{B}_k (r)$$

The equations of motion can then be written as follows;

$$\begin{aligned} \boldsymbol{H} &= M_i M_j / \boldsymbol{r}^2 \\ \boldsymbol{F} &= -K T_{\mu\nu} + \ell T^{\lambda}_{\mu\nu} \\ &= G_{\mu\nu} \\ &= -K T_{\mu\nu} + \Phi_{tot} \\ &= \boldsymbol{H} (\boldsymbol{F}_{drv}) \end{aligned}$$

F *is the heave force (**H**), from sec. 5.1 above. It is fundamentally equivalent to the induced curvature* $G_{\mu\nu}$ *. This is the conceptual basis for determination of the force and velocity vectors for a vehicle using the curvature-drive (Geodesic-Fall) propulsion system.*

6.4 *Some Ramifications*

One can claim the geodesic-fall propulsion process includes a magnetic-levitation (mag-lev) type process, wherein the magnets are carried by the vehicle undergoing propulsion. Said vehicle is no longer constrained by a base/rail, as is a typical mono-rail system or other similar mag-lev type systems. A vehicle (while under geodesic-fall propulsion) is free of terrain constraints. Roads, bridges, etc. would not be needed. Transportation infrastructure requirements would be significantly reduced.

One can also claim that said vehicle, since internal-combustion is not used, is free of emissions, and has minimal environmental impact, and could eliminate oil dependency for transportation systems. *The potential implications, for spacecraft propulsion, are enormous. Principal among such implications is the removal of the speed-of-light as a velocity constraint [10]*.

6.5 *Powering a Geodesic-Fall Propulsion System*

A concept for powering a Geodesic-Fall propulsion system is given in appendix B. It is applicable for providing power to;

- --- vehicles
- --- space stations
- --- planetary structures
  - buildings
  - dwellings
  - stations
  - etc.

7.0 Costs, Risk-Factors, Payoff-Potential

This section is a cursory discussion, attempting to highlight some primary issues and obstacles that might need attention, when moving forward with the technology defined in this document.

7.1 *Risks*

The technical risk factors are arguably minimal. The ECE-Theory has been proven. A device technology has been defined [17-23], which is the focus of this paper. This technology includes the capability to produce SCR [18], and thus anti-gravity effects, and the ability to transfer energy from the background potential energy of spacetime. As shown herein, this technology can be the basis for revolutionizing the transportation industry, the power/energy industry, and the aerospace & defense industries. Successful initial steps, to an energy transfer device (i.e. a cross-field generator) have been taken. A cross-field generator device is discussed in Appendix B.

The primary risk factor is overcoming the present entrenched technological & economic infrastructures. *The cross-field device technology is disruptive technology*. It will severely, and adversely impact the status-quo. The status-quo (i.e. in-place geo-political industrial complex) includes "*Big Oil*", the electric-power industry, and railroads. Technology alone might not overcome the status-quo. A large commitment to marketing, public-relations, and political operation will be required.

7.2 *Costs*

Initial technical costs (for the 1st cross-field device construction, and demonstration) should be relatively minimal (approx: $3M - $3.5M, for 1yr to 18 months). Subsequent *counter*-status-quo costs could be reduced, if marketing to industries that could immediately benefit from the technology is successful. The aerospace & defense industries are examples. Thus, a large funding commitment to marketing is anticipated. A departure from conventional marketing strategy would be gaining government support & funding for execution of technology development programs. Such a program, *including costs & financial factors*, is proposed in [24]. The obvious environmental benefits of the technology could be emphasized to governments, with the help of interested high-profile green organizations. This would amount to reduced marketing costs to potential government customers.

7.3 *Payoff*

Some primary benefits the technology offers are the following;

- ----- cars that fly & don't need gasoline
- ----- cheap reproducible energy
- ----- fast, economic, secure space-travel

The payoff in *each* of these areas alone could be $multi-billions. Plus, *a measure of control* of these industral areas could be possible through the cross-field technology. As such, the payoff could extend beyond monetary parameters. These payoff factors could begin to surface within 1 yr. of the 1st cross-field device demonstration.

8.0 Summary

With this document, we attempt to aid the reader in visualization of the basic geodesic-fall process. The levitron-like-devices exhibit (*and the Levitron, at the laboratory scale*) behavior similar to that of a vehicle under a geodesic-fall propulsion process. *No exotic matter, hyperspace, or other such conundrums are involved*. The fundamental equivalence, of the geodesic-fall process and the Levitron-like-device mag-lev dynamics, is shown. *The mag-lev process is actually a manipulation of spacetime curvature*. This discussion should facilitate & accelerate better understanding of the geodesic-fall process, and provide a design & engineering framework for geodesic-fall propulsion systems.

Fundamentally, the equivalence of electromagnetism and gravitation is shown in [7]. In [14], the overall constraints of Relativity are generalized to the more comprehensive ECE-Theory. This leads to several significant ramifications [10], [19-23]. Principle among these, from an engineering perspective, is the removal of the speed-of-light (c) as a constraint on achievable velocities. The geodesic-fall process exploits these principles, using controlled electromagnetism to induce spacetime curvature, which can result in propulsion. This propulsion method/process is not constrained by (c). The geodesic-fall propulsion technology offers the ability to exceed the speed-of-light, *in normal spacetime*. For spacecraft applications, the speed of light is no longer a limit. Practical, *cost-effective*, safe space travel can be within reach.

It offers a technology free of internal combustion, nuclear costs & dangers, independent of fossil-fuels (*and other costly energy requirements*), and applicable to most forms of vehicular transport. This is fundamental, *if* present environmental and economic concerns are to be *effectively* addressed.

9.0 Acknowledgements

Prof. Myron W. Evans, Dr. Horst Eckardt, Mr. Simon Clifford, Dr. Douglas Lindstrom and the AIAS environment are thanked for many interesting discussions, and invaluable suggestions.

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Aspects of Differential Geometry

Appendix A

Considering the levitron-like-device, where the base is a rotating magnetic field, we define a basis for the device's top, and a basis for the device's base. We then take the following steps;

-- define covariant derivatives for a vector in the top's vector space
-- define covariant derivatives for a vector in the base's vector space
-- take commutator of the covariant derivatives
(2 torsion tensors should result, considering eq. 9 of [11])

Let:

$(x_b , y_b , z_b, t_b) = \mathcal{V}^b \rightarrow$ base ; $(x_z , y_z , z_z, t_z) = \mathcal{V}^z \rightarrow$ top

be base vectors for the coordinate systems of the device base and top, respectively.

Since a vector is a tensor of rank 1, the covariant derivatives of $\mathcal{V}^b$ and $\mathcal{V}^z$ are;

$$D_\mu \mathcal{V}^b = \partial_\mu \mathcal{V}^b + \Gamma_{\mu\theta}{}^b \mathcal{V}^\theta$$
$$D_\mu \mathcal{V}^z = \partial_\mu \mathcal{V}^z + \Gamma_{\mu\theta}{}^z \mathcal{V}^\theta$$

As the commutator of covariant derivatives operates on vectors $\mathcal{V}^b$ and $\mathcal{V}^z$ we have the following;

$$[D_\mu , D_\nu] \mathcal{V}^b = R^b{}_{\sigma\mu\nu} \mathcal{V}^\sigma - T^\kappa{}_{\mu\nu} D_\kappa \mathcal{V}^b \quad \text{and} \quad [D_\mu , D_\nu] \mathcal{V}^z = R^z{}_{\sigma\mu\nu} \mathcal{V}^\sigma - T^\kappa{}_{\mu\nu} D_\kappa \mathcal{V}^z$$

Substituting $D_\mu \mathcal{V}^b$ and $D_\mu \mathcal{V}^z$ in the expressions for $[D_\mu , D_\nu] \mathcal{V}^b$ and $[D_\mu , D_\nu] \mathcal{V}^z$ respectively, yields the following 2 torsion tensors;

$T_{\mu b}{}^\theta = q^\theta{}_a \, T^a{}_{\mu b} \rightarrow$ torsion tensor (from [9]) for the device's base

$T_{\mu z}{}^\theta = q^\theta{}_a \, T^a{}_{\mu z} \rightarrow$ torsion tensor (from [9]) for the device's top
(where: (q) --- is a tetrad/frame-field,
(a) --- is the index of the tangent space

Realizing the device's anti-gravity effect is enabled by induced curvature of spacetime, the interaction of the magnetic fields of its base-component and its top (i.e. the magnetic ring around its top), should be considered. One can replace the connection coefficients Γ with the interactive spin connection ω_{int} which (*simplifying indices*) results in the following basis vectors;

$$D_\mu \mathcal{V}^b = \partial_\mu \mathcal{V}^b + \omega_{int} \mathcal{V}^b$$

$$D_\mu \mathcal{V}^z = \partial_\mu \mathcal{V}^z + \omega_{int} \mathcal{V}^z$$

Under ECE-Theory & technology, a primary method for achieving counter-gravity effects is to use the electric field to induce a spacetime curvature of sufficient magnitude, and in the opposite direction of natural gravitational forces. We define:

$\omega_{int} \rightarrow$ the interactive spin connection between the device's base & top
$\Phi \rightarrow$ the spacetime electric potential energy

Φ must be sufficiently amplified, via SCR, to produce such spacetime curvature.

Energy Transfer

Appendix B

Energy Transfer Device
(*Operational Overview*)

The purposes of the energy transfer device are production of electric energy and production of anti-gravity conditions. The device works by using background potential energy of spacetime to power electrical mechanisms.

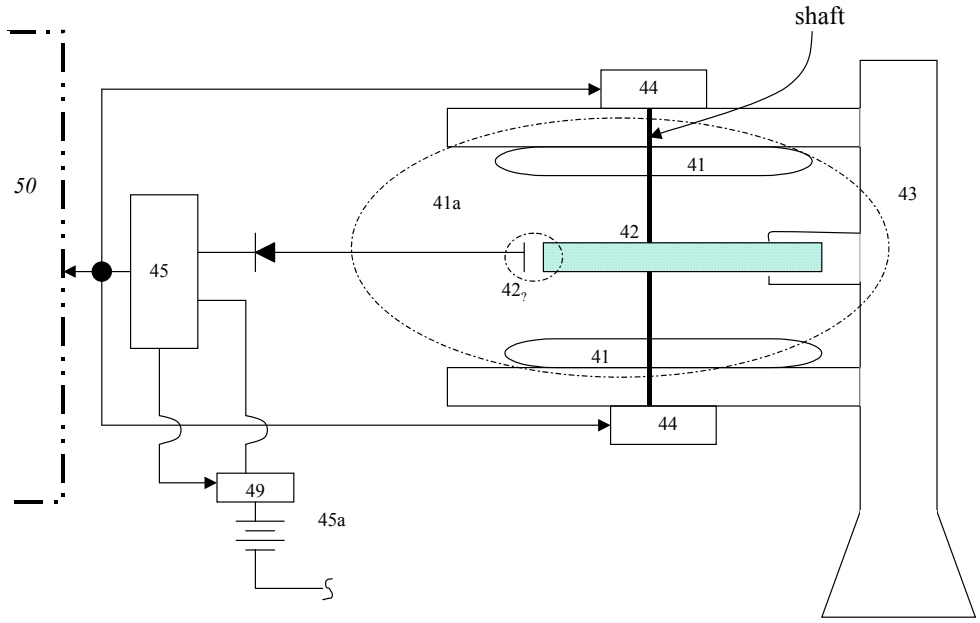
The energy transfer device is based on the new ECE-Theory of cosmology. The ECE (Einstein-Cartan-Evans)-Theory is a unified field theory, developed by Prof. Myron W. Evans in 2003. A major principle of the ECE-Theory is that electromagnetism and gravitation are both manifestations of spacetime curvature and spin. Electromagnetism is the spinning (or torsion) of spacetime. Gravitation is the curvature of spacetime. By properly amplifying the interaction between these forces, anti-gravity effects can be produced.

The ECE-Theory also shows that tapping between the background potential of spacetime can be established by appropriate electrical and/or mechanical devices. This tapping manifests as amplification of the potential (in volts) of such devices, as said devices resonate with the background potential energy of spacetime. This phenomenon is called spin-connection-resonance (SCR). The device can be used to demonstrate SCR, to refine methods of attaining SCR, and to examine SCR related conditions. The device can be implemented on the laboratory-scale, or up-scaled for real applications.

It is well known, through research & experiment, that counter-rotating magnets can produce anti-gravity effects. This is an example of SCR. A dielectric material, in the resulting anti-gravity field, can cause energy transfer from the background potential of spacetime. This energy (in voltage) can be used to power electric devices, as the demonstration shows. This energy is a property of spacetime, thus in limitless supply. Dr. Horst Eckardt derived this concept in 2008.

The basic structure of the device includes two magnetic sources mounted on a stand, which separates the magnetic sources by a given space, such that a counter-gravitational region is induced in said space. Matter in this induced counter-gravitational region levitates, or in other words behaves as matter in a zero-gravity environment, such as outer-space.

The basic device structure is illustrated in the figure below. Components of the device are numbered to simplify the figure, and for clarity of description. The device consists of two magnetic sources 41, which can be implemented as basic magnets, magnetic disks, or as arrays of electromagnetic elements.



A Generic Device Configuration
(*for Electric Power Generation*)

A generic configuration, primarily for electric power generation is shown. The stand 43 can be any suitable material. The dielectric material 42 is used in the process of electric energy generation. The electric energy is generated by dynamics of the magnetic field, produced by the counter-rotating magnetic sources 41, interacting with the dielectric material 42. This is the initial demonstration unit. The magnetic sources 41 remain stationary, while the dielectric material 42 is rotated. The dielectric is implemented as a (*magnetic dipole*) flywheel type device. The motors 44 are used to spin/rotate the flywheel 42. Counter-rotation of the magnets is achieved by the spinning flywheel, because a rotating magnet (*with its poles rotating/spinning*) in the field of a stationary magnet, is the functional equivalent of two counter-rotating magnets. The area 41a, between the magnetic sources becomes an anti-gravity "bubble", wherein anti-gravity effects can be examined and utilized. The control circuit 45, and its initialization battery power subsystem 45a, is used to turn on the system, and to control the electric energy feed, from the device when the electric power transfer application is in operation. An alternate configuration, utilizing counter-rotating magnetic fields, generated by solenoid type devices is under construction & testing by ECE Technologies, Ltd. This configuration has several *engineering* advantages over the above experimental configuration.

This electric power is transferred from the spacetime background energy to the electric mechanism 50. The circuit 49, of the *initialization-battery-power* subsystem, detects the spacetime energy transfer, indicating the device is in operation. Once the device is operating, the circuit 49 causes the *initialization-battery-power* subsystem to shutdown. Then a portion of the electric power (*transferred from background potential energy of spacetime*) is distributed to the motors 44, to maintain device operation. A capacitor type arrangement 42_{λ} is used to extract resulting energy. The anti-gravity effect will increase the efficiency of the flywheel rotation. The dielectric material 42 is properly magnetized, for optimal operation of the device.

This device, an energy transfer unit, can be viewed *functionally* as a battery. Depending on device size, it can be used to power anything from cities, households, to vehicles, to handheld devices. *The household generator application would be of extreme benefit, as power outages (and related problems), and utility bills could be eliminated*. A low cost, efficient, environmentally-friendly energy resource is now continuously available. Requirements for gasoline (and other organic/fossil fuels) can be eliminated. Wind-farms, costly nuclear-energy, coal, and other pollutants can be put aside. *The environment can be saved*. An unlimited energy resource (spacetime) is all around us.

Proper utilization of the background energy reservoir of spacetime should prevent any future energy crisis (environmental or economic), in the foreseeable future of mankind.

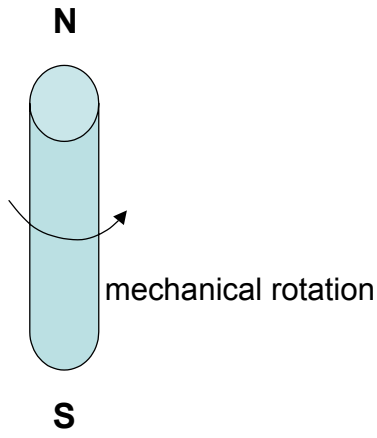
Rotation

Appendix C

It is important that there is no ambiguity concerning the meaning of a rotating magnetic *field*, as apposed to mechanical rotation/spin of a magnet. Generally, a spinning magnet (where the poles remain stationary), is a simple mechanical rotation. There is no *field* rotation. However, when the poles rotate, a *rotating magnetic field* is produced. Rotating-magnetic-fields (in a counter-rotation configuration) are used in the cross-field technology.

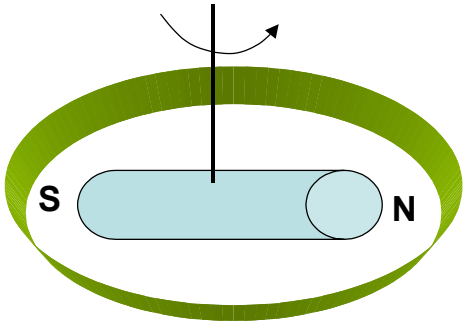
The figure used in this appendix, was prepared by Dr. Horst Eckardt.

Rotating Magnets



no rotating field

Example device:
Levitron's magnetic top



rotating field

Example device:
switched-linear-solenoid

Several commercially available devices can be used to produce rotating magnetic fields.

Notes