SPIN CONNECTION RESONANCE IN MAGNETIC MOTORS

by

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ABSTRACT

A mechanism is proposed for rotation of magnetic assemblies by a torque consisting of the magnetic dipole moment of the assembly and a magnetic field generated from space-time in Einstein Cartan Evans (ECE) field theory. It is shown that when the magnetic assembly is stationary, the space-time is described by a Helmholtz wave equation in the tetrad as eigenfunction. This is a balance condition in which the Cartan torsion of the space-time is zero but in which the tetrad and spin connection are non-zero. This balance may be broken by a driving current density produced by the magnetic assembly. The Helmholtz equation becomes an undamped oscillator equation. At resonance the torque on the magnetic assembly may be amplified sufficiently to cause the whole assembly to rotate as observed experimentally in a repeatable and reproducible manner.

Keywords: Spin connection resonance (SCR), magnetic motors, Einstein Cartan Evans (ECE) field theory.

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1. INTRODUCTION

Recently it has been shown in Einstein Cartan Evans (ECE) field theory {1-12} that electromagnetism is a property of space-time. The electromagnetic potential is the Cartan tetrad within a scaling factor $A^{(0)}$, where $cA^{(0)}$ has the units of volts, and the electromagnetic field is the Cartan torsion within the same scaling factor. The Einstein equation relating space-time geometry to canonical energy-momentum density has been extended to all fundamental fields, the gravitational, electromagnetic, weak, strong and matter fields. In index reduced form {13} this equation is:

$$R = - kT \qquad - (1)$$

where R is a well defined scalar curvature, k is the Einstein constant and T the index reduced canonical energy-momentum density. Eq. (1) shows that the latter is available from space-time scalar curvature for all fields, including the electromagnetic field. The ECE theory has been tested experimentally and theoretically {1-12} in numerous ways, and has also been applied to explain how the spin connection can create resonance amplification of voltages obtained from the interaction of space-time with a device of particular design. Examples have been given for the Coulomb Law and in magneto-statics.

In Section 2 ECE theory is applied to magnetic motors. It is known that magnetic assemblies of a given design can rotate and translate without batteries or electrical input of any kind. Such phenomena are reproducible and repeatable {14} but have no explanation in the standard model of electrodynamics, which is well known to be the Maxwell Heaviside (MH) theory of special relativity. In special relativity space-time is Minkowski space-time with metric diag (-1, 1, 1, 1). This kind of space-time has zero scalar curvature R, so T in Eq. (1) is zero. The space-time itself cannot input energy or momentum into a device in MH theory. In particular, a magnetic assembly does not rotate in MH theory without an electrical input of correct design. In ECE theory the space-time for electromagnetism is a dynamic space-time governed by Cartan geometry {15}. It is shown in this Section that when the magnetic assembly is stationary the space-time is such that it has no Cartan torsion, but has finite Cartan tetrad and spin connection. If it is assumed that the space part is isotropic, the tetrad is governed by a Helmholtz wave equation in which appears a characteristic wave-number κ , a property of the space-time itself. This is referred to in this paper as the balance condition.

In Section 3 the balance condition is broken by an initially small driving term, which is assumed to be cosinal or periodic, and which is a property of the magnetic assembly with characteristic wave-number κ_0. The Helmholtz equation becomes an undamped oscillator equation which resonates at:

$$\kappa_0 = \kappa . \qquad -(2)$$

This is referred to as the spin connection resonance condition. At resonance it is shown in Section 3 that the torque is amplified to the point at which the whole magnetic assembly begins to rotate as observed experimentally {14}. A similar analysis can be made for force, under which the magnetic assembly translates {14}. The magnetic motor is the rotating or translating magnetic assembly.

2. THE BALANCE CONDITION

In ECE theory {1-12} the magnetic flux density in Tesla is defined by:

$$\underline{B}^a = \underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b \qquad -(3)$$

where A^a is the vector potential and where $\underline{\omega}^a{}_b$ is the spin connection vector. The magnetic flux density may be expressed as an angular momentum {16} through:

$$\underline{B}^a = \left(\frac{\mu_0 e}{4\pi M r^3} \right) \underline{L}^a \quad -(4)$$

where μ_0 is the S. I. permeability of the vacuum, e is charge, M is mass and:

$$V = \frac{4}{3} \pi r^3 \quad -(5)$$

is the volume for an assumed spherical symmetry.

In the standard model:

$$\underline{B} = \underline{\nabla} \times \underline{A} \quad -(6)$$

and the spin connection is missing. There is no possibility of spin connection resonance (SCR) in the standard model.

Given the existence of a net magnetic dipole moment $\underline{m}$ in a magnet or assembly of magnets, there is present a force, torque and energy defined by:

$$\underline{F}^a = \underline{\nabla} (\underline{m} \cdot \underline{B}^a) \quad -(7)$$

$$\underline{Tq}^a = \underline{m} \times \underline{B}^a \quad -(8)$$

$$En^a = - \underline{m} \cdot \underline{B}^a . \quad -(9)$$

In ECE theory the torque is:

$$\underline{Tq}^a = \frac{1}{3} \left(\frac{\mu_0 e}{M V} \right) \underline{m} \times \underline{L}^a \quad -(10)$$

where the angular momentum is:

$$\underline{L}^a = \frac{3 M V}{\mu_0 e} \left(\underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b \right) \quad -(11)$$

$$= 3\left(\frac{m \nabla A^{(0)}}{\mu_0 e}\right)\left(\underline{\nabla} \times \underline{q}^a - \underline{\omega}^a{}_b \times \underline{q}^b\right). \quad -(12)$$

Here q^a is the vector part of the Cartan tetrad:

$$q^a_\mu = \left(q^a_0, -\underline{q}^a\right) \quad -(13)$$

which defines the Cartan torsion through the first structure equation of Cartan:

$$T^a = d \wedge q^a + \omega^a{}_b \wedge q^b. \quad -(14)$$

So the origin of the torque (12) is the Cartan torsion of space-time itself. In the standard model $\underline{A}$ is considered classically as a convenient mathematical quantity introduced by Heaviside, and has no relation to the Cartan tetrad in the standard model (MH theory). Therefore in ECE theory the torque on a magnetic assembly of net magnetic dipole moment $\underline{m}$ is:

$$\underline{Tq}^a = A^{(0)} \underline{m} \times \left(\underline{\nabla} \times q^a - \underline{\omega}^a{}_b \times \underline{q}^b\right). \quad -(15)$$

In this expression $\underline{m}$ and $A^{(0)}$ are properties of the magnetic assembly, and the rest of the expression is space-time itself. It is seen that if:

$$\underline{\nabla} \times \underline{q}^a = \underline{\omega}^a{}_b \times \underline{q}^b \quad -(16)$$

there is no torque, and the magnetic assembly does not spin. It is observed experimentally {14} that a magnetic assembly of a given critical design spins continuously with no electrical input of any kind. This is a reproducible and repeatable phenomenon that has no explanation in MH theory. In ECE theory the phenomenon is explained straightforwardly as a torque between $\underline{m}$ and a magnetic flux density:

$$\underline{B}^a = A^{(0)} \left(\underline{\nabla} \times \underline{v}^a - \underline{\omega}^a{}_b \times \underline{v}^b \right) \quad -(17)$$

generated by space-time. Thus, ECE theory is preferred over MH theory.

The balance condition may be expressed in the complex circular basis {1-12} as:

$$\underline{\nabla} \times \underline{v}^{(1)*} = i \kappa_1 \underline{v}^{(2)} \times \underline{v}^{(3)} \quad -(18)$$

$$\underline{\nabla} \times \underline{v}^{(2)*} = i \kappa_2 \underline{v}^{(3)} \times \underline{v}^{(1)} \quad -(19)$$

$$\underline{\nabla} \times \underline{v}^{(3)*} = i \kappa_3 \underline{v}^{(1)} \times \underline{v}^{(2)} \quad -(20)$$

in general. For plane wave solutions {1-12}:

$$\underline{v}^{(1)} = \underline{v}^{(2)*} = \frac{1}{\sqrt{2}} \left(\underline{i} - i \underline{j} \right) e^{i(\omega t - \kappa Z)}, \quad -(21)$$

$$\underline{v}^{(3)} = \underline{v}^{(3)*} = \underline{k}, \quad -(22)$$

and the condition (16) becomes a Beltrami condition {1-12}:

$$\underline{\nabla} \times \underline{v}^{(1)} = -\kappa \underline{v}^{(1)} \quad -(23)$$

$$\underline{\nabla} \times \underline{v}^{(2)} = \kappa \underline{v}^{(2)} \quad -(24)$$

$$\underline{\nabla} \times \underline{v}^{(3)} = 0 \, \underline{v}^{(3)} \quad -(25)$$

with eigenvalues - κ , κ , and 0 , indicating O(3) symmetry. These may be regarded as being generated from the boson eigenvalues -1, 0 and 1. The fermion eigenvalues are -1/2 and ½.

The Beltrami condition is in turn a Helmholtz wave equation. This is shown for example as follows:

$$\underline{\nabla} \times (\underline{\nabla} \times \underline{v}^{(1)}) = -\kappa\, \underline{\nabla} \times \underline{v}^{(1)}$$
$$= \kappa^2 \underline{v}^{(1)}. \quad -(26)$$

Using the vector identity:

$$\underline{\nabla} \times (\underline{\nabla} \times \underline{v}^{(1)}) = \underline{\nabla}(\underline{\nabla} \cdot \underline{v}^{(1)}) - \nabla^2 \underline{v}^{(1)} \quad -(27)$$

and using the property of the plane wave:

$$\underline{\nabla} \cdot \underline{v}^{(1)} = 0 \quad -(28)$$

we obtain three Helmholtz wave equations:

$$(\nabla^2 + \kappa^2)\,\underline{v}^{(1)} = \underline{0}, \quad -(29)$$
$$(\nabla^2 + \kappa^2)\,\underline{v}^{(2)} = \underline{0}, \quad -(30)$$
$$(\nabla^2 + 0)\,\underline{v}^{(3)} = \underline{0}. \quad -(31)$$

Note carefully that these are wave equations of the space-time ITSELF when there is no Cartan torsion and where a rotational symmetry has been assumed for the space part of the space-time. This is equivalent to assuming an O(3) or isotropic symmetry. Therefore the Helmholtz equations define the balance condition under which there is no torque between the magnetic dipole moment of the assembly and the space-time surrounding it. This is the condition of for example a non-rotating bar magnet resting on a laboratory bench. The magnet's own magnetic field cannot rotate it, and there is no space-time torque to rotate it.

3. ROTATING THE MAGNETIC ASSEMBLY

In order to rotate the magnetic assembly as observed experimentally {14} it is assumed that the Helmholtz equation of space-time, of general form:

$$(\nabla^2 + \kappa^2)\underline{q} = \underline{0} \quad -(32)$$

is changed into an undamped resonator equation {17} by the addition of a right hand driving term as follows:

$$(\nabla^2 + \kappa^2)\underline{q} = \underline{R}\cos(\underline{\kappa}_0 \cdot \underline{r}) \quad -(33)$$

where $\underline{R}$ has the units of inverse square meters, the units of curvature. In the Z axis:

$$(\nabla^2 + \kappa^2) q_Z = R_Z \cos(\kappa_0 Z). \quad -(34)$$

The solution of Eq. (34) is {1-12, 17}:

$$q_Z = \frac{R_Z \cos(\kappa_0 Z)}{\kappa_0^2 - \kappa^2} \quad -(35)$$

and at the resonance condition

$$\kappa_0 = \kappa \quad -(36)$$

q_Z goes to infinity. This means that the potential {1-12}:

$$A_Z = A^{(0)} q_Z \quad -(37)$$

goes to infinity and the torque:

$$\underline{Tq} = \underline{m} \times \underline{B}_Z \quad -(38)$$

between $\underline{m}$ and space-time goes to infinity.

In practical terms enough torque is generated so that the magnetic motor starts to rotate indefinitely as observed {14}. This is a qualitative explanation which shows that the rotation of the magnetic assembly is due to a torque between its magnetic dipole moment and space-time. It is also shown that resonant amplification is needed, it is observed experimentally {14} that the magnetic assembly starts to rotate only when a critical design is completed, for example by the addition of a small component. Without the right design, rotation does not occur. The key design of the assembly is described by the resonance condition:

$$\kappa_0 = \kappa \qquad -(39)$$

of Eq. (36). Here κ_0 is a characteristic wave-number (inverse distance) of the assembly and κ of space-time. The small driving term on the right hand side of Eq. (34) is amplified at resonance, and it is assumed that the driving term is a property of the magnetic assembly. When the latter is such that Eq. (39) holds, the torque is amplified enough to produce rotation. It is observed {14} that the rotation occurs only when the magnetic design is correct and when the rotation starts, it is continuous. This means that the driving term must be periodic, the simplest type being the cosine of Eq. (34).

It is well known that the compass needle rotates to magnetic north and stops. In ECE theory this is due to the Cartan torsion of space-time indicating the presence of the Earth's static magnetic field $\underline{B}$. The torque on the compass needle is:

$$\underline{Tq} = \underline{m} \times \underline{B} \qquad -(40)$$

where $\underline{m}$ is its magnetic dipole moment. When $\underline{m}$ is parallel to $\underline{B}$ the torque vanishes and the needle points to magnetic north and stops rotating. In order to make a magnetic assembly rotate continuously without stopping, as observed {14}, a spinning torque is needed as in Eq. (34), a static torque is not sufficient.

This is a qualitative and essentially simple explanation of magnetic motors in ECE theory. In MH theory there is no explanation of magnetic motors because there is no mechanism in ~~E~~ M H theory through which $\underline{m}$ can form a torque with space-time.

4. MAGNETIC EQUIVALENT OF OHM'S LAW.

(Horst Eckardt's section)

4. MAGNETIC EQUIVALENT OF OHM'S LAW

After the qualitative explanation of magnetic motors we try to go a step further to come to design methods for such devices. We already know that the assembly has to provide a periodic driving term (Eq. (33)) providing the resonance condition (36) for the spatial frequency. The driving term contains a vector of curvature, $\underline{R}$. So far we have not discussed how to provide such a curvature. This can be created electromagnetically since electromagnetic fields exhibit curvature as well as torsion. From {5} we know that magnetic fields can be enhanced by a resonance which is induced by a homogeneous current. Such fields can serve then for providing the curvature $\underline{R}$ used in Eq. (33).

From existing rotating magnetic assemblies {14} it is known that they do not have complicated setups. Some experimenters report on special materials they have used. This leads to the assumption that the homogeneous current is produced in the magnets directly, may it be the rotating parts or the stationary space-time modulation parts or both. To explain this we use an analogy to the standard theory. In Ohm's law the charge current (inhomogeneous current in ECE parlance) is assumed to be proportional to the electric field:

$$\underline{J} = \sigma \, \underline{E} \tag{41}$$

where $\underline{J}$ is the vector of charge current density, $\underline{E}$ the electric field and σ the conductivity which is assumed to be a scalar quantity in most cases. Inserting this term in the MH equations eliminates the current terms and ensures that the feed-back of the fields on the conduction effects is fully accounted for.

The analogue can be done for the homogeneous current j of ECE theory. We assume

$$\underline{j} = \sigma_m \, \underline{B} \tag{42}$$

for the current density of the homogeneous current with a "magnetic conductivity" σ_m. This means that magnets having a suitable material constant σ_m create a homogeneous current by their permanent magnetic field.

The homogeneous current appears in the generalized Faraday law of ECE theory (with indices omitted):

$$\underline{\nabla} \times \underline{E} + \partial \underline{B}/\partial t = \mu_0 \, \underline{j}' =: \underline{j} \tag{43}$$

The left hand side has the physical units of Weber/m^{2}s, this is a magnetic flux density per second, or a magnetic current density, fully analogous to the electrical charge current density. Therefore $\underline{j}$ represents a magnetic current density. If we subsume the factor μ_0 into $\underline{j}$ for convenience, as indicated in Eq. (43), we obtain from Eq. (42) that σ_m has the units of inverse time or frequency. This is plausible since B is magnetic induction or flux densitiy, and B per time gives the flux per time as calculated for $\underline{j}$. In total we have:

$$[E] = V/m \tag{44a}$$

$$[B] = Wb/m^2 \tag{44b}$$

$$[\underline{J}] = A/m^2 = C/m^2s \tag{44c}$$

$$[\underline{j}] = Wb/m^2s \tag{44d}$$

$$[\sigma] = A/Vm = C/Vms \tag{44e}$$

$$[\sigma_m] = 1/s \tag{44f}$$

To develop the analogy between electric and magnetic current further, one can think about "magnetic charges" to be carriers of the flow. Indeed the ECE theory allows this by the generalized Gauss law

$$\underline{\nabla} \cdot \underline{B} = \mu_0 \, j_0, \tag{45}$$

but these charges are not necessarily required to make up a magnetic flux. This is seen from comparing Eq. (44e) with (44f). The units of σ contain a charge quantity, while the units of σ_m do not. So magnetic monopoles are not required for explanation.

Finally there are further methods imaginable for producing rotation of magnetic assemblies. From Eq. (43) it can be seen that $\underline{j}$ can lead to a timely varying magnetic field which in turn may be used to render the resonance frequency being required for creating the torque. Science is at the very beginning of understanding devices for gaining energy from space-time, and in this paper the first successful attempt to describe rotating magnetic assemblies was made.

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