1) 132(1): Relation between the Antisymmetry Law and the Lorentz Boost.

The antisymmetry law means that tetrad components are related as follows:

$$\partial_\mu q^a_\nu = -\partial_\nu q^a_\mu, \quad -(1)$$

Therefore potential components are related by:

$$\partial_\mu A^a_\nu = -\partial_\nu A^a_\mu. \quad -(2)$$

The minimal prescription is:

$$p^a_\mu = e A^a_\mu \quad -(3)$$

so A^a_μ is a momentum within e. In the limit of one frame moving with uniform velocity with respect to another:

$$A^{a'} = \Lambda^{a'}{}_a A^a \quad -(4)$$

for each μ. Here $\Lambda^{a'}{}_a$ is the Lorentz transform matrix:

$$\Lambda^{a'}{}_a = \begin{bmatrix} \cosh\phi & 0 & 0 & -\sinh\phi \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -\sinh\phi & 0 & 0 & \cosh\phi \end{bmatrix} \quad -(5)$$

Therefore tetrads are related by:

$$q^{a'}_\mu = \Lambda^{a'}{}_a q^a_\mu. \quad -(6)$$

In the case of a Z axis electric field:

$$E^{(3)}_Z = \phi_0 \frac{\partial q^{(3)}_0}{\partial Z} = \phi_0 \cdot \frac{1}{c} \frac{\partial q^{(3)}_3}{\partial t} \quad -(7)$$

2) For attraction between two charges, experiment shows that:

$$\phi_0 = -\frac{e}{4\pi\epsilon_0 Z} \quad -(8)$$

and:

$$E_Z^{(3)} = \frac{e}{4\pi\epsilon_0 Z^2} \quad -(9)$$

so:

$$q_0^{(3)} = -\frac{1}{Z} \quad -(10)$$

$$q_3^{(3)} = \left(\frac{ct}{Z}\right)\frac{1}{Z} \quad -(11)$$

Therefore:

$$\begin{bmatrix} \phi^{(0)} \\ 0 \\ 0 \\ \phi^{(3)} \end{bmatrix} = \frac{\phi_0}{Z}\begin{bmatrix} ct/Z & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & ct/Z \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix} \quad -(12)$$

Therefore

$$q_0^{(0)} = q_3^{(3)} = \left(\frac{ct}{Z}\right) \quad -(13)$$

$$q_3^{(0)} = q^3_{(0)} = -1 \quad -(14)$$

where a factor of $1/Z$ has been normalized out as in eq. (12).

Comparing eqs. (5) and (13):

$$\cosh\phi = \frac{ct}{Z}, \quad \sinh\phi = 1 \quad -(15)$$

In the Lorentz boost

$$\cosh\phi = \gamma, \quad \sinh\phi = \beta\gamma, \quad \tanh\phi = v/c \quad -(16)$$

3) Defining:
$$v = \frac{z}{t} \quad -(17)$$

it is seen that
$$\boxed{q_\mu^{\ a} = \frac{1}{\beta\gamma}\Lambda_\mu^{\ a}} \quad -(18)$$

where $q_\mu^{\ a}$ is the tetrad matrix defined in eq. (12):

$$q_\mu^{\ a} = \begin{bmatrix} c/v & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & c/v \end{bmatrix} \quad -(19)$$

and $\Lambda_\mu^{\ a}$ is the Lorentz transform matrix:

$$\Lambda_\mu^{\ a} = \begin{bmatrix} \gamma & 0 & 0 & -\beta\gamma \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -\beta\gamma & 0 & 0 & \gamma \end{bmatrix} \quad -(20)$$

Here:
$$\gamma = \frac{1}{(1 - v^2/c^2)^{1/2}}, \quad \beta = \frac{v}{c}. \quad -(21)$$

The Lorentz transform has been linked to the antisymmetry law through eq. (9):

$$q_\mu^{\ a} = \begin{bmatrix} 1/\beta & 0 & 0 & -1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ -1 & 0 & 0 & 1/\beta \end{bmatrix} \quad -(22)$$

1.132(2): Expressions for the "Static" Electric Field and the Gravitational Field.

In previous work the longitudinal component of the electric field was shown to be:

$$E_Z^{(3)} = -2\left(\frac{\partial \phi_0^{(3)}}{\partial Z} + \omega^{(3)}_{3(3)}\phi_0^{(3)} + \omega^{(3)}_{3(0)}\phi_0^{(0)}\right) \quad -(1)$$

$$= -2\left(\frac{1}{c}\frac{\partial \phi_Z^{(3)}}{\partial t} + \omega^{(3)}_{0(3)}\phi_Z^{(3)} + \omega^{(3)}_{0(0)}\phi_Z^{(0)}\right).$$

Defining:

$$v = Z/t \quad -(2)$$

it is found that:

$$\phi_3^{(3)} = -\left(\frac{c}{v}\right)\phi_0^{(3)}, \quad -(3)$$

$$\phi_0^{(0)} = -\left(\frac{c}{v}\right)\phi_{(3)}^{0} \quad -(4)$$

with:

$$\phi_0^{(0)} = \phi_3^{(3)}, \quad \phi_0^{(3)} = \phi_{(3)}^{0} \quad -(5)$$

Therefore:

$$E_Z^{(3)} = -2\left(\frac{1}{c}\frac{\partial \phi_3^{(3)}}{\partial t} + \left(\omega^{(3)}_{0(3)} - \frac{v}{c}\omega^{(3)}_{0(0)}\right)\phi_3^{(3)}\right)$$

$$= -2\left(\frac{1}{c}\frac{\partial \phi_0^{(3)}}{\partial Z} + \left(\omega^{(3)}_{3(3)} - \frac{c}{v}\omega^{(3)}_{3(0)}\right)\phi_0^{(3)}\right) \quad -(6)$$

Eq. (6) has the structure:

$$\boxed{E = -\frac{1}{c}\left(\frac{\partial \phi}{\partial Z} + \omega\phi\right)} \quad -(7)$$

where:

2.)

$$\phi = 2\phi_0^{(3)} \quad -(8)$$

$$\omega = \omega^{(3)}_{3}(3) - \frac{c}{v}\,\omega^{(3)}_{3}(0) \quad -(9)$$

Similarly:

$$\boxed{E = -\left(\frac{1}{c}\frac{\partial \phi_1}{\partial t} + \omega_1 \phi_1\right)} \quad -(10)$$

where:

$$\phi_1 = 2\phi_3^{(3)} \quad -(11)$$

$$\omega_1 = \omega^{(3)}_{0}(3) - \frac{v}{c}\,\omega^{(3)}_{0}(0) \quad -(12)$$

Similarly the gravitational field is:

$$g = -\left(\frac{\partial}{\partial Z} + \omega\right)\Phi \quad -(13)$$

or

$$g = -\left(\frac{1}{c}\frac{\partial}{\partial t} + \omega_1\right)\Phi_1 \quad -(14)$$

The longitudinal electric field and longitudinal gravitational field have a time dependent component through eqs. (10) and (14). The velocity of propagation of the field is finite through eq. (2). In a vacuum:

$$v \rightarrow c \quad -(15)$$

but in a material $v < c$. In the standard physics the spin connections are missing, and the

time dependence and finite velocity are also missing.
So in the standard model:

$$\underline{E} = ? - \underline{\nabla}\,\phi, \quad -(16)$$

$$\underline{g} = ? - \underline{\nabla}\,\Phi \quad -(17)$$

so

$$E = ? - \partial\phi/\partial Z \quad -(18)$$

$$g = ? - \partial\Phi/\partial Z \quad -(19)$$

along the Z axis.

Therefore in ECE theory all four polarizations of the electromagnetic and gravitational fields are physically meaningful and propagate at a finite velocity v. In the standard model, there are self-contradictions and errors introduced by the entirely arbitrary assertion that only transverse components are physically meaningful in a vacuum. There is no explanation in the standard model for the longitudinal electric field between two charges or the longitudinal gravitational field between two masses.

On the simplest level of mathematics, the antisymmetry law shows that:

$$\underline{E} = -\underline{\nabla}\,\phi = -\frac{\partial \underline{A}}{\partial t} \quad -(20)$$

$$\underline{g} = -\underline{\nabla}\,\Phi = -\frac{1}{c}\frac{\partial \underline{\Phi}}{\partial t} \quad -(21)$$

4)

In the above analysis the a index has been utilized to the full in order to show the presence of spin connection resonance. The a index appears in the first Cartan structure equation:

$$T^a_{\mu\nu} = (D \wedge q^a)_{\mu\nu}, \quad -(22)$$

which in tensorial notation is:

$$T^a_{\mu\nu} = \partial_\mu q^a_\nu - \partial_\nu q^a_\mu + \omega^a_{\mu b} q^b_\nu - \omega^a_{\nu b} q^b_\mu. \quad -(23)$$

$$= \left(\partial_\mu q^a_\nu + \omega^a_{\mu\nu}\right) - \left(\partial_\nu q^a_\mu + \omega^a_{\nu\mu}\right) \quad -(24)$$

where by definition

$$\omega^a_{\mu\nu} = \omega^a_{\mu b} q^b_\nu, \quad -(25)$$

$$\omega^a_{\nu\mu} = \omega^a_{\nu b} q^b_\mu. \quad -(26)$$

By antisymmetry in μ and ν:

$$\boxed{\begin{aligned} T^a_{\mu\nu} &= 2\left(\partial_\mu q^a_\nu + \omega^a_{\mu\nu}\right) \\ &= -2\left(\partial_\nu q^a_\mu + \omega^a_{\nu\mu}\right) \end{aligned}}, \quad -(27)$$

so $$T^\kappa_{\mu\nu} = q^\kappa_a T^a_{\mu\nu} = 2\Gamma^\kappa_{\mu\nu} = -2\Gamma^\kappa_{\nu\mu}. \quad -(28)$$

In the next note it is shown how the a index may be integrated out. This procedure simplifies eq. (27), but loses some information.

1. 132(3): Simplified Field Tensors of ECE Theory

The first Cartan structure equation is:

$$T^a_{\mu\nu} = \partial_\mu q^a_\nu - \partial_\nu q^a_\mu + \omega^a_{\mu\nu} - \omega^a_{\nu\mu}, \quad -(1)$$

i.e.:

$$\boxed{\tau^a_{\mu\nu} = \partial_\mu q^a_\nu - \partial_\nu q^a_\mu} \quad -(2)$$

where:

$$\boxed{\tau^a_{\mu\nu} = T^a_{\mu\nu} - \left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}\right).} \quad -(3)$$

Now incorporate the spin connection into the fundamental field definitions. The electromagnetic field is:

$$F^a_{\mu\nu} = \phi_0 \, \tau^a_{\mu\nu} \quad -(4)$$

and the gravitational field is:

$$g^a_{\mu\nu} = \Phi_0 \, \tau^a_{\mu\nu}. \quad -(5)$$

The gravitational and electromagnetic potentials are:

$$\Phi^a_\mu = \Phi_0 \, q^a_\mu, \quad -(6)$$

$$\phi^a_\mu = \phi_0 \, q^a_\mu \quad -(7)$$

So:

$$F^a_{\mu\nu} = \partial_\mu \phi^a_\nu - \partial_\nu \phi^a_\mu, \quad -(8)$$

$$g^a_{\mu\nu} = \partial_\mu \Phi^a_\nu - \partial_\nu \Phi^a_\mu, \quad -(9)$$

or

$$F^a = d \wedge \phi^a \quad -(10)$$

$$g^a = d \wedge \Phi^a. \quad -(11)$$

In vector notation:

$$\underline{E}^{a} = -\underline{\nabla}\phi^{a} - \frac{\partial \underline{A}^{a}}{\partial t}, \quad -(12)$$

$$\underline{B}^{a} = \underline{\nabla} \times \underline{A}^{a}, \quad -(13)$$

$$\underline{g}^{a} = -\underline{\nabla}\,\underline{\Phi}^{a} - \frac{1}{c}\frac{\partial \underline{\Phi}^{a}}{\partial t} \quad -(14)$$

$$\underline{h}^{a} = \frac{1}{c}\,\underline{\nabla} \times \underline{\Phi}^{a}. \quad -(15)$$

The four senses of polarization in the complex circular basis are:

$$a = (0), (1), (2), (3), \quad -(16)$$

in which

$$x^{\mu} = \left(x^{(0)}, x^{(1)}, x^{(2)}, x^{(3)}\right). \quad -(17)$$

Eqs. (12) to (15) hold for each sense of polarization of the electromagnetic and gravitational fields.

Therefore for each a, using antisymmetry:

$$\boxed{\begin{aligned}
\underline{E} &= -\underline{\nabla}\phi = -\frac{\partial \underline{A}}{\partial t} && -(18)\\
\underline{g} &= -\underline{\nabla}\,\underline{\Phi} = -\frac{1}{c}\frac{\partial \underline{\Phi}}{\partial t} && -(19)\\
\underline{B} &= \underline{\nabla} \times \underline{A}, && -(20)\\
\underline{h} &= \frac{1}{c}\,\underline{\nabla} \times \underline{\Phi} && -(21)\\
&\text{in which} \quad \frac{\partial A_x}{\partial Z} = -\frac{\partial A_Z}{\partial X} \ \text{etc.} && -(22)\\
&\frac{\partial \Phi_x}{\partial Z} = -\frac{\partial \Phi_Z}{\partial X} \ \text{etc.} && -(23)
\end{aligned}}$$

3) This type of ECE theory has the advantage of simplicity, but it obscures the presence of spin connection resonance. However it will be very useful for applications in electrical engineering that deal with the electric field in the form (18). Similarly for applications in gravitational engineering or cosmology.

For example, eq. (18) shows that the longitudinal electric field between two charges has a time dependence as well as the inverse square distance dependence. For the Coulomb field:

$$\underline{A}_Z = -\frac{e}{4\pi\epsilon_0}\int \frac{1}{Z^2}\,dt \quad -(24)$$

and for the Newton field:

$$\Phi_Z = -mGc\int \frac{1}{Z^2}\,dt \quad -(25)$$

The gravitomagnetic field $\underline{h}$ is provided by ECE theory as in previous papers.

In this type of ECE theory, for every sense of polarization:

$$\partial_\mu A_\nu = -\partial_\nu A_\mu \quad -(26)$$

in electromagnetic theory for example. Eq. (26) is mathematically the same as MH theory

4) on a superficial level, but eq. (26) is based on torsion and spin connection, neither of which exist in MH theory. Also, the usual gauge transform in MH theory is:

$$A_\mu \rightarrow A_\mu + \partial_\mu \chi \quad -(27)$$

If this is tried in eq. (26), the antisymmetry equation remains the same, because:

$$\partial_\mu \partial_\nu \chi = \partial_\nu \partial_\mu \chi = 0 \quad -(28)$$

by orthogonality of coordinates. However, antisymmetry means:

$$\partial_\mu \partial_\nu \chi = -\partial_\nu \partial_\mu \chi \quad -(29)$$

It follows from eqs. (28) and (29) that:

$$\chi = 0. \quad -(30)$$

The antisymmetry law removes gauge freedom. The whole of twentieth century gauge theory is meaningless.

1) 132(4): Antisymmetry in the Definition of the Magnetic Field.

The antisymmetry of the field tensor in ECE theory originates in the fundamental antisymmetry of the commutator as follows:

$$[D_\mu, D_\nu] V^\rho = R^\rho{}_{\sigma\mu\nu} V^\sigma - T^\lambda{}_{\mu\nu} D_\lambda V^\rho \quad -(1)$$

All quantities with μ and ν subscripts must be antisymmetric, they are all generated by the commutator.

The field tensor is:

$$F^a{}_{\mu\nu} = \partial_\mu A^a{}_\nu - \partial_\nu A^a{}_\mu + \omega^a{}_{\mu b} A^b{}_\nu - \omega^a{}_{\nu b} A^b{}_\mu \quad -(2)$$

where by definition:

$$\omega^a{}_{\mu\nu} = \omega^a{}_{\mu b} A^b{}_\nu \quad -(3)$$

$$\omega^a{}_{\nu\mu} = -\omega^a{}_{\nu b} A^b{}_\mu \quad -(4)$$

We have:

$$\omega^a{}_{\mu\nu} = -\omega^a{}_{\nu\mu} \quad -(5)$$

so:

$$\boxed{\omega^a{}_{\mu b} A^b{}_\nu = -\omega^a{}_{\nu b} A^b{}_\mu} \quad -(6)$$

In vector notation:

$$\boxed{\underline{\omega}^a{}_b \times \underline{A}^b = -\underline{A}^b \times \underline{\omega}^a{}_b} \quad -(7)$$

In general:

$$\underline{\omega} \neq \underline{A} \quad -(8)$$

An example of eq. (7) is the $\underline{B}^{(3)}$

field observed in the inverse Faraday effect:

$$\underline{B}^{(3)*} = -ig\,\underline{A}^{(1)} \times \underline{A}^{(2)} \quad -(9)$$

From eq. (5):

$$\boxed{B^{(3)}_{12} = A^{(0)}\,\omega^{(3)}_{12}} \quad -(10)$$

or in vector notation:

$$B^{(3)}_{Z} = A^{(0)}\,\omega^{(3)}_{Z} \quad -(11)$$

or:

$$\underline{B}^{(3)*} = A^{(0)}\,\underline{\omega}^{(3)*} \quad -(12)$$

$$= -ig\,\underline{A}^{(1)} \times \underline{A}^{(2)}$$

with:

$$\underline{A}^{(1)} \times \underline{A}^{(2)} = -\underline{A}^{(2)} \times \underline{A}^{(1)}. \quad -(13)$$

Therefore:

$$\underline{\omega}^{(3)*} = -\frac{ig}{A^{(0)}}\,\underline{A}^{(1)} \times \underline{A}^{(2)}. \quad -(14)$$

Finally use:

$$g = \kappa / A^{(0)} \quad -(15)$$

and

$$\boxed{\underline{\omega}^{(3)*} = -i\kappa\,\underline{e}^{(1)} \times \underline{e}^{(2)}} \quad -(16)$$

where:

$$\underline{e}^{(1)} = \underline{e}^{(2)*} = \frac{1}{\sqrt{2}}\left(\underline{i} - i\underline{j}\right) \quad -(17)$$

91) 132(5): Antisymmetry in the Definition of the Electric Field.

The Z axis electric field is:

$$E^a_{\ 03} = \partial_0 \phi^a_{\ 3} - \partial_3 \phi^a_{\ 0} + \omega^a_{\ 0b} \phi^b_{\ 3} - \omega^a_{\ 3b} \phi^b_{\ 0} \quad -(1)$$

where:

$$a = (3). \quad -(2)$$

Therefore:

$$E^{(3)}_{\ 03} = \partial_0 \phi^{(3)}_{\ 3} - \partial_3 \phi^{(3)}_{\ 0} + \omega^{(3)}_{\ 0b} \phi^b_{\ 3} - \omega^{(3)}_{\ 3b} \phi^b_{\ 0} \quad -(2)$$

$$= \partial_0 \phi^{(3)}_{\ 3} - \partial_3 \phi^{(3)}_{\ 0} + \omega^{(3)}_{\ 03} - \omega^{(3)}_{\ 30}.$$

The antisymmetry is:

$$\partial_0 \phi^{(3)}_{\ 3} = -\partial_3 \phi^{(3)}_{\ 0} \quad -(3)$$

$$\omega^{(3)}_{\ 03} = -\omega^{(3)}_{\ 30} \quad -(4)$$

Therefore

ELECTRIC $\rightarrow$ $$\boxed{\omega^{(3)}_{\ 0b} \phi^b_{\ 3} = -\omega^{(3)}_{\ 3b} \phi^b_{\ 0}} \quad -(5)$$

Note carefully that eq. (5) is a different type of antisymmetry from that relevant to the magnetic field:

MAGNETIC $\rightarrow$ $$\boxed{\omega^{(3)}_{\ 1b} \phi^b_{\ 2} = -\omega^{(3)}_{\ 2b} \phi^b_{\ 1}} \quad -(6)$$

Using: $$\phi_0 = c A_0 \quad -(7)$$

eq. (6) is:

$$\omega^{(3)}_{\ 1b} A^b_{\ 2} = -\omega^{(3)}_{\ 2b} A^b_{\ 1} \quad -(8)$$

So in vector notation, eq. (8) is:

$$\boxed{\underline{\omega}^a{}_b \times \underline{A}^b = -\underline{A}^b \times \underline{\omega}^a{}_b} \quad -(9)$$

However, in eq. (5), there are scalar valued and vector valued terms. The vectors are:

$$\underline{\phi}^b = \phi^b{}_1 \, \underline{i} + \phi^b{}_2 \, \underline{j} + \phi^b{}_3 \, \underline{k}, \quad -(10)$$

$$\underline{\omega}^{(3)}{}_b = \omega^{(3)}{}_{1b} \, \underline{i} + \omega^{(3)}{}_{2b} \, \underline{j} + \omega^{(3)}{}_{3b} \, \underline{k}. \quad -(11)$$

So:

$$\omega^{(3)}{}_{0b} \, \underline{\phi}^b = -\phi^b{}_0 \, \underline{\omega}^{(3)}{}_b \quad -(12)$$

or

$$\omega^{(3)}{}_{0b} \, \underline{A}^b = -c \, \phi^b{}_0 \, \underline{\omega}^{(3)}{}_b. \quad -(13)$$

In general:

$$\boxed{\omega^a{}_{0b} \, \underline{A}^b = -c \, \phi^b{}_0 \, \underline{\omega}^a{}_b} \quad -(14).$$

<u>Note carefully</u> that the spin connections of eqs. (9) and (14) are <u>different</u>. While it is true that in eq. (14):

$$\omega^a{}_{0b} \underline{A}^b \, (\text{electric}) \; // \; -c \phi^b{}_0 \underline{\omega}^a{}_b \, (\text{electric}) \quad -(15)$$

it does not follow that eq. (9) is zero.

1. 132(6): Electric Field in Engineering Model

The electric field is:

$$E^a_{\ oi} = \phi \left(\partial_0 q^a_{\ i} - \partial_i q^a_{\ 0} + \omega^a_{\ 0b} q^b_{\ i} - \omega^a_{\ ib} q^b_{\ 0} \right) \quad -(1)$$

where ϕ is in volts. By antisymmetry:

$$E^a_{\ oi} = 2\phi \left(\partial_0 q^a_{\ i} + \omega^a_{\ 0b} q^b_{\ i} \right) \quad -(2)$$
$$= -2\phi \left(\partial_i q^a_{\ 0} + \omega^a_{\ ib} q^b_{\ 0} \right)$$

and:

$$\partial_0 q^a_{\ i} = -\partial_i q^a_{\ 0}, \quad -(3)$$
$$\omega^a_{\ 0b} q^b_{\ i} = -\omega^a_{\ ib} q^b_{\ 0}. \quad -(4)$$

The following four vectors are used:

$$\partial_\mu = (\partial_0, \partial_i) = \left(\frac{1}{c}\frac{\partial}{\partial t}, \underline{\nabla} \right) \quad -(5)$$
$$q^a_{\ \mu} = (q^a_{\ 0}, q^a_{\ i}) = (q^a_{\ 0}, -\underline{q}^a) \quad -(6)$$
$$\omega^a_{\ \mu b} = (\omega^a_{\ 0b}, \omega^a_{\ ib}) = (\omega^a_{\ 0b}, -\underline{\omega}^a_{\ b}) \quad -(7)$$

The electric field vector is:

$$\underline{E}^a = E^a_{\ 01}\,\underline{i} + E^a_{\ 02}\,\underline{j} + E^a_{\ 03}\,\underline{k} \quad -(8)$$

Therefore:

$$\boxed{\begin{aligned} \underline{E}^a &= -2\phi \left(\underline{\nabla} q^a_{\ 0} - q^b_{\ 0}\, \underline{\omega}^a_{\ b} \right) \\ &= -2\phi \left(\frac{1}{c}\frac{\partial \underline{q}^a}{\partial t} - \omega^a_{\ 0b}\, \underline{q}^b \right) \end{aligned}} \quad -(9)$$

The a and b indices are of the complex

2. circular basis:

$$a = (0), (1), (2), (3). \quad -(10)$$

By definition:

$$\omega^a{}_{0i} = \omega^a{}_{0b}\, q^b{}_i \quad -(11)$$

$$\omega^a{}_{i0} = \omega^a{}_{ib}\, q^b{}_0 . \quad -(12)$$

Therefore eq. (4) is:

$$\omega^a{}_{0i} = -\omega^a{}_{i0} . \quad -(13)$$

The electric field is therefore:

$$E^a{}_{0i} = 2\phi\left(\partial_0 q^a{}_i + \omega^a{}_{0i}\right) \quad -(14)$$

$$= -2\phi\left(\partial_i q^a{}_0 + \omega^a{}_{i0}\right)$$

or in vector notation:

$$\boxed{\begin{aligned}\mathbf{E}^a &= -2\phi\left(\nabla q^a{}_0 - \boldsymbol{\omega}^a\right) \\ &= -2\phi\left(\frac{1}{c}\frac{\partial \mathbf{q}^a}{\partial t} + \boldsymbol{\omega}^a\right)\end{aligned}} \quad -(15)$$

with:

$$\nabla q^a{}_0 = \frac{1}{c}\frac{\partial \mathbf{q}^a}{\partial t} \quad -(16)$$

For each a:

$$\left(\mathbf{E} + 2\phi\,\boldsymbol{\omega}\right) = -2\nabla\phi_0 = -2\frac{\partial \mathbf{A}}{\partial t} \quad -(17)$$

where

$$\mathbf{A} = c\phi\,\mathbf{q} \quad -(18)$$

3.) The structure of eq. (9) gives Euler Bernoulli resonance in either $q^a{}_0$ or $\underline{q}^a$. Eq. (17) shows that the electric field of Maxwell Heaviside theory:

$$\underline{E} = -2\underline{\nabla}\,\phi = -2\frac{\partial \underline{A}}{\partial t} \quad -(19)$$

is replaced by $\boxed{\underline{E} + 2\phi\,\underline{\omega}}$ for each polarization index a.

Conclusion

In general relativity the electric field can be generated by spinning the frame of reference. Therefore electric field strength (volts per metre) is generated by the spinning of spacetime:

$$\boxed{\underline{E} = 2\phi\,\underline{\omega}} \quad -(20)$$

Similarly:

$$\boxed{\underline{g} = 2\,\Phi\,\underline{\omega}} \quad -(21)$$

in gravitational theory.

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1. 132(7): Magnetic Field in Engineering Model

This is given by:

$$B^a_{ij} = A\left(\partial_i q^a_j - \partial_j q^a_i + \omega^a_{ib} q^b_j - \omega^a_{jb} q^b_i\right) \quad -(1)$$

Here:

$$\underline{B}^a = B^a_{23}\,\underline{i} + B^a_{31}\,\underline{j} + B^a_{12}\,\underline{k} \quad -(2)$$

For example:

$$\begin{aligned} B^a_3 = B^a_{12} &= A\left(\partial_1 q^a_2 - \partial_2 q^a_1 + \omega^a_{1b} q^b_2 - \omega^a_{2b} q^b_1\right) \\ &= A\left(\partial_1 q^a_2 - \partial_2 q^a_1 + \omega^a_{12} - \omega^a_{21}\right) \\ &= A\left(\partial_1 q^a_2 - \partial_2 q^a_1 + 2\omega^a_3\right) \quad -(3) \end{aligned}$$

So:

$$B^a_3 - 2A\omega^a_3 = A\left(\partial_1 q^a_2 - \partial_2 q^a_1\right) \quad -(4)$$

i.e.

$$B^a_Z - 2A\omega^a_Z = \left(\underline{\nabla} \times \underline{A}\right)_Z \quad -(5)$$

$$\boxed{\underline{B}^a - 2A\underline{\omega}^a = \underline{\nabla} \times \underline{A}^a} \quad -(6)$$

A magnetic field is generated by spinning spacetime:

$$\underline{B}^a = 2A\underline{\omega}^a \quad -(7)$$

The vector format of eq. (1) is:

$$\boxed{\underline{B}^a = \underline{\nabla} \times \underline{A}^a - \underline{\omega}^a{}_b \times \underline{A}^b} \quad -(8)$$

2)

Antisymmetry means:

$$\partial_i q^a_j = -\partial_j q^a_i \quad -(9)$$

$$\omega^a_{ib} q^b_j = -\omega^a_{jb} q^b_i \quad -(10)$$

The structure of eq. (8) leads to Euler-Bernoulli resonance, and eqs. (6) and (7) are equivalent equations which show very clearly that in general relativity, a magnetic field is generated by spinning spacetime.

Similarly, the gravitomagnetic field h^a is generated by spinning spacetime:

$$\boxed{\underline{h}^a = 2\frac{\Phi}{c}\underline{\omega}^a} \quad -(11)$$

or:

$$h^a_{ij} = \frac{\Phi}{c}\left(\omega^a_{ij} - \omega^a_{ji}\right) \quad -(12)$$

The gravitational field is:

$$g^a_{oi} = \Phi\left(\omega^a_{oi} - \omega^a_{io}\right) \quad -(13)$$

In S.I. units, in analogy to the relation between E and B in S.I. units

3) The gravitomagnetic field is c times smaller than the gravitational field.

Analogously:

$$E^{a}_{0i} = \phi \left(\omega^{a}_{0i} - \omega^{a}_{i0} \right) \quad -(14)$$

and

$$B^{a}_{ij} = \frac{\phi}{c} \left(\omega^{a}_{ij} - \omega^{a}_{ji} \right). \quad -(15)$$

In S.I. units:

g is $\frac{e}{4\pi\epsilon_0 G M}$ smaller than E

h is " " " B.

for a given distance r between two charged masses.

1. 132(8): New Definition of the Magnetic Field.

From the antisymmetry laws:

$$\frac{\partial \underline{A}^a}{\partial t} = \underline{\nabla} \phi^a \quad -(1)$$

it is found that:

$$\underline{\nabla} \times \left(\frac{\partial \underline{A}^a}{\partial t} \right) = \underline{\nabla} \times \underline{\nabla} \phi^a \quad -(2)$$
$$= \underline{0}$$

If it is assumed that:

$$\underline{A}^a \parallel \frac{\partial \underline{A}^a}{\partial t} \quad -(3)$$

then:

$$\boxed{\underline{\nabla} \times \underline{A}^a = \underline{0}} \quad -(4)$$

The magnetic field is then:

$$\boxed{\begin{aligned} \underline{B}^a &= -\underline{\omega}^a{}_b \times \underline{A}^b \\ &= 2 A \underline{\omega}^a \end{aligned}} \quad -(5)$$

and is defined directly by the spin connection.

As pointed out in previous work:

$$\underline{B}^{(3)} = 2 A \underline{\omega}^{(3)} \quad -(6)$$

THIS PROVES THAT ELECTRODYNAMICS IS GENERAL RELATIVITY.

1) 132(9): Some Consequences of Antisymmetry

On the u(1) level:

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} \quad -(1)$$

where

$$\underline{\nabla}\phi = \frac{\partial \underline{A}}{\partial t}. \quad -(2)$$

Therefore:

$$\underline{\nabla} \times \underline{\nabla}\phi = \underline{\nabla} \times \left(\frac{\partial \underline{A}}{\partial t}\right) = \underline{0}. \quad -(3)$$

If:

$$\underline{A} \parallel \frac{\partial \underline{A}}{\partial t}, \quad -(4)$$

then

$$\underline{B} = \underline{\nabla} \times \underline{A} = \underline{0}. \quad -(5)$$

In free space:

$$\underline{\nabla} \times \underline{E} + \frac{\partial \underline{B}}{\partial t} = \underline{0} \quad -(6)$$

$$\underline{\nabla} \times \underline{B} - \frac{1}{c^2}\frac{\partial \underline{E}}{\partial t} = \underline{0} \quad -(7)$$

so:

$$\underline{\nabla} \times \underline{E} = \underline{0}, \quad \frac{\partial \underline{E}}{\partial t} = \underline{0} \quad -(8)$$

This means:

$$\underline{\nabla} \times \frac{\partial \underline{A}}{\partial t} = \underline{0} \quad -(9)$$

$$\frac{\partial^2 \underline{A}}{\partial t^2} = \underline{0} \quad -(10)$$

Eq. (9) is the same as eq. (3). A possible solution of eq. (10) is:

$$\underline{E} = -2\frac{\partial \underline{A}}{\partial t} = \underline{0} \quad -(11)$$

2)

If it is assumed that $\underline{A}$ has no time dependence, or that there is no vector potential associated with a static electric field, then:

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} = \underline{0} \quad -(12)$$

because:

$$\frac{\partial \underline{A}}{\partial t} = \underline{\nabla}\phi = \underline{0} \quad -(13)$$

or:

$$\underline{A} = \underline{0}. \quad -(14)$$

In this case:

$$\boxed{\partial_\mu A_\nu = \partial_\nu A_\mu = 0} \quad -(15)$$

and

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu = 0 \quad -(16)$$

On the ECE level:

$$\left.\begin{aligned} E^a_{\ 0i} &= \phi\left(\omega^a_{\ 0b} q^b_{\ i} - \omega^a_{\ ib} q^b_{\ 0}\right) \\ B^a_{\ ij} &= \frac{\phi}{c}\left(\omega^a_{\ ib} q^b_{\ j} - \omega^a_{\ jb} q^b_{\ i}\right) \end{aligned}\right\} -(17)$$

In vector notation:

$$\boxed{\begin{aligned} \underline{E}^a &= 2\phi\, \underline{\omega}^a_E \quad -(18) \\ \underline{B}^a &= \frac{2\phi}{c}\, \underline{\omega}^a_m \quad -(19) \end{aligned}}$$

On the U(1) level the antisymmetry law

3) means that:

$$\underline{B} = \underline{0} \quad -(20)$$

So $\underline{E}$ can only be static. If it is assumed that for a static electric field, there is no vector potential, the usual u(1) assumption, then:

$$\underline{E} = \underline{0}. \quad -(21)$$

The antisymmetry law means that u(1) sector symmetry electrodynamics collapses completely.

On the ECE level, the theory simplifies to eqs. (18) and (19). We define:

1) The electric spin connection, $\underline{\omega}^a_E$.

2) The magnetic spin connection, $\underline{\omega}^a_B$.

Spin Connection Resonance

Resonant structure must now be found from:

$$F^a_{\mu\nu} = A^{(0)}\left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}\right) \quad -(21)$$

$$\partial_\mu F^{a\mu\nu} + \omega^a_{\mu b} F^{b\mu\nu} = A R^{a\ \mu\nu}_{\ \mu} \quad -(22)$$

In this structure, the Cartan torsion simplifies to:

$$T^a_{\mu\nu} = \omega^a_{\mu\nu} - \omega^a_{\nu\mu} \quad -(23)$$

4)

$$= \omega^a_{\mu b} q^b_\nu - \omega^a_{\nu b} q^b_\mu \quad -(24)$$

and the Riemann torsion is:

$$T^\lambda_{\mu\nu} = q^\lambda_a T^a_{\mu\nu}$$

$$= q^\lambda_a \left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu} \right) \quad -(25)$$

$$= \Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}$$

Therefore:

$$\boxed{\Gamma^\lambda_{\mu\nu} = q^\lambda_a \omega^a_{\mu\nu} = \omega^\lambda_{\mu\nu}} \quad -(26)$$

An example of eq. (22) is:

$$\underline{\nabla} \cdot \underline{E}^a + \underline{\omega}^a{}_b \cdot \underline{E}^b = \phi R^a \quad -(27)$$

where:

$$R^a = R^a{}_1{}^{10} + R^a{}_2{}^{20} + R^a{}_3{}^{30} \quad -(28)$$

So eq. (27) is:

$$\boxed{\underline{\nabla} \cdot \underline{\omega}^a_E + \underline{\omega}^a{}_b \cdot \underline{\omega}^b_E = \frac{R^a}{2}} \quad -(29)$$

So:

$$\cancel{\nabla^2 \omega^a_E + \underline{\omega}^a{}_b \cdot \left(\underline{\nabla} \cdot \underline{\omega}^b_E \right)}$$

$$\cancel{+ \underline{\omega}^b_E \cdot \left(\underline{\nabla} \cdot \underline{\omega}^a{}_b \right) =}$$

for example:

$$\frac{\partial \omega^a_E}{\partial Z} + \omega^a{}_b\,\omega^b_E = \frac{R^a}{2} \quad -(30)$$

and

$$\boxed{\frac{\partial^2 \omega^a_E}{\partial Z^2} + \left(\frac{\partial \omega^a{}_b}{\partial Z}\right)\omega^b_E + \omega^a{}_b\,\frac{\partial \omega^b_E}{\partial Z} = \frac{1}{2}\left(\frac{\partial R^a}{\partial Z}\right)} \quad -(31)$$

If the right hand side is periodic this can produce resonance. At resonance, the electric field density is amplified.

In eq. (27):

$$\phi R^a = \rho^a / \epsilon_0 \quad -(32)$$

where ρ^a is electric charge density.

1) 132(10): Incompatibility of Antisymmetry and U(1)

In U(1):

$$\underline{E} = -\underline{\nabla}\phi - \frac{\partial \underline{A}}{\partial t} \quad -(1)$$

$$\underline{B} = \underline{\nabla} \times \underline{A} \quad -(2)$$

The antisymmetry laws are:

$$\partial_\mu A_\nu = -\partial_\nu A_\mu \quad -(3)$$

i.e.

$$\underline{\nabla}\phi = \frac{\partial \underline{A}}{\partial t} \quad -(4)$$

$$\partial_i A_j = -\partial_j A_i \quad -(5)$$

From (2) and (4):

$$\underline{\nabla} \times \frac{\partial \underline{A}}{\partial t} = \frac{\partial}{\partial t}\left(\underline{\nabla} \times \underline{A}\right) = \underline{0} \quad -(6)$$

So

$$\boxed{\frac{\partial \underline{B}}{\partial t} = \underline{0}} \quad -(7)$$

From the U(1) Faraday Law:

$$\boxed{\underline{\nabla} \times \underline{E} = \underline{0}} \quad -(8)$$

This ~~means that~~ both $\underline{E}$ and $\underline{B}$ are static, as usually defined in U(1). A static electric field in U(1) is defined by:

2)

$$\underline{A} = \underline{0}. \quad -(9)$$

Therefore: $$\underline{B} = \underline{\nabla} \times \underline{A} = \underline{0} \quad -(10)$$

and from eq. (4): $$\underline{\nabla}\phi = \underline{0} \quad -(11)$$

and so: $$\underline{E} = -\underline{\nabla}\phi = \underline{0} \quad -(12)$$

It is concluded that the antisymmetry law (3) means that $\underline{E}$ and $\underline{B}$ vanish, and U(1) electrodynamics is incompatible with fundamental antisymmetry.

As described by Ryder (2nd. ed.) pages 117 ff., the commutator method is:

$$[D_\mu, D_\nu]\phi = [\partial_\mu - igA_\mu, \partial_\nu - igA_\nu]\phi \quad -(13)$$

where ϕ is the gauge field. Eq. (13) is a round trip by parallel transport. The covariant derivative is:

$$D_\mu = \partial_\mu - igA_\mu \quad -(14)$$

where: $$g = \frac{e}{\hbar} = \frac{\kappa}{A^{(0)}} \quad -(15)$$

3) In eq. (13):

$$[\partial_\mu, \partial_\nu] = 0 \quad -(16)$$

So:

$$[D_\mu, D_\nu]\phi = -ig\left(\partial_\mu A_\nu - \partial_\nu A_\mu - ig[A_\mu, A_\nu]\right)\phi$$

$$-[\partial_\nu, A_\mu] \quad -(17)$$

$$= -ig\left([\partial_\mu, A_\nu] - ig[A_\mu, A_\nu]\right)\phi \quad -(18)$$

By definition:

$$[D_\mu, D_\nu]\phi = -[D_\nu, D_\mu]\phi \quad -(19)$$

$$[\partial_\mu, A_\nu]\phi = -[\partial_\nu, A_\mu]\phi \quad -(20)$$

$$[A_\mu, A_\nu]\phi = -[A_\nu, A_\mu]\phi \quad -(21)$$

As in paper 131, eq. (20) is:

$$[\partial_\mu, A_\nu]\phi = \partial_\mu A_\nu \phi \quad -(22)$$

$$= -[\partial_\nu, A_\mu]\phi = -\partial_\nu A_\mu \phi \quad -(23)$$

So:

$$\boxed{\partial_\mu A_\nu = -\partial_\nu A_\mu} \quad -(24)$$

The only way to resolve this paradox is to use ECE electrodynamics, where..

4)

$$\boxed{\begin{aligned} \underline{E}^{a} &= E^{(0)} \, \underline{\omega}^{a}_{E} \\ \underline{B}^{a} &= B^{(0)} \, \underline{\omega}^{a}_{B} \end{aligned}} \qquad \begin{aligned} &-(25) \\ &-(26) \end{aligned}$$

Replacement of the Gauge Field.

The $u(1)$ gauge field equation (13) is replaced by:

$$[D_\mu, D_\nu] V^\rho = R^\rho{}_{\sigma\mu\nu} V^\sigma - T^\lambda{}_{\mu\nu} D_\lambda V^\rho \qquad -(27)$$

in Riemann geometry. The ECE electromagnetic field is:

$$F^\lambda{}_{\mu\nu} = A^{(0)} T^\lambda{}_{\mu\nu} \qquad -(28)$$

Define:

$$\boxed{A^\rho = A^{(0)} V^\rho} \qquad -(29)$$

so A^ρ replaces V^ρ to give:

$$\boxed{[D_\mu, D_\nu] A^\rho = R^\rho{}_{\sigma\mu\nu} A^\sigma - F^\lambda{}_{\mu\nu} D_\lambda V^\rho} \qquad -(29)$$

i.e.

$$[D_\mu, D_\nu] A^\rho = -\Gamma^\lambda{}_{\mu\nu} D_\lambda V^\rho A^{(0)} + \cdots \qquad -(30)$$

where

$$\Gamma^\lambda{}_{\mu\nu} = -\Gamma^\lambda{}_{\nu\mu} \qquad -(31)$$

Eq. (29) is equivalent to its Cartan

5) format, in which:

$$F^a_{\mu\nu} = \partial_\mu A^a_\nu - \partial_\nu A^a_\mu + A^{(0)}\left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}\right) \quad -(32)$$

and

$$\partial_\mu A^a_\nu = -\partial_\nu A^a_\mu \quad -(33)$$

$$\omega^a_{\mu\nu} = -\omega^a_{\nu\mu} \quad -(34)$$

For each a:

$$\partial_\mu A_\nu = -\partial_\nu A_\mu \quad -(35)$$

$$\omega_{\mu\nu} = -\omega_{\nu\mu} \quad -(36)$$

Using the above arguments, it is concluded that the derivatives of the potentials do not produce electric or magnetic fields.

Therefore:

$$\boxed{F^a_{\mu\nu} = A^{(0)}\left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}\right)} \quad -(37)$$

We have, by definition:

$$F^\lambda_{\mu\nu} = q^\lambda_a F^a_{\mu\nu} = A^{(0)}\left(\Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}\right)$$

$$= A^{(0)} q^\lambda_a \left(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}\right) \quad -(38)$$

b) So:

$$\Gamma^{\lambda}_{\mu\nu} = q^{\lambda}_{\ a}\,\omega^{a}_{\mu\nu} = \omega^{\lambda}_{\mu\nu} \quad -(39)$$

$$\boxed{\Gamma^{\lambda}_{\mu\nu} = \omega^{\lambda}_{\mu\nu}} \quad -(40)$$

Also by definition

$$\omega^{a}_{\mu\nu} = \omega^{a}_{\mu b}\, q^{b}_{\nu} \quad -(41)$$

so:

$$A^{(0)}\left(\omega^{a}_{\mu\nu} - \omega^{a}_{\nu\mu}\right) = \omega^{a}_{\mu b}A^{b}_{\nu} - \omega^{a}_{\nu b}A^{b}_{\nu} \quad -(42)$$

Therefore:

$$\boxed{\begin{aligned} F^{a}_{\mu\nu} &= \omega^{a}_{\mu b}A^{b}_{\nu} - \omega^{a}_{\nu b}A^{b}_{\nu} \\ &= A^{(0)}\left(\omega^{a}_{\mu\nu} - \omega^{a}_{\nu\mu}\right) \end{aligned}} \quad -(43)$$

which replaces the old $u(1)$:

$$F_{\mu\nu} = \partial_{\mu}A_{\nu} - \partial_{\nu}A_{\mu} \quad -(44)$$

132(11): New Fundamental Antisymmetry of the Riemannian Curvature.

This is based on the electrodynamical result:

$$[\partial_\mu, A_\nu]\phi = (\partial_\mu A_\nu)\phi. \quad -(1)$$

In Riemann geometry:

$$[\partial_\mu, \Gamma^\rho_{\nu\lambda}]V^\lambda = \partial_\mu(\Gamma^\rho_{\nu\lambda}V^\lambda) - \Gamma^\rho_{\nu\lambda}\partial_\mu V^\lambda$$

$$= (\partial_\mu \Gamma^\rho_{\nu\lambda})V^\lambda + \Gamma^\rho_{\nu\lambda}\partial_\mu V^\lambda - \Gamma^\rho_{\nu\lambda}\partial_\mu V^\lambda$$

$$= (\partial_\mu \Gamma^\rho_{\nu\lambda})V^\lambda \quad -(2)$$

It follows that:

$$\boxed{\partial_\mu \Gamma^\rho_{\nu\lambda} = -\partial_\nu \Gamma^\rho_{\mu\lambda}} \quad -(3)$$

The Riemannian curvature is therefore:

$$R^\rho{}_{\sigma\mu\nu} = \partial_\mu \Gamma^\rho_{\nu\sigma} - \partial_\nu \Gamma^\rho_{\mu\sigma} + \Gamma^\rho_{\mu\lambda}\Gamma^\lambda_{\nu\sigma} - \Gamma^\rho_{\nu\lambda}\Gamma^\lambda_{\mu\sigma}$$

$$= 2(\partial_\mu \Gamma^\rho_{\nu\sigma} + \Gamma^\rho_{\mu\lambda}\Gamma^\lambda_{\nu\sigma}) \quad -(4)$$

and this greatly simplifies and clarifies its meaning. The complete antisymmetries are:

$$R^{\rho}{}_{\sigma\mu\nu} = - R^{\rho}{}_{\sigma\nu\mu} \quad -(5)$$

$$\partial_{\mu} \Gamma^{\rho}_{\nu\lambda} = - \partial_{\nu} \Gamma^{\rho}_{\mu\lambda} \quad -(6)$$

$$\Gamma^{\rho}_{\mu\lambda} \Gamma^{\lambda}_{\nu\sigma} = - \Gamma^{\rho}_{\nu\lambda} \Gamma^{\lambda}_{\mu\sigma} \quad -(7)$$

$$\Gamma^{\lambda}_{\mu\nu} = - \Gamma^{\lambda}_{\nu\mu} \quad -(8)$$

Similarly, the Riemannian torsion is:

$$T^{\lambda}_{\mu\nu} = \Gamma^{\lambda}_{\mu\nu} - \Gamma^{\lambda}_{\nu\mu} \quad -(9)$$

$$= 2\Gamma^{\lambda}_{\mu\nu} \quad -(10)$$

The only symmetry that appears in the textbooks is eq. (5). Finally, the connection of Riemann geometry must itself be a commutator, or have a commutator structure. These are all fundamental advances in Riemann (and Cartan) geometry. They work their way through into all geometries of the twentieth century which were derived from Riemann and Cartan geometry.