Chapter 10

ECE Antisymmetry Laws in the Natural Sciences and Engineering

by

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Abstract

New antisymmetry laws of gravitation and electrodynamics are derived within the context of ECE unified field theory. The Riemannian connection is shown to be antisymmetric and new potential antisymmetry laws of electrodynamics are inferred. Both inferences are based straightforwardly on the fundamental antisymmetry of the commutator of covariant derivatives. It follows that the Riemannian torsion is identically non-zero, and that the natural sciences and engineering should be developed from spacetime torsion. Fundamentally new antisymmetry laws are derived within the Riemannian curvature tensor. The gravitational and electrodynamical sectors of the standard model are wholly incompatible with the antisymmetry laws. For example, the latter show that there are no electric and magnetic fields in the U(1) sector symmetry, they both

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vanish. The gravitational, electric and magnetic fields are shown to be directly proportional to the respective spin connections of spacetime, so all are defined directly by the spinning of spacetime.

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10.1 Introduction

In recent papers of this series, [1] - [10], major advances have been made in areas such as gravitation and electrodynamics through the straightforward introduction of fundamental antisymmetry laws based on commutator antisymmetry. It has been shown (www.aias.us Paper 122) that the Riemannian connection is antisymmetric, and that in consequence, the Riemannian torsion is identically non-zero. The Einstein field equation is therefore fundamentally incorrect because of its arbitrary neglect of spacetime torsion. All metrics and inferences based on the Einstein field equation are also incorrect, notably the Einsteinian gravitational theory, the theory of Big Bang and black holes, and derivative dogma such as dark matter. These are well known to be unscientific ideas which have been replaced by ECE theory. Subsequently, in Paper 131 on www.aias,us fundamental antisymmetry laws were discovered in classical electrodynamics. These laws are new fundamental relations between Heaviside's potentials. It is shown in Section 2 that the standard U(1) sector of classical electrodynamics is incompatible with the fundamental antisymmetry laws of Paper 131. Application of the laws result in zero electric field and zero magnetic field. The only known theory of electrodynamics that is compatible with these fundamental antisymmetry laws is ECE theory, in which the electric and magnetic fields are directly proportional to their respective spin connections. The Heaviside potentials play no part in the definition of the electric and magnetic fields, so gauge freedom does not exist in nature. These conclusions overturn much of the empty dogma of the twentieth century in areas such as electrodynamics and gauge theory. Similarly, in the gravitational sector, the demonstration of antisymmetry in the connection overturns all the conclusions of the Einstein field equation. In Section 3, it is shown that there exist new antisymmetry relations within the Riemannian curvature tensor, relations which have been overlooked for over a hundred years. These again mean that the twentieth century development of gravitation is almost entirely pseudoscientific dogma. Furthermore, these conclusions are reached in a very simple way and for this reason are in accord with Ockham's Razor. To any scientist or engineer, the arguments are irrefutable.

10.2 The Incompatibility of U(1) Gauge Symmetry Electrodynamics and Fundamental Potential Antisymmetry

In the standard U(1) gauge symmetry electrodynamics the electromagnetic field tensor is well known to be defined by:

$$F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu \tag{10.1}$$

where A_μ is the four potential:

$$A_\mu = (\frac{\varphi}{c}, -\mathbf{A}). \tag{10.2}$$

Here φ is the Heaviside scalar potential and $\mathbf{A}$ is the vector potential. The antisymmetry law derived in paper 131 of www.aias.us is, on this U(1) level:

$$\partial_\mu \mathbf{A}_\nu = -\partial_\nu \mathbf{A}_\mu. \tag{10.3}$$

In vector notation:

$$\boldsymbol{\nabla}\varphi = \frac{\partial \mathbf{A}}{\partial t} \tag{10.4}$$

and

$$\frac{\partial \mathrm{A_j}}{\partial x_i} = -\frac{\partial \mathrm{A_i}}{\partial x_j}. \tag{10.5}$$

From Eqs. (10.1) and (10.4):

$$\boldsymbol{\nabla} \times \frac{\partial \mathbf{A}}{\partial t} = \frac{\partial}{\partial t}\boldsymbol{\nabla} \times \mathbf{A}) = 0. \tag{10.6}$$

On the U(1) level the electric field strength in volts per metre is defined by:

$$\mathbf{E} = -\boldsymbol{\nabla}\varphi - \frac{\mathbf{A}}{\partial t} \tag{10.7}$$

and the magnetic flux density in tesla by:

$$\mathbf{B} = \boldsymbol{\nabla} \times \mathbf{A}. \tag{10.8}$$

Therefore Eq. (10.6) implies that:

$$\frac{\partial \mathbf{B}}{\partial t} = 0. \tag{10.9}$$

It is immediately evident that $\mathbf{B}$ is always a static magnetic field, so the U(1) gauge sector symmetry is flawed fundamentally because it is not compatible with the very fundamental antisymmetry law (10.3). The U(1) Faraday law of induction is:

$$\boldsymbol{\nabla} \times \mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = 0 \tag{10.10}$$

so it follows that:

$$\boldsymbol{\nabla} \times \mathbf{E} = 0 \tag{10.11}$$

which is the U(1) equation [11] of a static electric field. A static electric field on the U(1) level is defined by [11]:

$$\mathbf{A} = 0 \tag{10.12}$$

so it follows that:

$$\mathbf{B} = \boldsymbol{\nabla} \times \mathbf{A} = 0. \tag{10.13}$$

From the antisymmetry equation (10.4) it follows that:

$$\boldsymbol{\nabla} \varphi = \frac{\partial \mathbf{A}}{\partial t} = 0 \tag{10.14}$$

and so:

$$\mathbf{E} = -\boldsymbol{\nabla} \varphi = 0. \tag{10.15}$$

The catastrophic result is obtained that the **E** and **B** fields vanish on the U(1) level. All attempts at constructing a unified field theory based on a U(1) sector symmetry are incorrect fundamentally. Even worse for the standard physics is that the method introduced by Heaviside of expressing electric and magnetic fields through Eqs. (10.7) and (10.8) must be abandoned, so all of twentieth century gauge theory is proven to be empty dogma. This conclusion reinforces many other ways [1]- [10] of showing that a U(1) gauge theory of electromagnetism is incorrect and that gauge freedom in the natural sciences is an illusion.

Furthermore, the fundamental antisymmetry equations (10.3) are obtained in an irrefutable way from the standard U(1) method itself. In this method the commutator of covariant derivatives acts on the gauge field ψ as follows [12]:

$$[D_\mu,\ D_\nu]\psi = [\partial_\mu - igA_\mu,\ \partial_\nu - igA_\nu\psi]. \tag{10.16}$$

The covariant derivative is:

$$D_\mu = \ \partial_\mu - igA_\mu \tag{10.17}$$

where

$$g = \frac{e}{\hbar} = \frac{\kappa}{A^{(0)}}. \tag{10.18}$$

Here e is the charge on the proton, $\hbar$ is the reduced Planck constant, κ is a wavenumber and $A^{(0)}$ is a scalar valued potential magnitude. The photon momentum is therefore:

$$p = \hbar\kappa = eA^{(0)}. \tag{10.19}$$

In Eq. (10.16):

$$[\partial_\mu,\ \partial_\nu] = 0 \tag{10.20}$$

so:

$$\begin{aligned}[D_\mu,\ D_\nu]\psi &= -ig(\ \partial_\mu A_\nu -\ \partial_\nu A_\mu - ig[A_\mu,\ A_\nu])\psi \\ &= ig([\ \partial_\mu,\ A_\nu] - ig[A_\mu,\ A_\nu])\psi\end{aligned} \tag{10.21}$$

By fundamental definition of the antisymmetric commutator:

$$[D_\mu,\ D_\nu]\psi = -[D_\nu,\ D_\mu]\psi, \tag{10.22}$$

$$[\partial_\mu, A_\nu]\psi = -[\partial_\nu,\ A_\mu]\psi, \tag{10.23}$$

$$[A_\mu,\ A_\nu]\psi = -[A_\nu,\ A_\mu]\psi. \tag{10.24}$$

As in Paper 131:

$$[\partial_\mu,\ A_\nu]\psi = -[\partial_\mu,\ A_\nu]\psi \tag{10.25}$$

so we obtain Eq. (10.3) irrefutably:

$$\partial_\mu A_\nu = -\partial_\nu A_\mu. \tag{10.26}$$

The derivation of the antisymmetry law is so simple that it is almost trivially evident from the commutator method. Yet the law is so powerful that it can refute one hundred years of dogma in a few lines of straightforward algebra.

This catastrophe for the standard model leaves ECE theory [1]- [10] as the only correct theory of electrodynamics. In the ECE unified field theory the electrodynamical sector is obtained from the equation [1] - [10]:

$$[D_\mu, D_\nu]V^\rho =\ R^\rho{}_{\sigma\mu\nu}V^\sigma - T^\lambda{}_{\mu\nu}D_\lambda V^\rho \tag{10.27}$$

in which the commutator of covariant derivatives acts on a vector V^ρ. In any spacetime and in any dimension to produce the Riemannian curvature $R^\rho{}_{\sigma\mu\nu}$ and the Riemannian torsion $T^\lambda{}_{\mu\nu}$. The electromagnetic field is:

$$F^\lambda{}_{\mu\nu} = A^{(0)}T^\lambda{}_{\mu\nu}. \tag{10.28}$$

Define the four-potential:

$$A^\rho := A^{(0)}V^\rho \tag{10.29}$$

to obtain:

$$[D_\mu,\ D_\nu]A^\rho = \ R^\rho{}_{\sigma\mu\nu}A^\sigma - F^\lambda{}_{\mu\nu}D_\lambda V^\rho. \tag{10.30}$$

Using the definition of the Riemannian torsion in terms of the Riemannian connection

$$T^\lambda{}_{\mu\nu} = \Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu} \tag{10.31}$$

Eq. (10.30) may be written as:

$$[D_\mu,\ D_\nu]A^\rho = -A^{(0)}F^\lambda{}_{\mu\nu}D_\lambda V^\rho + \ldots \tag{10.32}$$

whereby it is immediately evident that the Riemannian connection is antisymmetric:

$$\Gamma^\lambda_{\mu\nu} = -\Gamma^\lambda_{\nu\mu}, \tag{10.33}$$

not symmetric as in the mathematically incorrect standard model [13]. The Riemannian torsion is identically non-zero because the commutator is identically non-zero.

Eq. (10.30) is equivalent to its Cartan representation [1]- [10], [13]:

$$F^a{}_{\mu\nu} = \ \partial_\mu A^a_\nu - \ \partial_\nu A^a_\mu + A^{(0)}(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}) \tag{10.34}$$

in which the antisymmetry law is:

$$\partial_\mu A^a_\nu = - \ \partial_\nu A^a_\mu \tag{10.35}$$

and

$$\omega^a_{\mu\nu} = -\omega^a_{\nu\mu}. \tag{10.36}$$

For each internal index:

$$\partial_\mu A_\nu = - \ \partial_\nu A_\mu, \tag{10.37}$$

$$\omega_{\mu\nu} = -\omega_{\nu\mu}. \tag{10.38}$$

The first of these equations is identical to the U(1) version, but is written in a different spacetime, one in which the torsion and curvature are non-zero. In the Minkowski spacetime of the U(1) theory, the torsion and curvature are zero. Using the same arguments as for the U(1) gauge theory, the antisymmetry (10.37) prohibits the existence of an electric or magnetic field from this term. Therefore we obtain a result of major importance:

$$F^a_{\mu\nu} = A^{(0)}(\omega^a_{\mu\nu} - \omega^a_{\nu\mu}). \tag{10.39}$$

In vector notation, Eq. (10.39) is:

$$\mathbf{E}^a = E^{(0)}\boldsymbol{\omega}^a_E\ , \quad \mathbf{B}^a = B^{(0)}\boldsymbol{\omega}^a_B. \tag{10.40}$$

This means that the electric and magnetic fields are generated directly by their respective spin connection tensors or vectors. They are not generated by the electromagnetic potentials.

By definition:

$$F^{\lambda}{}_{\mu\nu} = q^{\lambda}_{a} F^{a}{}_{\mu\nu} = A^{(0)}(\Gamma^{\lambda}_{\mu\nu} - \Gamma^{\lambda}_{\nu\mu}) = A^{(0)} q^{\lambda}_{a}(\omega^{a}_{\mu\nu} - \omega^{a}_{\nu\mu}) \tag{10.41}$$

so:

$$\Gamma^{\lambda}_{\mu\nu} = q^{\lambda}_{a}\omega^{a}_{\mu\nu} = \omega^{\lambda}_{\mu\nu} \tag{10.42}$$

for ECE electromagnetism. By definition:

$$\omega^{a}_{\mu\nu} = \omega^{a}_{\mu b} q^{b}_{\nu} \tag{10.43}$$

where $\omega^{a}_{\mu b}$ is the Cartan spin connection and where q^{b}_{ν} is the Cartan tetrad. Therefore:

$$F^{a}{}_{\mu\nu} = A^{(0)}(\omega^{a}_{\mu\nu} - \omega^{a}_{\nu\mu}) = \omega^{a}_{\mu b} A^{b}_{\nu} - \omega^{a}_{\nu b} A^{b}_{\mu}. \tag{10.44}$$

This expression replaces the incorrect U(1) equation:

$$F_{\mu\nu} =?\ \partial_{\mu} A_{\nu} - \partial_{\nu} A_{\mu}. \tag{10.45}$$

10.3 Novel Antisymmetries of the Riemann Curvature

These important new antisymmetries emerge in a simple and irrefutable way as follows. They have been missed since inception of Riemann geometry during the nineteenth century. In Paper 131 on www.aias.us and as used in Section 2, it is simple to show that:

$$[\ \partial_{\mu},\ A_{\nu}]\psi = (\ \partial_{\mu} A_{\nu})\psi \tag{10.46}$$

in electromagnetism. Applying this commutator method in Riemann geometry it is found that:

$$\begin{aligned}[\ \partial_{\mu},\ \Gamma^{\rho}_{\nu\lambda}]V^{\lambda} &= \ \partial_{\mu}(\Gamma^{\rho}_{\nu\lambda} V^{\lambda}) - \Gamma^{\rho}_{\nu\lambda}\ \partial_{\mu} V^{\lambda} \\ &= (\ \partial_{\mu}\Gamma^{\rho}_{\nu\lambda})V^{\lambda} + \Gamma^{\rho}_{\nu\lambda}\ \partial_{\mu} V^{\lambda} - \Gamma^{\rho}_{\nu\lambda}\ \partial_{\mu} V^{\lambda} \\ &= (\ \partial_{\mu}\Gamma^{\rho}_{\nu\lambda})V^{\lambda}.\end{aligned} \tag{10.47}$$

It follows immediately that:

$$\partial_{\mu}\Gamma^{\rho}_{\nu\lambda} = -\ \partial_{\nu}\Gamma^{\rho}_{\mu\lambda}. \tag{10.48}$$

The Riemannian curvature [1] - [10], [13] is the tensor:

$$R^{\rho}{}_{\sigma\mu\nu} = \ \partial_{\mu}\Gamma^{\rho}_{\nu\sigma} - \ \partial_{\nu}\Gamma^{\rho}_{\mu\sigma} + \Gamma^{\rho}_{\mu\lambda}\Gamma^{\lambda}_{\nu\sigma} - \Gamma^{\rho}_{\nu\lambda}\Gamma^{\lambda}_{\mu\sigma}. \tag{10.49}$$

By the fundamental antisymmetry (10.48), the curvature tensor can be written equivalently as:

$$R^{\rho}{}_{\sigma\mu\nu} = 2(\ \partial_\mu \Gamma^{\rho}_{\nu\sigma} + \Gamma^{\rho}_{\mu\lambda}\Gamma^{\lambda}_{\nu\sigma}). \tag{10.50}$$

The complete antisymmetries of the Riemannian curvature are therefore:

$$R^{\rho}{}_{\sigma\mu\nu} = -R^{\rho}_{\sigma\nu\mu}, \tag{10.51}$$

$$\partial_\mu \Gamma^{\rho}_{\nu\sigma} = -\ \partial_\nu \Gamma^{\rho}_{\mu\sigma}, \tag{10.52}$$

$$\Gamma^{\rho}_{\mu\lambda}\Gamma^{\lambda}_{\nu\sigma} = -\Gamma^{\rho}_{\nu\lambda}\Gamma^{\lambda}_{\mu\sigma}, \tag{10.53}$$

$$\Gamma^{\lambda}_{\mu\nu} = -\Gamma^{\lambda}_{\nu\mu}. \tag{10.54}$$

Only the antisymmetry (10.55) was known hitherto. Similarly, the Riemannian torsion is the tensor:

$$T^{\lambda}{}_{\mu\nu} = \Gamma^{\lambda}_{\mu\nu} - \Gamma^{\lambda}_{\nu\mu} \tag{10.55}$$

and may be written equivalently as:

$$T^{\lambda}{}_{\mu\nu} = 2\Gamma^{\lambda}_{\mu\nu}. \tag{10.56}$$

It is understood that Eq. (10.50) is equivalent to Eq. (10.49), and that Eq. (10.56) is equivalent to Eq. (10.55). It is well known that the Riemannian connection is in itself not a tensor, but the curvature and torsion are tensors.

The novel antisymmetries (10.52) to (10.54) are fundamental advances in Riemann geometry, advances made in a simple manner by use of the fundamental antisymmetry of the commutator.

10.4 Discussion

It is immediately evident from these simple considerations that both the gravitational and electrodynamical sectors of the standard model are irretrievably incorrect. The ECE unified field theory is therefore the only correct field theory of physics at present. It makes all other field theories obsolete and refutes much of twentieth century dogma that cannot be tested experimentally. In ECE theory the gravitational sector is based on the same equations as the electrodynamical sector. This method has the major advantage that conclusions obtained in one sector are also true for the other. Therefore it is evident that the gravitational field **g** cannot be described in terms of potentials, the gravitational field is due directly to the spin connection in a manner analogous precisely to the electric and magnetic fields. Similarly the gravitomagnetic field is proportional to a spin connection. Again in direct analogy to electrodynamics, the gravitomagnetic field **h**, which plays the role of **B**, is c times smaller than the gravitational field **g**, which plays the role of **E**. So we obtain:

$$\mathbf{g} = g^{(0)}\boldsymbol{\omega}_g, \tag{10.57}$$

$$\mathbf{h} = h^{(0)}\boldsymbol{\omega}_h. \tag{10.58}$$

The four fields **E**, **B**, **g** and **h** are manifestations of spinning spacetime. These inferences change the face of physics remarkably. No longer are force fields derived from potentials, but are derived directly from the spinning of spacetime in general relativity.

The fundamental antisymmetry laws immediately refute the U(1) sector symmetry and also the Einstein field equation in the gravitational sector. They also work their way through to other subject areas such as magnetohydrodynamics, plasma physics, hydrodynamics, aerodynamics and thermodynamics. They also apply to nuclear physics because the weak and strong fields are affected by the antisymmetry laws. In electrical engineering and in chemistry, the Coulomb law for example is shown by this paper to be a law in spin connections. Spin connection resonance is possible, and this has many technological applications in fields such as new energy, energy saving, environmental studies and counter gravitation. These are all areas of immediate importance to society.

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