

ECE GENERALIZATION OF THE D'ALEMBERT, PROCA AND
SUPERCONDUCTIVITY WAVE EQUATIONS: ELECTRIC POWER FROM ECE
SPACE-TIME.

by

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ABSTRACT

The well known d'Alembert, Proca and superconductivity wave equations are shown to be special cases of the wave equations which can be constructed from the homogeneous and inhomogeneous field equations of Einstein Cartan Evans (ECE) unified field theory. One of the important practical consequences is that a material can become a superconductor by absorption of the inhomogeneous and homogeneous currents of ECE spacetime. This means that in a well designed circuit or material, the output voltage or power can exceed by orders of magnitude the input power needed to run the circuit. This phenomenon has been observed experimentally and is reproducible and repeatable. An array of such circuits would in principle produce a new type of electric power for general use on a sufficiently large scale to be significant.

Keywords: Einstein Cartan Evans (ECE) unified field theory; electric power from ECE space-time; generally covariant d'Alembert, Proca and superconductivity equations.

Paper 51 of the ECE Series

1. INTRODUCTION

Rigorous objectivity in science requires general relativity to be applied to all the main equations of physics, chemistry and the natural sciences. The equations must all retain their form under the general coordinate transformation, and the philosophy of relativity requires that every event have a cause, science must be causal as well as objective. A plausible theoretical structure for causal and objective natural science has recently been suggested using standard Riemann geometry in its most general form {1-34}. This type of geometry was developed by Cartan into well known differential geometry, a concise and elegant formulation of the general Riemann geometry of the early nineteenth century. In well known letters to Einstein, Cartan suggested in the early twenties of the twentieth century that the electromagnetic field be the torsion form of Cartan geometry. From 2003 onwards this suggestion led to ECE unified field theory {1-33}. The gravitational field is represented by the Riemann or curvature form of Cartan geometry. The torsion form represents the spinning of four-dimensional space-time (the electromagnetic, weak and strong fields, fermion and boson fields), and the curvature form the curving of four-dimensional space-time (the gravitational field, gravitons and gravitinos). This was a notable advance upon the Einstein Hilbert field theory of 1915, which was the first theory to successfully apply general relativity to gravitation. In so doing however general Riemann geometry was specialized into Riemann geometry without torsion. Only the curvature of space-time was considered, the spinning of space-time was neglected by use of the symmetric or Christoffel connection {34}, sometimes also known as the Riemann or Levi-Civita connection. In general Riemann geometry the connection is asymmetric in its lower two indices. For a given upper index the connection is therefore a matrix which is the sum of a symmetric and anti-symmetric component. In Cartan's well known formulation of general Riemann geometry, the torsion and curvature forms are in general non zero, and defined respectively by the Cartan structure equations,

known in contemporary, standard, differential geometry as the master equations.

A differential two-form translates into an anti-symmetric tensor, both the torsion and Riemann tensors are anti-symmetric in their last two indices. The Riemann form is a tensor valued two-form, the torsion form is a vector valued two-form {34}. As inferred by Cartan, the latter becomes the electromagnetic field, for example, through the Evans Ansatz {1-33}:

$$F^a = A^{(0)} T^a \quad - (1)$$

where $A^{(0)}$ is a vector potential magnitude. The electromagnetic potential is the fundamental field, the tetrad, or fundamental field of ECE theory:

$$A^a = A^{(0)} \vartheta^a. \quad - (2)$$

In Cartan geometry the torsion form is the covariant exterior derivative of the tetrad:

$$T^a = d \wedge \vartheta^a + \omega^a_b \wedge \vartheta^b \quad - (3)$$

and the curvature form is defined by the spin connection as follows:

$$R^a_b = d \wedge \omega^a_b + \omega^a_c \wedge \omega^c_b. \quad - (4)$$

The torsion and curvature forms are inter-related by the first Bianchi identity:

$$d \wedge T^a + \omega^a_b \wedge T^b := R^a_b \wedge \vartheta^b \quad - (5)$$

and the curvature form always obeys the second Bianchi identity:

$$D \wedge R^a_b := 0. \quad - (6)$$

Using the Evans Ansatz (1) or (2) links the electromagnetic field to the

electromagnetic potential as follows:

$$F^a = d \wedge A^a + \omega^a_b \wedge A^b \quad - (7)$$

using Eq. (3). The first Bianchi identity (5) produces with the Ansatz the homogeneous field equation of ECE theory {1-33}:

$$d \wedge F^a = \mu_0 j^a \quad - (8)$$

where the homogeneous current of ECE field theory is defined by:

$$j^a = \frac{A^{(0)}}{\mu_0} \left(R^a_b \wedge v^b - \omega^a_b \wedge T^b \right). \quad - (9)$$

Hodge duality transformation fo Eq. (9) {1-333} produces the inhomogeneous field equation of ECE field theory:

$$d \wedge \tilde{F}^a = \mu_0 J^a \quad - (10)$$

where the inhomogeneous current is defined by:

$$J^a = \frac{A^{(0)}}{\mu_0} \left(\tilde{R}^a_b \wedge v^b - \omega^a_b \wedge \tilde{T}^b \right). \quad - (11)$$

In Section 2 Eqs. (7) and (10) are translated into tensor notation and the ECE generalization obtained of the d'Alembert, Proca and superconductivity wave equations {35, 36}. This means (Section 3), that superconductivity can be understood in terms of general relativity, a conclusion which indicates the possibility of designing a material or circuit that becomes a superconductor from absorbing j^a and J^a from ECE space-time. The generally covariant London equation and Meissner effect follow from the ECE superconductivity equation. This conclusion of ECE field theory has been verified experimentally in reproducible and repeatable experiments { 37 }.