

On the Development of “Spacetime” and a Unified Theory of Physics

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Overview

Most would agree that Galileo Galilei started the **first scientific revolution** in 1642 with the publication of his thesis “Two New Sciences” (that in effect anticipated Isaac Newton’s “laws of motion”). This is widely regarded as the birth of modern science. Albert Einstein said of him:

“Galileo ... is the father of modern physics - indeed of modern science”

1687 heralded the next great landmark when Newton introduced the concept of ***absolute space and time***. His “Principia Mathematica” is almost certainly still the most important book ever written in physics.

In 1873 Heaviside, one of the best physicists / mathematicians of his time, developed his field equations - wrongly attributed to Maxwell who derived a complicated system of twenty or so quaternion equations (Heaviside equations are still referred to as the Maxwell equations). These are a set of four partial differential equations that describe the properties of the electric and magnetic fields and relate them to their sources, charge and energy density. Heaviside also developed vector theory.

In 1887 Michelson Morley undertook one of the most famous experiments in the history of physics attempting to detect the Earth's motion relative to the “luminiferous aether” (this actually provided strong evidence against the “luminiferous aether”). The experiment resulted in theoretical developments that constitute **the second scientific revolution**.

In 1892, in a half page article to science, Fitzgerald proposed ***length contraction***. This was independently proposed and extended by Lorentz to explain Michelson Moreley’s negative results. In 1887 Voigt wrote down the equations of the Lorentz transformation developed in 1898 by Larmor and 1899 by Lorentz. In 1898 Poincare considered time intervals and in 1904 he essentially stated the relativistic principle of an observer at rest or absolute motion. Poincare's work is very important in relativity, as is that of Ricci, Bianchi and Levi-Civita, who developed tensor theory.

The next well known landmark came in 1905 when Einstein published his work “On the Electrodynamics of Moving Bodies”, stating the two principle of special relativity. In Sept 1905 he published, and is solely accredited with, the most well

known equation in physics, $E = mc^2$. In fact, the equation was inferred independently by several workers, the first by Henri Poincare, then by Olinto de Pretto in 1903, by Poincare again, and by Hasenhorl and by Planck (as well as by Einstein). In 1908 Planck published the second paper on special relativity, and in 1908 Minkowski proposed “**spacetime**”. Einstein's field equation appeared in 1915: "The Field Equations of Gravitation". David Hilbert submitted his manuscript four days earlier, but gave precedence to Einstein.

In March 2003 the Einstein Cartan Evans (ECE) unified field theory was proposed by Myron Evans **based directly on Cartan geometry**. In 2007 it was found that **the Einstein field equation is geometrically self-inconsistent** due to its neglect of torsion. It is corrected and replaced by the ECE field equation based directly on the Bianchi identity. These and developments by other workers (notably Ruggero Santilli and Diego Rapoport) suggest that we have entered the period of a **third scientific revolution** – one in which all the branches of physics are brought together, by one theory, in a consistent manner for the first time.

Einstein, Cartan, Evans (ECE) theory has been developed by Myron Evans over the last five years (and named by his contemporaries). It is increasingly perceived as a landmark development in the history of science because it unifies all the fields of physics, it provides many new conceptual insights, and it suggests the possibility of new technologies (including a completely new generation of renewable, clean and “green” energy producing / saving devices). If these possibilities are realized, fossil fuels, with the associated pollution and the harm their combustion causes to natural processes and cycles, could become a thing of the past. Many other new technological applications have started to emerge.

On ECE theory, Professor Diego Rapoport (Professor of Mathematics in the National University of Quilmes in Buenos Aires) has written (May, 2008):

*“Your ansatz is very natural. You complete with the electromagnetic potential the additional degree of freedom of the **contravariant part of the full torsion**, and then the covariant two form which is to be characterized is the electromagnetic two-form. **Brilliant!**”*

Now, as an additional bonus, you have a coupling of the potential one-form with the two-form, the torsion tensor is an interaction, which in your ansatz has to do with a topological invariant given by this coupling”.

Diego Rapoport, a renowned and accomplished mathematical physicist in his own right, worked with the acknowledged expert in geometry, Prof. Shlomo Steinberg of Tel Aviv and Harvard Universities. He has studied all the key proofs of the ECE theory and found them **to be correct in all detail**, notably the various proofs of the duality invariance of the Bianchi identity (details on www.aias.us). In his independent study of ECE theory **he has found no errors.**

Diego Rapoport has introduced insights of his own and plans to develop ECE theory. He describes the basic anzatz as **powerful, natural and economical**. He points out that the electromagnetic potential of ECE theory **completes the additional degree of freedom of the contra variant part of the complete torsion**. The covariant two form that is to be characterized is the electromagnetic two form. There is a coupling of the potential one form and two form, and the torsion tensor is an interaction which has to do with a topological invariant given by this coupling. He describes ECE theory as **providing a far more economical description of orbits than that given by Einstein and his co-workers**. In fact, as discussed below, their work is now seen to be incorrect, thus surely bringing to an end the **second scientific revolution**.

So, what is this new theory of physics, how does it advance our knowledge of physical processes, what are the important new insights it provides, and what are the new technological and industrial possibilities it opens up?

An Introduction to Einstein, Cartan, Evans (ECE) Theory

This journey started for Myron Evans thirty years ago when the foundations of the contributions he is making to science were laid in a chemical physics background at Aberystwyth and Oxford university. At this time Myron Evans worked with the distinguished chemical physicists Professors John Rowlinson FRS and Mansel Davies (between them, some time Oxford, Cambridge and Aberystwyth universities).

Some of the inconsistencies and paradoxes that have plagued standard model physics were well known in those early days. More flaws and inconsistencies have emerged as Myron Evans has developed his new physics and ECE theory. Myron Evans soon set himself the enormous task of improving the standard model approach to correct and reconcile these inherent flaws and the inconsistencies that have plagued the field of physics and hindered real progress for over almost a century. A number of concepts and hypothesis, that are now seen to be groundless and meaningless, have been developed by physicists during this period.

ECE stands for **Einstein-Cartan-Evans** Field Theory. It is a generally covariant unified field theory developed by Myron Evans since 2003. It describes **in a consistent manner, for the first time, all the well known laws of physics**. It **unifies classical and quantum physics**. It is based directly on **standard Cartan geometry**.

In ECE theory, **electromagnetism and gravitation are both manifestations of spacetime**. Since physics is geometry, the electric field is geometric and therefore part of spacetime - just like gravity. No source is needed - **electromagnetism is the torsion and gravity the curvature of spacetime** (in

terms of differential geometry, torsion is actually a kind of curvature as well). **Without torsion neither Riemann nor Cartan geometry have meaning.** Without torsion **there is no electromagnetism.** The significance of the omission of spacetime torsion from our theories of physics is as basic as that. Without torsion all that exists in the universe is spacetime curvature – a universe without spacetime torsion is deprived of the complexity and diversity that we know and is essential for life. This is how fundamentally flawed the standard model is in approximating nature. This is why ECE theory, and the unification of physics, is such a big advance – it opens up a new era in physics (**a third scientific revolution**).

The Coulomb law is the most precise law in classical electrodynamics and in ECE is the law obtained from the Bianchi identity of geometry. Space-time itself does not have an origin, and so the electric field is due entirely to the primordial voltage, which is ever present, and proportional to the charge on the electron. The charge on the electron is always present and time independent.

It emerges from the theory that the **wave equations of physics** are based directly **on the tetrad postulate of Cartan**, which is developed into the ECE Lemma and wave equation. This has been proven by Myron Evans in about twelve ways that are all self-checking. **The field equations of physics** are based on the **Bianchi identity of Cartan**, which are duality invariant. The duality invariant Bianchi identity gives the field equations both of dynamics and electrodynamics (what are referred to in the standard model as the gravitomagnetic equations and the Maxwell Heaviside (MH) equations). The ECE field equations are however far more rigorous and general. There appears at present to be **no experimental data, collected by physicists over the centuries, that cannot be described by ECE theory.**

Relativity is an objective theory of nature, developed by Albert Einstein, and based on geometry. The development of ECE theory has convincingly demonstrated ***that some, but not all, of the assumptions made by Einstein in his pioneering work were incorrect.*** In particular, it is now evident ***that there is a fundamental flaw in the Einstein field itself.*** This flaw has been confirmed using computer algebra (and is reported in papers 93 - 111 of the ECE theory series of papers on the AIAS website (www.aias.us) **so is logically irrefutable.**

Einstein's contributions were a landmark in scientific thought and development and some aspects of Einstein's general relativity work remain intact and are still good (notably the basic idea that physics is geometry, the equivalence principle, and his idea that the orbit is described by the line element). Other aspects of Einstein's work are also still good: e.g. special relativity, Brownian motion, photoelectric effect, and photon theory.

The electromagnetic field in ECE theory is considered to be the full Cartan torsion tensor, the vector valued two-form. The quantized nature of space-time (and the diffusion equations of the Brownian motion: Fokker Planck,

Smoluchowski, Kramers, etc.) are obtained in ECE from the Lemma from which all the wave equations of physics are recovered. So, ***wave mechanics is obtained from geometry, retaining causality, rejecting Bohr Heisenberg.***

In fact, ECE theory is shown in an on-going, systematic investigation of its properties and range of applications (ECE papers 1 – 111 on the AIAS website, www.aias.us) to reproduce ***all the equations of physics in well defined limits*** and to reproduce ***very precisely for the first time*** several types of previously unsuccessfully explained data relating to, as examples, binary pulsars, spiral galaxies etc. These are tests that taken together are beyond the scope of standard model physics – the physics we learn as students.

ECE theory allows gravitation to be quantized straightforwardly and allows a unification of the electroweak field, strong, and gravitational fields. The electroweak theory was derived by Myron Evans without use of the Higgs mechanism in volume one of his book series GCUFT (see www.aias.us). So, **ECE theory is a unified field theory in the full, scientific sense because it can produce the classical equations of electrodynamics, the classical equations of dynamics (and their quantized equivalents) and also provides information on the interaction of electromagnetism and gravitation (e.g. change of polarization in light grazing a white dwarf).** Importantly, **the conservation of energy and momentum is retained in ECE theory** as demonstrated in several ways in paper 103 of the ECE series of papers (www.aias.us).

ECE theory removes the need for concepts such as the uncertainty principle - that have caused so much debate and confusion. ECE theory predicts a whole range of new effects and phenomena **that are missed in the standard and classical approaches. The acid test of any new theory is its ability to make new predictions that can be used for engineering purposes.**

It is these new predictions that are now causing a lot of interest in the technological and industrial sectors. In principle they allow the development of new, timely, and vitally needed technologies to address the big issues of our day (energy and fuel crises, global warming, climate change, polluting emissions, creation of waste etc).

The Scientific Significance of ECE Theory (and Possible Future Extensions)

It has been well known for a considerable time that there are numerous and very precise experimental tests available demonstrating that classical Newtonian dynamics are limited. The Newtonian synthesis of 1665 - 1687 is a pinnacle of human thought, and remains so despite the fact that we know, with the benefit of hundreds of years of hindsight, that Newtonian theory cannot explain all observed orbits. There are many precise satellite experiments available that

show that Newtonian dynamics has well established limitations - it is known with high precision that there are non-Newtonian aspects to orbits.

The advances of Einstein and Hilbert were significant but they were unaware of the effects of torsion in 1915 - that is entirely understandable. Their work, for all its flaws and inconsistencies, also remains a pinnacle of human thought. Einstein recognized himself, however, that General Relativity was incomplete – a complete theory of physics would unify, in a consistent manner, all the various fields of physics.

Oliver Heaviside's Field Equations of 1873 simplified the original twenty quaternion equations of Maxwell into vector equations. Maxwell published his equations in 1865 in Proc. Roy. Soc., 155, 459 (1865), entitled: "A Dynamical Theory of the Electromagnetic Field". From 1880 to 1887 Heaviside developed the operational calculus and made many advances in electrical engineering and mathematics. These are what are referred to as the Maxwell Heaviside field equations.

Myron Evans's B(3) spin field signaled the fact that classical electrodynamics, for consistency, **HAD TO BE** part of any generally covariant field theory. This was well understood by Einstein as he attempted in his latter years to extend his theory of General Relativity. The crucial missing link for Einstein was the B(3) spin field of Myron Evans. This realization, and the development of this aspect by Myron Evans, evolved into a theory (ECE theory) that unifies all of physics in a rigorous and consistent manner.

The U(1) sector of Special Relativity is still used to describe electrodynamics in the Standard Model EVEN THOUGH any attempt to develop a unifying theory from this (extending it to other fields of physics) **could not possibly be generally covariant in all sectors.**

ECE theory can explain all known orbits quite easily, on the basis of torsion and curvature of space-time. Paper 109 of the ECE series on the AIAS website (www.aias.us) shows essentially that torsion and curvature must always exist **in a four dimensional space-time**. It is important to emphasise that ECE theory is developed in four dimensions, from first geometrical principles, and is free from uncertain assumptions and unknown variables.

In fact, ECE theory describes experimental data, ***in all the various fields of physics***, in a self-consistent manner for the first time and provides a vast amount of new, and sometimes unexpected, insight. ECE theory provides straightforward explanations of experiments such as the Sagnac effect and the Faraday disk, the inverse Faraday effect, the Aharonov Bohm effects, the gravitational equivalent of the Faraday law of induction, the change of polarization of light deflected by gravity, and so forth. These are all observations that are difficult, if not

impossible, to explain fully with standard approaches that still dominate mainstream physics. As Diego Rapoport says, for example, “**the Aharonov Bohm effect is built in torsion geometry**, it is a term of the general decomposition of the trace torsion one-form”.

ECE theory is able to describe **all the precision tests** of Special and General Relativity using self-consistent Cartan geometry. ECE suffers from **none of the geometrical failures of the Einstein theory**. ECE theory explains the observations (from electron microscopy etc) that have unambiguously proved the existence of atoms - data that actually refute Bohr / Heisenberg indeterminacy. More recent data data by Prof. Jose Croca's group do the same. Indeterminacy is now seen to be unnecessary because unification has been achieved through Cartan geometry within ECE theory.

ECE theory explains the orbits of planets, spiral arms of galaxies, binary pulsars etc successfully for the first time in a coherent and consistent manner and without the need for notions such as Dark Matter. Spacetime torsion has been used on www.aias.us to describe the very essence of spiral galaxies.

Orbits are not due to an incorrect Einstein field equation, they are due to the spherical symmetry of spacetime. This is true regardless of any other assumption, notably metric compatibility and the type of connection used. In fact the connection is not needed at all, only the line element. The use of the line element analysis by Einstein is correct, but **his field equation is incorrect**.

All satellite data can be explained by simple line element geometry. Nearly all orbital phenomena are due simply to the spherical symmetry of spacetime, i.e. light bending, perihelion precession, Lense Thirring effect, Shapiro delay and so forth. The only known exception is the orbit of binary pulsars, which spirals inwards from the relativistic Kepler problem as shown in paper 108 of the ECE theory series on the AIAS website and the Pioneer / Cassini anomalies of the solar system (as again discussed by Evans on his website). Both these are explained by ECE theory without using the incorrect postulate of gravitational radiation from the incorrect linearization procedure of the standard model.

As stated, the orbital equation follows from the line element and this part of Einstein's work was correct, as was his equivalence principle and basic idea that physics is geometry. However, the Einstein field equation is not a correct solution of the Bianchi identity. The Hodge dual of the Bianchi identity is a re-arrangement of indices in the original identity. The field equations of physics are then the Bianchi identity itself, the wave equations being derived from the fundamental tetrad postulate. So the geometrical approach to physics proposed by Einstein is now developed in this way. The relation between field and potential is given by the Cartan structure equations.

Orbits are due to the spherical symmetry of spacetime **irrespective of any field equation**. They are not due to the Einstein field equation, which violates the Bianchi identity. This is **clearly demonstrated with the simplest type of geometry and with computer algebra**. Other more elaborate geometries may provide more insight but no geometry can change this basic result. So, all these, so called, precision tests of the Einstein field equation are in reality **a very simple consequence of the spherical symmetry of spacetime**. The data are of course precise, and an admirable achievement of observational physics, **but they are not due to the Einstein field equation at all**.

In fact, **any line element** (exact solutions of the Einstein field equation – hundreds, if not thousands, of such solutions exist) such as the Robertson Walker, violates the Bianchi identity (paper 93 on www.aias.us). This is because it uses the Christoffel symbol for which the torsion tensor is zero. All the many classes of exact solutions of the Einstein field equation use the Christoffel symbol and so violate the Bianchi identity except for the class of vacuum solutions. But, Stephen Crothers has shown that these are physically meaningless - they violate the Einstein equivalence principle and do not allow interaction between m and M . At least one type of Kerr metric, for example, does not obey the Ricci cyclic, and so also violates the Bianchi identity. The Alcubierre is completely incorrect, it violates metric compatibility and the Bianchi identity. As said above, the ECE field equations on the other hand, in which torsion is central, are the Bianchi identity itself.

There have been some claims made recently that spiral galaxies can be described by the Carmeli metric. In fact, Diego Rapaport has described the Carmeli solution of the Einstein field equation as being, ***“the last chance of the standard model to explain the structure of the universe”***. Carmeli's theory is the latest attempt **to salvage General Relativity** by including rotations in the very structure of the theory. Even without a computer algebra test, however, it is clear that this metric violates the Bianchi identity because it reduces to a Robertson Walker Friedmann LeMaitre metric. So, this metric is also incorrect – and **computer algebra confirms this**. It shows that the exact solution of the Einstein field equation known as the Carmeli metric can have no physical significance in relativity theory because it violates the Hodge dual of the Bianchi identity. The only way to self consistently describe spiral galaxies and their beautiful spiral structures (as seen in the Hubble space telescope) at this time is ***with ECE theory including space-time torsion***. There are excellent educational articles on spiral galaxies written by Horst Eckardt on www.aias.us.

ECE reduces to essentially all the equations of physics in a causal and objective manner. There are so many proofs of the self-consistency of Cartan geometry that any criticism of the geometry itself, and ECE theory on which it is based, has little or no scientific merit. **ECE theory appears to be a unified theory of physics in its barest “and purest” form**. To progress beyond the current state

of development of ECE theory probably requires the construction of a more general geometry beyond Cartan (such as the Finsler / Rapoport, Santilli and Connes geometries – Cartan was actually the father of Finsler geometry).

It will be particularly interesting to see what the wave and field equations of physics look like in these new geometries, how the Cartan structure equations and the Bianchi identity develop (together with the tetrad postulate), how electromagnetism and gravitation interact in these new geometries, and how it seems to be possible to eliminate curvature completely following Santilli's Hydronic Physics (that is also producing new technologies and **a new chemistry** based on new chemical species, "magnecules") and so on.

Recently it has emerged that Diego Rapoport and Myron Wyn Evans have in fact independently developed almost the same unified field theory – more testimony to the consistency, accuracy, and rigor of the ECE Unified Field theory approach. These are essentially the same theories, both based on the Cartan geometry with torsion. In the textbooks one will not find torsion mentioned. As Diego Rapoport points out, "***torsion is central to physics and astronomy, and to the natural and engineering sciences. Spacetime is naturally quantized in a geometrical way***".

This was also the view of Louis de Broglie and many others. So, it has become completely clear that ***the standard model incorrectly neglects torsion***. It was known as early as 1918 that the Einstein field equation was self-inconsistent. The field equation has become a meme, that is, an idea that is not correctly understood.

The convergence of the work of Diego Rapoport and Myron Evans is a classic example of two workers arriving at the same idea independently, without previously knowing about each other's work, and is a "double blind test".

As suggested above, the whole of this work can probably be generalized further with the methods of Santilli and Schadeck. Rugerro Santilli has argued that curvature can be removed completely from general relativity, leaving only the torsion as developed in ECE (and Rapoport) theory. A new school of physics has dawned and a new Association of some of the leading theoretical physicists in the world has now been formed to take this new physics forward (the Santilli - Galilei Association). Myron Evans and his research group, the Alpha Foundation Institute for Advanced Studies (AIAS), are fully affiliated with this new organization. ECE theory forms one of the corner stones on which it will be based and developed.

As a word of caution, any more "general geometry" used in the future to develop ECE theory must, of course, avoid unnecessary abstraction. So any future extensions must also provide physically meaningful results, it should be applicable to science in general, and move us even closer to the laws of nature

(that our scientific theories attempt to mimic). Logic suggests that any extension, any new geometry, must reduce to Cartan geometry in a well defined limit if it is also to reproduce all the well known laws of physics.

The logic of Cartan geometry is well studied in ECE papers 93 to 109 on the AIAS website (www.aias.us). This logic leads to the ***rejection of any physical inference made without consideration of Cartan torsion***. That is, ALL of the physical inferences of standard Einstein Hilbert (EH) theory must be rejected and replaced, as in papers 93 to 109, with a self consistent analysis. The choice is between logic and anthropomorphism. The experimental data (such as those on light deflection, time delay, pendulum precession and so on) are valid within the limits of observational uncertainty and these **MUST** be reproduced by any proposed new advance. These data **DO NOT support standard EH theory in any manifestation**. ECE theory has been systematically applied to this series of experimental data, in the geometrically correct manner, fully demonstrating its accuracy and rigor.

The logic of paper 109 in the ECE series is irrefutable - the Einstein Hilbert theory is irreconcilably flawed and made obsolete. Obviously this does not mean that relativity is wrong, relativity is an expression of objectivity, a fundamental necessity of science itself. What has happened is that the geometry used by Einstein (and Hilbert) has unequivocally been demonstrated to be self inconsistent.

This cannot be over emphasized, the basis of relativity **is objectivity**, and objectivity **must be represented by a correct geometry**. Unless this is done, no physical inference can be made in relativity. This is such an important point. Prior to paper 93 (work of 2007) in the ECE series of papers (www.aias.us), the self inconsistency and incorrectness of General Relativity and the EH equations was not fully understood. The physics establishment that expounds the notions of Big Bang, Black Holes, Dark Matter, Gravity Waves etc were not aware of this most basic, and irreconcilable, flaw in their standard model approach. A lot of assumptions have been postulated, meaningless adjustable parameters used, hopelessly incorrect conclusions and claims made on the basis of ideas that were flawed at the most basic of levels. An incorrect starting geometry results in predictions that have no foundational basis. It is no longer surprising that there has been so much confusion and controversy, even within the standard model establishment itself, because their geometry, the essential starting point, was wrong.

Einstein himself used a geometry that was incorrect and so the Einstein field equation is incorrect. The Einstein geometry and field equation give a result that conflicts with the Bianchi identity, i.e. the Einstein field equation is not a correct solution of the Bianchi identity and has to be rejected because conclusions based on it are logically flawed. The Einstein field equation is also obsolete after ninety years of intense interest in it.

The ECE field equations are based directly on the Bianchi identity, developed to include torsion and using the correct geometry that has been systematically tested and demonstrated to unify all the fields of physics, in a consistent way, for the first time.

Mathematics for its own sake is fine but the role of a theoretical physicist is to develop more accurate theories that more closely approximate nature. That is, their theories must describe the results of well founded experiments and observations (a theory has to be compared with data and not just with another theory that it may supplant). This is what ECE theory achieves with such remarkable success.

Despite this, most of the standard model establishment is still even reluctant to acknowledge that quantum mechanics and electromagnetism are spacetime structures. The resistance is quite astonishing in the circumstances on the basis of the many well accepted inconsistencies and uncertainties and the growing body of evidence and irrefutable facts – as discussed above.

In fact, in 1918, Schroedinger showed that the Einstein field equation did not produce a consistent self stress energy momentum tensor of the gravitational field, and in the same year Bauer showed that the Minkowski metric in the absence of gravitation produced a non-zero stress energy momentum tensor of gravitation, **a basic self inconsistency**. These findings by Bauer and Schroedinger, **ninety years ago**, showed the self-inconsistency of the geometry used by Einstein in 1915. But at that time it was the only known geometry - due to Riemann in the early nineteenth century. As pointed out by Schadeck, Riemann actually recognized the limitations of his own geometry.

Technological Developments from ECE Theory

For an introduction, Review paper 100 in the ECE theory series is an excellent summary with many equation flow charts demonstrating how the fields of physics are brought together by ECE theory. The concept of tetrad has been used in its most general form, and this general definition is needed to derive equations such as the Dirac and Proca equations from the ECE wave equation. All concepts have been meticulously cross checked in a network of theorems and proofs running across the one hundred and eleven papers in the ECE series to date.

As stated above, the duality invariant Bianchi identity gives the field equations both of dynamics and electrodynamics within the rigorously formulated and general ECE theory. **All the work has been translated from differential form to tensor to vector notations, and coded up for engineering.** Computer algebra has been used with increasing frequency to handle the complicated algebra, notably in paper 93 of the series.

ECE theory is now developed to the point where new technologies and industries can be developed based on the results of the theory and the new insights it provides. The timing of these developments could not be better because of the looming energy and fuel crisis and issues such as global warming and climate change. All of these pending crises have their roots in our traditional technologies and in particular in the burning of carbon (in the form of fossil fuels that have been stored in the Earth for millions of years). Burning fossil fuels causes pollution with a vast array of impacts on the health of people, other animals, plant life and the environment in general. It increases the amount of greenhouse gases in the atmosphere, thereby warming the earth, it depletes oxygen from the atmosphere and oceans, it acidifies the oceans and inland waters and, of course, the amount of fossil fuels reserves is limited – the Earth's store of usable carbon will run out.

Scientists and Governments around the world now recognize that we must develop cleaner technologies and we must find new sources of renewable energy that does pollute and can replace fossil fuels in a sustainable way. This is a big challenge, probably the biggest challenge mankind has ever faced. ECE theory predicts many new technologies, some of which have already been verified, others that are being developed.

Below are examples of new technologies already identified that can immediately be developed on the basis of ECE theory – there are many more that will emerge as engineers and technologists manipulate and use the new equations of physics.

1. Radiatively Induced Fermion Resonance (RFR)

RFR is of great potential use. It is a form of electron and proton spin resonance induced not by customary permanent magnets but using a circularly polarized electromagnetic field. ***This allows effects to be considerably amplified and the resolution to be increased for characterization and identification purposes, in the analytical sciences, and for diagnostic work, in the medical fields.*** There are many source documents on Myron Evans's Omnia Opera section of www.aias.us dealing with these topics in detail.

Myron Evans's interest in optically induced magnetic phenomena started at IBM Kingston and Cornell University when he was introduced to the work of Georges Wagniere from the University of Zurich on the inverse Faraday effect (IFE) from which his new, spin B(3) field was developed in about November 1991 and published in Physica B in 1992. The B(3) field is ***always present in an electromagnetic wave***. This is because all electromagnetic waves are actually circularly polarized.

Linearly polarized waves involve two circular polarizations which cancel out making the B(3) field undetectable. The B(3) field can be detected by means of the Inverse Faraday Effect (IFE). Another way of understanding this is to consider the concepts of linear and angular momentum. Photons can impart linear momentum onto atoms and electrons e.g. the Compton effect. However, photons can also impart angular momentum if they are circularly polarised.

When considering the B(3) field one is referring to the wave nature of light rather than its particle nature and to a single photon (and not a beam of light). A circularly-polarized laser beam, used in the IFE experiment, will have millions of individual B(3) fields, one per photon. The B(3) field should not be confused with the static magnetic field and is very small compared to the other magnetic B fields

Myron Evans subsequently spent a year at the University of Zurich developing the inverse Faraday effect. Many of the source papers of that era are also on www.aias.us as is a computer animation of the IFE produced at Cornell (with Chris Pelkie - [Google Video](#)). At that time the well known conjugate product theory of non-linear optics was used to describe and develop the work.

Myron Evans also started work on optical NMR and other optically induced magnetic and birefringence phenomena whilst at Cornell. This was taken up by Warren at Princeton, and small shifts observed - these were precisely of the order predicted by B(3) theory (i.e conjugate product theory of non-linear optics). These first source papers are also available on the Omnia Opera.

Myron Evans proceeded to re-develop electromagnetism as an O(3) gauge invariant theory, instead of the standard U(1) gauge invariant theory. This led to the inference of radiatively induced fermion resonance (RFR) in late 1994. A form of RFR (in inverse Raman scattering) has been observed many times (see the source papers in the Omnia Opera, www.aias.us). From 1994 to present Myron Evans has developed RFR systematically using one electron theory.

The simplest RFR experiment is in an electron gas needing only a circularly polarized RF or microwave pump beam, a sample of electron gas, and a detector to observe the phenomenon. In this simplest case the resonance frequency is proportional to I over ω squared, and the constant of proportionality can be worked out exactly. Here I is the circularly polarized pump beam's power density (watts per square metre) and ω is the pump beam angular frequency.

There are several papers on RFR on the ECE series on www.aias.us. The advantages of RFR are obvious, ***it has a much higher resolution than conventional ESR or NMR, and should be much less expensive because it dispenses with the use of the very expensive permanent magnet assembly in a typical FT NMR instrument for example.***

The B(3) field causes the fermion resonance to occur. If one prefers the empirical conjugate product theory, the resonance is caused by the conjugate product. The latter is well known to cause magnetization (the inverse Faraday effect), so RFR is the resonance phenomenon produced from the IFE.

Many other types of RFR can be developed, using different designs, and a prototype is under construction at Charles University Prague. This group, that is associated with AIAS, intends to apply RFR first to water where a spectrum, instead of one line as in the electron gas, should be observed.

RFR **produces a unique chemical shift pattern**. This is **the aspect that is important for chemical characterization, identification, and analyses purposes**. This could proceed on a supercomputer following the highly developed code available for density functional computation of NMR and ESR spectra - adapted for density functional computation of RFR type spectra. This would proceed by replacing the permanent magnetic flux density of ESR and NMR with the B(3) flux density or conjugate product, whichever is preferred. The molecular property tensors of RFR are in general hyperpolarizabilities of the type used in IFE theory (see papers of the era 1989 to about 1993 on the Omnia Opera and the ECE papers on RFR all available on www.aias.us).

Evans, Wozniak, Wagniere (Molecular Physics, 1992) used semi-classical methods to reveal resonances in IFE spectra. This is another type of RFR phenomenon. So instruments can be developed to observe these spectra. The chemical shift is of a different type from that in NMR theory and so **is a unique new spectral method**.

RFR can be developed ultimately using the latest Fourier transform technology. All FT NMR instruments are now fully automated as is well known. As many different types of RFR instrument can be developed as there different types of FT NMR instrument. A hybrid type of optical NMR has already been highly developed at the Naval Research Laboratory in Washington, Kennedy group. RFR methods can also be **extended to magnetic resonance imaging (MRI) and medical applications (diagnostics etc)** dispensing with large and cumbersome permanent magnet assemblies completely. Magnetic resonance imaging (MRI) is a medical imaging technique primarily used in Radiology to visualize the structure and function of the body. It provides detailed images of the body in any plane.

2. Spin Connection Resonance (SCR)

SCR is of great potential use because the equations of classical electrodynamics, as developed within the framework of Evans's unified field theory (ECE), can become resonance equations under certain conditions of the type first inferred by Bernoulli and Euler.

Spacetime is in fact a large reservoir of energy. The reservoir that creates gravitation, which keeps us on the ground, is the Cartan **curvature of spacetime**. Space Energy, or Energy from Spacetime, is **energy derived from the geometry of spacetime**. In the ECE theory, the zero point energy comes from the zero'th eigenvalue of the ECE Lemma with harmonic oscillator eigen functions. Space energy **is not** free energy. ECE theory predicts that voltages can reach infinity through SCR. This is no different from the electromagnetic spectrum having no limit. SCR does not violate Noether's Theorem and **it does not create energy from nothing**.

The spin connection is essential to Cartan geometry and general relativity, because it is the entity that introduces torsion and curvature into spacetime. In ECE theory it comes in to the definition of the electromagnetic potential and electromagnetic field. The way in which it enters the theory allows resonances, which are peaks or surges of electric power from spacetime. **This happens while rigorously obeying the basic law of conservation of energy**.

It is simply a high voltage caused by a particular type of oscillation (resonance) of a collection of charges by three or more external frequencies. Unfortunately, the frequencies necessary to achieve resonances in most materials are either far too high (X-Rays) or unknown. For example, SCR in principle would allow one to ionize diatomic oxygen (and make it glow green) but this would require the incident electromagnetic waves to be gamma- or x-rays. So, for many materials and applications, SCR is impractical. However, there is anecdotal evidence that Germanium semiconductors and mild steel can exhibit SCR-induced voltage surges for many frequency and amplitude combinations in the radio frequency range. This is spin connection resonance on a macroscopic level, compared to molecular processes.

There have been many claims of over unity devices but currently the only experiment / device that has been widely replicated and that demonstrates SCR conclusively is Bedini's SG motor - although the voltage gains are not that great (see, for example papers 63, 87 94 in the ECE theory series on the AIAS website - www.aias.us).

In principle the rotor in this specific Bedini device could be substituted with a solid state circuit. Some AIAS members have replicated Bedini's SG motor thereby meeting the basic experimental requirements of reproducibility and repeatability. It seems to provide evidence of SCR-induced voltage surges (as discussed in paper 94 of the ECE series on the AIAS website, www.aias.us), There are other devices/experiments that are good candidates but these need to be fully tested and replicated.

So, **a new potential source of extractable electrical power exists within ECE theory** – the source is the **Cartan torsion of space-time**. Space-time in ECE is

the standard space-time of general relativity, **in four dimensions** – it is not the classical aether. The aether is in fact rejected on the basis of the Michelson Morley experiment (as discussed in the overview above) and the basic premise of ECE theory – namely, the objectivity of physics. This objectivity is embodied in the geometry. Cartan geometry is chosen but other geometries could in principle be used and may form the basis of future extensions and studies (again as discussed above).

Amplification occurs through SCR – spin connection itself being the property of four-dimensional space-time **with curvature and torsion** – the base manifold of ECE theory. These resonance equations are seen to be equivalent to electrical circuits that can be used to amplify electrical power. It is possible that these sorts of circuits were first developed empirically and used by TESLA who unwittingly tapped space-energy. The actual source of this space-energy was certainly not known to him at the time (and to others that have followed – including the current generation of space energy device developers)). In the past hundred years or so, no one was able to understand Tesla's work in terms of the Maxwell Heaviside field equations of the standard model. These ***do not give resonance*** and are phenomenological (as stated above, derived in very complicated quaternion form by Maxwell in 1865 and much simpler and more powerful vector form by Heaviside in 1873). Only much later (circa 1899 to 1904) was it discovered by Poincare, Lorentz and others that the Maxwell Heaviside field equations of the standard model are equations of special relativity. Minkowski later developed his spacetime, circa 1906, and the Maxwell Heaviside field equations were realized to be equations of flat, or Minkowski, spacetime.

A satisfactory explanation of space energy is only provided by ECE theory and the equations of the generally covariant unified field – that are much more powerful than the Maxwell Heaviside equations. So this source of electromagnetic energy is the same in concept as energy from the gravitational field. In ECE theory gravitation is the curving of spacetime and electromagnetism is the spinning of spacetime. The two fields interact when curving and spinning interact. So all the genuine experimentalists since Tesla were on the right track and their work is now seen to be of the utmost importance. It is reiterated that these resonances occur while rigorously conserving energy / momentum / charge / current density (see 111 ECE papers on www.aias.us).

In principle, CAD (and similar) software (computer based methods for designing prototype devices) could be used to solve the relevant ECE equations. The equations governing these processes are nonlinear and cannot be solved easily. CAD software could be used to solve the equations for developing new devices (and refining those already in existence). This would be an invaluable tool to assist in computer aided design, for determining the necessary frequencies to create resonance conditions, and for exploring the possible core materials best suited for SCR.

As stated, there are already prototype working devices available within AIAS based on the Bedini patent. The ECE engineering model is already well developed and can be seen in the slide set at:

<http://www.aias.us/documents/miscellaneous/ECE-Eng-Model.pdf>.

The Faraday Disc Generator has also been successfully explained for the first time using ECE theory. A Faraday disk generator can be used to demonstrate spin connection resonance (see paper 107 of the ECE series, www.aias.us). This paper was again experimentally led, in fact in response to a report of an exploding Faraday disk generator - that is, a generator that was presumably over powering itself.

Space energy is limitless, it is clean and renewable. Working devices are already available that demonstrate the scientific principles involved and can be used to tap this new source of energy. ECE theory is the only theory that successfully explains this source of energy. Using it, existing devices can be modeled, refined, and fine tuned. New types of devices can be developed from it.

3. Anti Gravity Devices

Summarizing from above, gravitation is the curvature of spacetime, and electromagnetism is the torsion of spacetime. Spin connection resonance is the key to new energy and counter gravitation devices. In terms of differential geometry, torsion can be viewed as a form of curvature.

Without spin connection resonance the effect of mass on the Coulomb law is entirely negligible in the laboratory (as shown, for example in paper 111 of the ECE theory series on the AIAS website, www.aias.us). However with SCR there is in theory a very large effect of an electromagnetic field on gravitation. A unified field theory (ECE) is needed to understand this. Spacetime energy devices produce this resonance, as seems to be the case from Tesla's time onwards. SCR was developed in response to these reported but unexplained effects. Either Tesla's work was artifact (unlikely because his work is seen everywhere in the modern electric industry) or there had to be an explanation outside the standard model approach (which cannot explain spacetime energy). ECE theory is the only one capable of describing Tesla's work without violation of conservation of energy. In theory, counter gravitation devices could work on the same resonance principles. That is, a propulsion system capability and anti gravity device becomes a possibility on the basis of ECE theory **under resonant conditions** (when the gravitational and electromagnetic fields can interact).

So, spin connection resonance (SCR) is again required to build a functional counter gravitation device – assuming at this stage that this is possible. Horst Eckardt has suggested that probably two effects will be required to be developed

and controlled: one is the creation of a spacetime imbalance and the other is SCR. The spacetime imbalance leads to a net gravitational force (push or pull). This can be achieved by electromagnetic fields. In principle there should not be a fixed coupling of the magnetic field to sources. Such a coupling is not present in e-m radiation where the magnetic field is coupled to the electric field and vice versa. The time dependence of fields will play a crucial role here as found in the calculations on the Bedini and homopolar machines. It should be possible to achieve this first condition by carefully manipulating the engineering model of ECE theory. An anti-gravitational device must not only produce the right spacetime geometry but must also create a resonance condition of the form necessary to induce a coupling between electromagnetism and gravitation (so that a net propulsion force is generated).

The possibility of such coupling and the creation of lift (or propulsion) may actually have been found accidentally under resonance conditions by some experimenters – but this needs to be confirmed and replicated in a controllable and repeatable manner.

4. Other Lines of Research and Development

It is already identified / suggested that ECE theory could have applications in other lines of research activity including:

- 1 New software developments
- 2 Stealth RADAR development.
- 3 Room temperature super conductors
- 4 Contributions to other technologies that AIAS is associated with such as those being developed by the companies Steriwave and MagneGas etc.

Many more lines of research and development will follow – ECE theory unifies all of physics and must have applications in all the fields of physics. The technological possibilities associated with a new theoretical advance of this significance are limited only by the bounds of imagination and ingenuity.

The technological mission of AIAS, and its associated groups, is to provide new engineering solutions to emerging world problems (such as the looming energy crisis, fuel shortages, global warming and climate change) using Einstein-Cartan-Evans (ECE) and Spin-Connection-Resonance (SCR) at its foundation. A main goal is the exploitation of power from the torsion of space-time. This will be a completely new, original, and important development in electrical engineering because electric power can be generated from an entirely new source, that does not require the burning of fossil fuels, does not create pollution, is limitless, is available to all nations (rich and poor), and, in principle, could satisfy the needs of an energy hungry world.

There is an enormous potential market for new energy products as fuel and energy prices increase and peak oil (when demand outstrip supplies) approaches. New energy devices can be developed to generate electricity on a large scale (power stations) or on the domestic scale (in electric circuits or on microchips that can be fitted to domestic devices to save power, for example). The potential market base is very large – energy is used at increasing rates in almost every aspect of our lives - in Government, in industry, the forces, in agriculture and our homes. 25% of the total electricity now generated in the UK is used to run the information technology and communications network alone – and this is still growing.

The dependency on tradition sources of energy is starting to change, however, as Governments commit themselves to lowering their carbon emissions and footprints – by 60%, for example, by 2050 in the UK under the new Climate Change Bill. The world order is changing in response to concerns about the environment and the possible fate of our planet. Our hunger for energy increases relentlessly worldwide and future demands will have to be met using new technologies - if current standards of living are to be maintained.

Conclusions

ECE Theory is a major new scientific advance. The theory, after only five years since inception, is already well developed and flaws in the standard model of physics are now seen to be so fundamental that it must be discarded and regarded as obsolete. The electromagnetic sector of the standard model is still in the form of a primitive and extremely limited $U(1)$ gauge symmetry. The gravitational sector was actually known to be flawed as far back as 1918 and must now be regarded as a societal miscomprehension or "meme". These flaws and inconsistencies have hindered the real progress of science – physics must now move on.

Torsion has be central to a unified field theory of physics and such a theory must be **causal and objective**. Flaws in the Bohr Heisenberg indeterminacy were demonstrated beyond all doubt in the early seventies using the direct observation of atoms with electron microscopy. What can be seen and photographed is real – there is no uncertainty.

ECE theory allows the development of new technologies and industries. The acid test of any new theory is its ability to make new predictions that can be used for engineering purposes.

