Alpha Institute for Advanced Studies (AIAS)

UBI MATERIA, IBI GEOMETRIA.

LLE MAE 'NA FATER, MAE 'NA GEOMETREG.

WO MATERIE IST, DORT IST GEOMETRIE.

WHERE THERE IS MATTER, THERE IS GEOMETRY.

Advantages of ECE Theory over the Standard Model

The following is a list of some of the philosophical and experimentally tested advantages of ECE theory over the contemporary Standard Model of physics. These advantages reflect the principles of Francis Bacon (test against data) and William of Ockham (the simpler the better).

The first version of this document was written by Myron Evans, and it was later updated and expanded by Horst Eckardt.

If only ECE theory is mentioned, then there is nothing similar in the Standard Model. Also, please note that the referenced UFT papers are available on the AIAS website (aias.us).

Cartan geometry and general relativity

1. *The derivation in UFT Paper 88 of the complete second Bianchi identity.* This derivation shows that the Einstein field equation is based on a second Bianchi identity that incorrectly omits spacetime torsion.

2. *The proofs, in several UFT papers, of the Hodge dual of the second Bianchi identity.* Both the identity and the dual identity must be obeyed in a field theory of general relativity.

3. *The demonstration, in UFT Paper 93, that the Einstein field equation fails the test of the dual identity because of its neglect of spacetime torsion.* Therefore, the Einstein field equation is geometrically incorrect.

4. *The ECE theory discovery that the symmetric Christoffel connection cannot be used in a theory of general relativity*.

5. *The development, in several UFT papers, of the origins of fundamental dynamical and electrodynamical quantities in terms of spin and orbital torsion.* Two of the laws of classical electrodynamics are due to orbital torsion (Coulomb and Gauss), and two are due to spin torsion (Ampere Maxwell and Faraday).

Quantum mechanics

6. *In ECE theory, the origin of particle spin is traced to geometry.* In this way, particle spin is successfully incorporated into general relativity. This is not possible in the Standard Model due to the neglect of torsion.

7. *The unification of quantum mechanics and general relativity.* This is achieved straightforwardly in ECE theory with geometry. In the Standard Model, no such unification has been achieved. The Dirac, Proca and similar wave equations are limits of the ECE wave equation, thus they can be used to describe the effects of gravitation on electromagnetism. This is not possible in the Standard Model.

8. *Discovery of the Fermion Equation.* This equation is based on 2x2 Pauli spin matrices, while the Dirac equation requires 4x4 extended spin matrices. Thus, negative energies, a point of much confusion in Dirac theory, are excluded and the handling of relativistic fermion systems is significantly simplified.

9. *Improvements to the Heisenberg Uncertainty Principle*. Various experiments show that, in the Standard Model, the Heisenberg Uncertainty Principle has been proved not to be valid for all combinations of conjugated operators. In such cases, it is incorrect by up to nine orders of magnitude. ECE theory modifies the Uncertainty Principle by introducing action density, thus giving qualitative agreement with data.

10. *The theory of photon mass.* The Proca equation is derived straightforwardly from geometry, using the ECE hypothesis that the potential is proportional to the tetrad. In the Standard Model, the theory of the Proca equation conflicts diametrically with the gauge principle.

11. *Description of the electroweak field without the Higgs mechanism.* This becomes possible by solving simultaneous ECE wave equations without the ad hoc Higgs mechanism, which is extraneous to Einstein's theory of general relativity.

12. *Description of particle exchange (for example, exchange of photon and electron), using general relativity as the basis.* This is achieved with simultaneous ECE

equations, and without having to use renormalization. In the Standard Model, this description is incomplete (special relativity) and requires a hugely elaborate renormalization procedure.

13. *Description of neutrino mass and oscillations.* This is accomplished straightforwardly in ECE theory, but with great difficulty in the Standard Model, because neutrino mass has been long thought to be zero, which is in conflict with Einstein's general relativity.

14. *Derivation of the quark gluon model from general relativity.* This has been achieved in ECE theory using the SU(3) representation space in Cartan geometry. In the Standard Model, the quark gluon model is still a theory of special relativity, with ad hoc infinities that have to be removed by renormalization.

15. *Derivation of quantum electrodynamics from general relativity.* This is achieved in ECE theory using the ECE wave equation and the ECE hypothesis, in which the potential is proportional to the tetrad. In so doing, a minimum particle volume is defined that makes renormalization obsolete - there are no point particles in nature.

16. *Quantum entanglement and the single photon Young experiment.* Both have been explained in ECE theory. This has been done by applying the concept of the spin connection of Cartan torsion to electrodynamics and quantum electrodynamics. The Standard Model fails, in this regard, because of the failure of the Bohr-Heisenberg indeterminacy.

17. *In ECE theory, the equations of quantum field theory have been derived from general relativity without the use of ad hoc "dimensions" (string theory).* Also, it has been admitted by leading string theorists that string theory cannot be tested experimentally.

18. *Quantum forces.* A novel quantum force equation has been developed, making quantum mechanical force calculations much easier.

19. *Quantum Hamilton equations.* The Hamilton formalism of classical mechanics has been adapted to the quantum level, which is a completely new development that is based on ECE theory.

Special quantum effects

20. *The inverse Faraday effect.* This effect is described in ECE theory by the spinning of spacetime, from first principles. It was described earlier by the B(3) field on the basis of O(3) electrodynamics (special relativity). In the Standard Model, it cannot be described self-consistently or without an ad hoc conjugate product A x A* of special relativity.

21. *The Aharonov Bohm effect.* This effect is described in ECE theory self-consistently through the spin connection, using the principles of general relativity. There is a description in the Standard Model (which involves special relativity) that is based on topological considerations. This description is confused, elaborate and in some respects erroneous (UFT Paper 279). Therefore, it does not give a satisfactory description of the Aharonov Bohm effect.

22. *The Sagnac effect and ring laser gyro.* These are described by Cartan torsion in ECE theory, but cannot be described by the Maxwell-Heaviside field theory of the Standard Model.

23. *The topological phases such as the Berry phase.* In ECE theory, they are derived from the first principles of general relativity. In the Standard Model, their description is incomplete because it is confined to special relativity.

24. *A simpler and more powerful understanding of radiative correction effects, such as the anomalous g factor of the electron and the Lamb shift.* Radiative corrections have been achieved through ECE theory. In UFT Paper 85, major internal inconsistencies in data from standards laboratories (such as www.nist.gov of the US National Institute for Standards and Technology) were demonstrated; therefore, the methods of QED and QCD must be considered obsolete. They were never first principles theories, because of the use of adjustable parameters (e.g., dimensional regularization) and renormalization, and also because of acausality and unobservable virtual particles.

25. *A comprehensive explanation of radiatively induced fermion resonance.* This novel fermion resonance of ECE theory allows a high resolution and magnetless form of ESR, NMR and MRI.

26. *New types of ESR and NMR spectroscopy.* The quantum sector of ECE2 theory describes new types of spectra, structures that are richer than those known from the Dirac equation.

Electrodynamics and optics

27. *The generally covariant description of the laws of electrodynamics.* In ECE theory, this is a straightforward consequence of Cartan's structure equations and identities. In the Standard Model, such a description is not possible, because electrodynamics is not generally covariant, i.e., the Standard Model uses the Maxwell-Heaviside theory of Lorentz-covariant special relativity.

28. *Replacement of the gauge principle by the invariance principle of ECE theory.* This allows a return to the original principle of general relativity, without the introduction of an ad hoc abstract internal space as in gauge theory. The weaknesses of gauge theory are thus not present in ECE theory.

29. *The ECE theory derivation of the Coulomb Law as a limit of the Theorem of Orbits.*

This connects electromagnetism with dynamics, for which the theorem of orbits was developed.

30. *All optical effects (particularly the polarization change) when light is deflected by gravitation are described in ECE theory.* These effects are not described in the Standard Model because of its neglect of torsion. In particular, the observed polarization of circularly deflected light around heavy stars is not explainable by general relativity.

31. *Snell's law, reflection, refraction, diffraction, interferometry and related optical effects.* These can only be described correctly with ECE theory. In the Standard Model, the theory of reflection, for example, does not fit with parity inversion due to the neglect of the B(3) spin field.

32. *The concept of spacetime resonance in classical electrodynamics.* This concept, the "spin connection resonance" of ECE theory, is missing entirely from the Standard Model because electrodynamics therein is special relativity (flat Minkowski metric). Spin connection resonance is due to spinning spacetime (the Cartan torsion), and is the reason why electric power may be obtainable from spacetime (as reported by several groups). The Standard Model has no explanation for these reported experimental observations.

33. *Longitudinal electromagnetic waves.* Longitudinal waves are possible, because they are a solution of the covariant Maxwell-Heaviside equations (in addition to the usual transverse waves).

34. *Electromagnetic fields for which the curled vector fields are parallel to the direction of propagation.* This is a valid solution of the ECE field equations, in vacuo as well as in matter. In standard physics, it is assumed for the vacuum that the curled field vectors are always perpendicular to the field vectors.

35. *Non-zero photon mass.* Photon mass has been computed in several ways by ECE theory, but is assumed to be zero in the Standard Model.

36. *Universal type of red shifts in spectra.* ECE theory explains how red shifts can appear in all absorption spectra at any frequency of the electromagnetic spectrum (Evans-Morris red shifts).

37. *In ECE theory, the equations of superconductivity have been derived from general relativity by using geometry.* This has also been done for the equations of semiconductor and plasma theory. This cannot be done in the Standard Model.

Classical mechanics

38. *Four laws of dynamics and gravitation.* Unification of gravitation and electrodynamics leads to four laws of dynamics and gravitation. In standard theory, there is only Newton's law of dynamics (later wrongly expanded by

Einstein's field equation) and Newton's law of mass attraction (gravitation). In ECE theory, the gravitomagnetic field was discovered to be the equivalent of the magnetic field. The four laws are formally identical to Maxwell's equations, and they are the Gauss law, the Faraday law, the law of gravitation (corresponding to the Coulomb law) and the Ampère-Maxwell law. The Standard Model only recognizes the law of gravitation.

39. *Counter gravitational spin connection resonance has been developed in ECE theory.* This development shows that counter-gravitation is feasible, and the Standard Model has nothing comparable.

40. *Unified handling of Thomas precession, de Sitter Precession and Lense-Thirring precession.* This follows from rotations of the relativistic line element of ECE2 theory. Orbital precession appears at all orders of magnitude (microscopic to macroscopic).

41. *Comprehensive explanation of the classical vacuum.* In ECE theory, the classical Vacuum is described by potentials without force fields. This description is not possible in the Standard Model.

42. *Vacuum force in spherically symmetric spacetime.* In ECE theory, a new type of force (vacuum force) appears that is directed towards the center of the spherical space and diverges when the distance to the center goes to zero. In this way, huge amounts of energy can be transferred from the vacuum to a real mass.

43. *Extension of the validity range of Lagrange theory.* The Lagrange theory (Euler-Lagrange equations) of special relativity is extended to general relativity, while the mathematical formalism is maintained. This method for dynamics calculations is easy to handle, light-years easier than Einstein's general relativity.

44. *Calculation of light trajectories during deflection by gravitation.* By using ECE theory, it is possible to compute the dynamics of relativistic light corpuscles. For light deflected by the Sun, quantitative agreement with Eddington's experiment is obtained.

45. *Simple explanation of LENR experiments by ECE theory.* Several methods have been developed, and the most conclusive one is based on ECE general relativity for a centrally symmetric spacetime.

Fluid dynamics

46. *Unification of general relativity with fluid dynamics.* ECE theory has made fluid dynamics generally covariant by unifying it with general relativity. The Navier-Stokes equations remain valid in a larger scope of applicability.

47. *The ECE theory derivation of the Euler equation of motion from the first Cartan structure equation.* This proves the general covariance of the Euler equation.

48. *Introduction of a generally covariant spacetime aether.* The curvature and torsion of spacetime can be clearly interpreted as a flow of a thin, incompressible liquid. This interpretation of general relativity allows the equations of fluid dynamics to be applied directly. It enables novel applications, and changes the abstract concept of curved and twisted spacetime into a workable theory.

49. *Unified interpretation of scalar and vector potentials.* Electromagnetic as well as mechanical scalar and vector potentials are interpreted as the pressure and the flux velocity of fluid spacetime or aether.

50. *Orbital precession as an effect of fluid spacetime.* This possibility is a result of the unification of general relativity with fluid dynamics, and suggests a new type of orbital precession of celestial bodies.

51. *The intrinsic structure of fields, and the origin of mass and charge.* Cartan geometry allows us to define the inner aether flows of force fields, thus enabling a deeper understanding of Nature. Mass and charge come out as divergences of a spherically symmetric spacetime structure. The Standard Model is not able to achieve this because it is not based on general covariance and is lacking the spin connection.

Cosmology

52. *A new cosmology has been developed in ECE theory (and it is in agreement with experiments).* This cosmology has several advantages (see below) over the Standard Model due to the incorporation of Cartan torsion, which is part of Riemann geometry. The cosmology used by Einstein and Hilbert neglects torsion because it assumes a symmetric Christoffel connection.

53. *The development, in UFT Paper 111, of the Theorem of Orbits.* This theorem replaces the Einstein field equation, with respect to all known orbits, as a simple and powerful explanation that uses the spherical symmetry of spacetime.

54. *The explanation, in UFT Paper 108, of the orbits of binary pulsars.* This explanation does not use the incorrect Einstein equation, in particular, it does not use its incorrect idea of gravitational radiation.

55. *The velocity curve of a spiral galaxy.* This is described in ECE theory by a constant torsion, which originates from a constant Cartan torsion of spacetime. The velocity curve cannot be described in the Standard Model without the introduction of ad hoc "dark matter".

56. *The cosmological red shift is explained in ECE theory as a simple optical effect.* This

shows why there can be different red shifts for equidistant objects (e.g., the data of Halton Arp). The Standard Model has no explanation for this and many other observations of astronomy.

57. *ECE theory shows that there are no singularities in nature, so there was no Big Bang.* This concept has been replaced in ECE theory by an oscillatory universe without singularities. The scholar Stephen Crothers has shown that the idea of a Big Bang is due to erroneous mathematics in the Standard Model. (These errors are not present in ECE theory.)

58. *Equinoctial precession and galactic dynamics.* These have been explained by the gravitomagnetic law of ECE theory.

59. *Fully relativistic orbits of heavy stars.* These can be computed numerically by ECE2 Lagrange theory, with moderate effort.

60. *Explanation of forward and backward precession.* ECE2 theory allows arbitrary types of precession of celestial orbits from perturbations in spacetime. These perturbations can be of known types, such as relativistic effects, or of novel types like vacuum fluctuations.

61. *Superluminal motion and quasi infinite energy in spherically symmetric spacetime.* A description of spherically symmetric spacetime has been developed that can easily handle vacuum variations such as a pressure gradient. As a result, the velocity of light can exceed the well-known constant value of special relativity.

62. *Higher dimensions in ECE theory.* Since Cartan geometry is not restricted to any specific number of dimensions, it is possible to work out ECE theory in more than four dimensions, at least to give philosophical considerations a mathematical basis. According to Burkhard Heim, the higher dimensions are time-like. A mechanism for solving the wave equation in such a structure has been developed.

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