6. SPIN CONNECTION RESONANCE

One of the most important consequences of general relativity applied to
electrodynamics is that the spin connection enters into the relation between the field and
potential as described in Section 5. The equations of electrodynamics as written in terms of
the potential can be reduced to the form of Bernoulli Euler resonance equations. These have
been incorporated during the course of development of ECE theory into the Coulomb law,
which is the basic law used in the development of quantum chemistry in for example density
functional code. This process has been illustrated \(1-12\) with the hydrogen and helium
atoms. The ECE theory has also been used to design or explain circuits which use spin
connection resonance to take power from space-time, notably papers 63 and 94 of the ECE
series on www.alnas.us. In paper 63, the spin connection was incorporated into the Coulomb
law and the resulting equation in the scalar potential shown to have resonance solutions using
an Euler transform method. In paper 94 this method was extended and applied systematically
to the Bedini motor. The method is most simply illustrated by considering the vector form of
the Coulomb law deduced in Section 5:

\[
\mathbf{\nabla} \cdot \mathbf{E} = \rho, \quad - (130)
\]

and assuming the absence of a vector potential (absence of a magnetic field). The electric
field is then described by:

\[
\mathbf{E} = - (\mathbf{\nabla} \phi), \quad - (131)
\]

rather than the standard model's:

\[
\mathbf{E} = - \mathbf{\nabla} \phi, \quad - (132)
\]

Therefore Eq. \(131\) in \(130\) produces the equation
\[ \nabla^2 \phi + \mathbf{a} \cdot \nabla \phi + (\nabla \cdot \mathbf{a}) \phi = -\frac{\rho}{\varepsilon_0} \]  
(133)

which is capable of giving resonant solutions as described in paper 63. The equivalent equation in the standard model is the Poisson equation, which is a limit of Eq. (133) when the spin connection is zero. The Poisson equation does not give resonant solutions. It is known from the work of Tesla for example that strong resonances in electric power can be obtained with suitable apparatus, and such resonances cannot be explained using the standard model. A plausible explanation of Tesla's well-known results is given by the incorporation of the spin connection into classical electrodynamics. Using spherical polar coordinates and restricting consideration to the radial component:

\[ \nabla^2 \phi = \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial \phi}{\partial r} \right) \]  
(134)

\[ \mathbf{a} \cdot \nabla \phi = \mathbf{a}_r \frac{\partial \phi}{\partial r} \]  
(135)

so that Eq. (133) becomes:

\[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial \phi}{\partial r} \right) + \frac{1}{r} \frac{\partial \phi}{\partial r} + \frac{\phi}{r^2} \left( 2r\mathbf{a}_r + r^2 \mathbf{a}_r \frac{\partial}{\partial r} \right) = -\frac{\rho}{\varepsilon_0} \]  
(136)

In paper 63 a spin connection was chosen of the simplest type compatible with its dimensions of inverse meters:

\[ \mathbf{a}_r = -\frac{1}{r} \]  
(137)

and thus giving the differential equation:

\[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial \phi}{\partial r} \right) = \frac{1}{r^2} \phi = -\frac{\rho}{\varepsilon_0} \]  
(138)
as a function of \( r \), Eq. (138) becomes a resonance equation if the driving term on the right hand side is chosen to be oscillatory, in the simplest instance:

\[
\rho = \rho(0) \cos(\kappa r), \quad -(139)
\]

To obtain resonance solutions from Eq. (138), an Euler transform \((1-12)\) is needed as follows:

\[
\kappa r = \exp(i\kappa R), \quad -(140)
\]

This is a standard Euler transform extended to a complex variable. This simple change of variable transforms Eq. (138) into:

\[
\frac{d^2 \phi}{dR^2} + \kappa^2 R \phi = \frac{\rho(0)}{\epsilon_0} \text{Re} \left( e^{2i\kappa R} \cos(e^{i\kappa R}) \right), \quad -(141)
\]

which is an undamped oscillator equation as demonstrated in detail in Eq. 63, where the domain of validity of the transformed variable was discussed in detail. It is seen from feedback software to www.nias.us that paper 63 has been studied in great detail by a high quality readership, so we may judge that its impact has been extensive. The concept of spin connection resonance has been extended to gravitational theory and magnetic motors and the theory published in standard model journals \((25-27)\). In paper 63 the simplest possible form of the spin connection was used, Eq. (137) and the resulting Eq. (138) was shown to have resonance solutions using a change of variable. There is therefore resonance in the variable \( R \).

In paper 90 of www.nias.us this method was made more general by considering the equation

\[
\frac{d^2 \phi}{dr^2} + \left( \frac{2}{r} + r \omega_i \right) \frac{d\phi}{dr} + \frac{\phi}{\omega^2} = -\frac{\rho(0)}{\epsilon_0}, \quad -(142)
\]
which is a more general form of Eq. (138). When the spin connection is defined as:

$$\omega = \omega_0 r - 4 \beta \log_e r - \frac{4}{r} = -145$$

Eq. (142) becomes a simple resonance equation in $r$ itself:

$$\frac{d^2 \phi}{dr^2} + 2 \beta \frac{d \phi}{dr} + \omega_0^2 \phi = \frac{f_0}{e_0}.$$  

(144)

There is freedom of choice of the spin connection. The latter was unknown in electrodynamics prior to ECE theory and must ultimately be determined experimentally. An example of this procedure is given in paper 94, where spin connection resonance (SCR) theory is applied to a patented device. One of the papers published in the standard model literature (26) applies SCR to magnetic motors that are driven by space-time. It is probable that SCR was also discovered and demonstrated by Tesla (28), but empirically before the emergence of relativity theory. SCR has also been applied to gravitation and published in the standard model literature (27). So a gradual loosening of the ties to the standard model is being observed at present.

In paper 92 of the ECE series (www.aiacs.us), Eq. (142) was further considered and shown to reduce to an Euler-Bernoulli resonance equation of the general type:

$$\frac{d^2 x}{dt^2} + 2 \beta \frac{dx}{dt} + \kappa_0^2 x = A \cos(n \tau) = -145$$

(145)

in which $A \beta$ plays the role of friction coefficient, $\kappa_0$ is a Hooke's law wave-number and in which the right hand side is a cosinal driving term. Eq. (142) reduces to Eq. (145) when:

$$\omega \tau = 2 \left( \beta - \frac{1}{r} \right), \quad \kappa_0^2 = \frac{4}{r} \left( \beta - \frac{1}{r} \right) + \frac{d \omega_0}{d \tau} = -146$$

(146)
Therefore the condition under which the spin connection gives the simple resonance equation (14.5) is defined by:

$$\omega_i = k_o^2 - 4\beta \log_e r - \frac{4}{r}.$$  \hspace{1cm} (147)

Reduction to the standard model Coulomb law occurs when:

$$\beta = \frac{1}{r}.$$ \hspace{1cm} (148)

when

$$\omega_i = 0, \quad k_o^2 = 0.$$ \hspace{1cm} (149)

In general there is no reason to assume that condition (14.8) always holds. The reason why the standard model Coulomb law is so accurate in the laboratory is that it is tested off resonance. In this off resonant limit the ECE theory has been shown (14.12) to give the Standard Coulomb law as required by a vast amount of accumulated data of two centuries since Coulomb first inferred the law. In general, ECE theory has been shown to reduce to all the known laws of physics, and in addition ECE gives new information. This is a classic hallmark of a new advance in physics. It is probable that Tesla inferred methods of tuning the Coulomb law (and other laws) to spin connection resonance. Many other reports of such surges in power have been made, and it is now known and accepted by the international community of scientists that they come from general relativity applied to classical electrodynamics.

Paper 94 of the ECE series is a pioneering paper in which the theory of SCR is applied to a patented device in order to explain in detail how the patented device takes energy from space-time. No violation of the laws of conservation of energy and momentum occurs in ECE theory or in SCR theory.
7. EFFECTS OF GRAVITATION ON OPTICS AND SPECTROSCOPY.

In the standard model of electrodynamics the electromagnetic sector is described by
the nineteenth century Maxwell Heaviside (MH) field theory, which in gauge theory is U(1)
invartant and Lorentz covariant in a Minkowski space-time. As such MH theory cannot
describe the effect of gravitation on optics and spectroscopy because gravitation requires a
non-Minkowski space-time. In ECE theory on the other hand all sectors are generally
covariant, and during the course of development of ECE theory several effects of gravitation
on optics and spectroscopy have been inferred, notably the effect of gravitation on the Sagnac
effect, RFR and on the polarization of light grazing a white dwarf. An explanation for the
well known Faraday disk generator has also been given in terms of spinning space-time, an
exploration which illustrates the fact that the torsion of space-time produces effects not
present in the standard model. Gravitation is the curvature of space-time and in ECE theory
the interaction of torsion and curvature is determined by Cartan geometry.

The Faraday disk generator has been explained in ECE theory from the basic
assumption that the electromagnetic field is the Cartan torsion within a factor:

\[ f_{\text{magn}} = A^{(a)} T_{\text{magn}} - (15^a) \]

where \( A \) is the primordial voltage. The factor \( A^{(a)} \) is considered to originate in the magnet
of the Faraday disk generator. The Faraday disk generator consists essentially of a spinning
disk placed on a magnet, without the magnet no induction is observed, i.e. no p.d. is
generated between the center and rim of the disk without a magnet being present. The original
experiment by Faraday on 20th Dec. 1831 consisted of spinning a disk on top of a static
magnet, but a p.d. is also observed if the disk is spun and the magnet is spun about the vertical axis. There continues to be no explanation for the Faraday disk generator in the
standard model, because in the latter there is no connection between the electromagnetic field.
and mechanical spin, angular momentum and torsion, while ECE makes this connection in
Eq. (150). The standard model law of induction of Faraday is:
\[ \nabla \times \mathbf{E} + \frac{\partial \mathbf{B}}{\partial t} = \mathbf{0} \quad -\quad (151) \]
and spinning the magnetic field about its own axis does not produce a non-zero curl of the
electric field as required. Clearly, a static magnetic field will not cause induction from Eq.
\((151)\). So this is a weak point of the standard model, in which induction is caused in the
classical textbook description by moving a bar magnet inside a coil, causing a current to
appear. In ECE it has been shown (1-12) that the explanation of the Faraday disk generator is
simply:
\[ \mathbf{F} = \mathbf{F} \text{ em} + \mathbf{F} \text{ mech} \quad -\quad (152) \]
which in vector notation (section 5) produces the law of induction:
\[ \nabla \times \mathbf{E} \text{ mech} + \frac{\partial \mathbf{B} \text{ mech}}{\partial t} = \mathbf{0} \quad -\quad (153) \]
Spinning the disk has the following effect in ECE theory.

In the complex circular basis \(\{1, 2, 3\}\) the magnetic flux density in ECE theory is
defined by:
\[ \mathbf{B}^{(1)} = \nabla \times \mathbf{A}^{(2')} - i \kappa \frac{\mathbf{A}^{(2)}}{\mathbf{A}^{(1)}} \mathbf{A}^{(3)} - (154) \]
\[ \mathbf{B}^{(2)} = \nabla \times \mathbf{A}^{(2)} - i \kappa \frac{\mathbf{A}^{(2)}}{\mathbf{A}^{(1)}} \mathbf{A}^{(3)} - (155) \]
\[ \mathbf{B}^{(3)} = \nabla \times \mathbf{A}^{(3)} - i \kappa \frac{\mathbf{A}^{(2)}}{\mathbf{A}^{(1)}} \mathbf{A}^{(3)} - (156) \]
where
\[ \kappa = \frac{\Omega}{c} \quad -\quad (157) \]
is a wave-number and $\Omega$ is an angular frequency in radians per second. When the disk is stationary the ECE vector potential is $(1-\Omega^2)$ proportional by fundamental hypothesis to the tetrad:

$$
\begin{align*}
A^{(1)} &= A^{(0)} \sqrt{1} & (158) \\
A^{(2)} &= A^{(0)} \sqrt{i} & (159) \\
A^{(3)} &= A^{(0)} \sqrt{-1} & (160)
\end{align*}
$$

In the complex circular basis the tetrads are:

$$
\begin{align*}
\sqrt{1}(1) &= \frac{1}{\sqrt{2}}(i - i) & (161) \\
\sqrt{i}(2) &= \frac{1}{\sqrt{2}}(i + i) & (162) \\
\sqrt{-1}(3) &= \frac{1}{\sqrt{2}}(i - i) & (163)
\end{align*}
$$

and have $O(3)$ symmetry as follows:

$$
\begin{align*}
\sqrt{1}(1) \times \sqrt{i}(2) &= i \sqrt{1}(1) & (164) \\
\sqrt{i}(2) \times \sqrt{-1}(3) &= i \sqrt{i}(2) & (165) \\
\sqrt{-1}(3) \times \sqrt{1}(1) &= i \sqrt{-1}(3) & (166)
\end{align*}
$$

In the absence of rotation about $Z$:

$$
\begin{align*}
\nabla \times A^{(1)} &= \nabla \times A^{(2)} = 0 & (167) \\
\nabla \times A^{(3)} &= A^{(0)} \frac{k}{r} & (168)
\end{align*}
$$

In the complex circular basis:

$$
\begin{align*}
\nabla \times E^{(1)} + \frac{dB^{(1)}}{dt} &= 0 & (169) \\
\nabla \times E^{(2)} + \frac{dB^{(2)}}{dt} &= 0 & (170) \\
\nabla \times E^{(3)} + \frac{dB^{(3)}}{dt} &= 0 & (171)
\end{align*}
$$

Therefore from Eqs. (158) to (171), the only field present is:

$$
\begin{align*}
B^{(2)} &= B^{(0)} \frac{k}{r} = -i B^{(0)} \sqrt{i} \times \sqrt{i} & (172)
\quad - i B^{(0)} \frac{k}{r} = B^{(3)} \frac{k}{r} & (173)
\end{align*}
$$
which is the static magnetic field of the bar magnet.

Now mechanically rotate the disk at an angular frequency $\Omega$ to produce:

$$\begin{align*}
A^{(1)}(3) &= \frac{A^{(2)}}{\sqrt{2}} \left( -i - \frac{i}{2} \right) \exp (i \Omega t), & (75) \\
A^{(2)}(3) &= \frac{A^{(2)}}{\sqrt{2}} \left( i + \frac{i}{2} \right) \exp (-i \Omega t), & (76)
\end{align*}$$

From Eqs. (75) to (76) electric and magnetic fields are induced in a direction transverse to $Z$, i.e. in the $XY$ plane of the spinning disk as observed experimentally. However, the $Z$ axis magnetic flux density is unchanged by physical rotation about the same $Z$ axis. This is again as observed experimentally. The $(2)$ component of the transverse electric field spins around the rim of the disk and is defined from Eq. (73) as:

$$E^{(2)} = E^{(1)} * \mathbf{e} = -\left( \frac{2}{\Omega} + i \Omega \right) A^{(2)} = (75)$$

It can be seen from section 5 that $i \Omega$ is a type of spin connection. The latter is caused by mechanical spin, which in ECE is a spinning of space-time itself. The real and physical part of the induced $E$ is:

$$\text{Real} \left( E^{(1)} \right) = \frac{2}{\sqrt{2}} A^{(2)} \Omega \left( i \sin \Omega t - \frac{1}{2} \cos \Omega t \right)$$

and is proportional to the product of $A$ and $\Omega$. Again as observed experimentally. An electromotive force is set up between the center of the disk and the rotating rim, as first observed experimentally by Faraday. This e. m. f. is measured experimentally with a voltmeter at rest with respect to the rotating disk.

The homogeneous law (118) of ECE theory is generally covariant (119) by construction, so retains its form in any frame of reference. ECE therefore produces a simple and complete description of the Faraday disk generator in terms of the spinning of space-time,
and concomitant spin connection. The latter is therefore demonstrated in classical
electrodynamics by the generator. All known experimental features are explained
straightforwardly by ECE theory, but cannot be explained by MH theory, in which the spin
connection is missing because Minkowski space-time has no connection by construction - it
is a “flat” space-time. It is relatively easy to think of electrodynamics as spinning space-time
and think of gravitation as curving space-time. This analysis also gives confidence in the
arguments of Section 6, waere power is obtained from space-time with spin connection
resonance.

The same ECE concept just used to explain the Faraday disk generator has been
used \( \{ -1 \} \) to give a simple explanation of the Sagnac effect (ring laser gyro). Again, the
standard model has no satisfactory explanation for the Sagnac effect \( \{ -1 \} \). Consider the
rotation of a beam of light of any polarization around a circle of area \( \pi r^2 \) in the XY plane at
an angular frequency \( \omega \). The rotation is a rotation of space-time itself in ECE theory,
described by the rotating tetrad:

\[
\mathbf{e} = \frac{1}{\sqrt{2}} \left( \mathbf{i} - \mathbf{j} \right) e^{i\omega t} - \left( 17.7 \right)
\]

This is rotation around the static platform of the Sagnac interferometer. The fundamental
ECE assumption means that this rotation produces the electromagnetic vector potential:

\[
\mathbf{A}^{(L)} = \mathbf{A}^{(o)} \mathbf{e} \left( \mathbf{i} - \mathbf{j} \right) e^{i\omega t} - \left( 17.8 \right)
\]

for left rotation and:

\[
\mathbf{A}^{(R)} = \mathbf{A}^{(o)} \left( \mathbf{i} + \mathbf{j} \right) e^{i\omega t} - \left( 17.9 \right)
\]

for right rotation. When the platform is at rest a beam going around left-wise takes the same
time to reach its starting point as a beam going around right-wise. The time delay is \( \Delta t \).
\[ \Delta t = 2\pi \left( \frac{1}{\omega_1} - \frac{1}{\omega_1} \right) = 0. \quad (180) \]

Eqs. (178) and (179) do not exist in special relativity because in the MH theory electromagnetism is a nineteenth century entity superimposed on a space-time that is flat and static and never rotates.

Now consider the left-wise rotating beam (178) and spin the platform mechanically in the same left-wise direction at an angular frequency \( \Omega \). The result is an increase in the angular frequency of the rotating tetrad as follows:

\[ \omega_1 \to \omega_1 + \Omega. \quad (181) \]

Similarly consider the left-wise rotating beam (178) and spin the platform right-wise. The result is a decrease in the angular frequency of the rotating tetrad:

\[ \omega_1 \to \omega_1 - \Omega. \quad (182) \]

The time decay between a beam circling left-wise with the platform, and one circling left-wise against the platform is therefore:

\[ \Delta t = 2\pi \left( \frac{1}{\omega_1 - \Omega} - \frac{1}{\omega_1 + \Omega} \right) \quad (183) \]

which is the Sagnac effect. The angular frequency \( \omega_1 \) can be calculated from the experimental result (174):

\[ \Delta t = \frac{4\Omega}{c^2} = \frac{4\pi \Omega}{\omega_1^2 - \Omega^2} \quad (184) \]

If

\[ \Omega \ll \omega_1 \quad (185) \]
it is found that
\[ \psi_1 = \frac{2}{c} \zeta \kappa \sim (186) \]
Q.E.D. Therefore the Sagnac effect is another result of a spin connection, which in this case can be thought of as the potential (119) itself.

Similarly, phase effects such as the Tomita-Chao effect were also described straightforwardly with the same basic concept during the development of ECE theory.

In order to describe the effects of gravitation on optics and spectroscopy a dielectric version of the ECE theory was developed and implemented to find that the polarization of light is changed by light grazing a very massive object such as a white dwarf, and the dielectric theory was also used to demonstrate the effect of gravitation on the Sagnac effect (1-12). The standard model is not capable of such descriptions without the use of adjustable parameters in such transient twentieth century artifacts as superstring theory, now being essentially discarded as being untestable experimentally. ECE is far simpler and is also capable of describing data such as the Faraday disk generator and the Sagnac effect straightforwardly. During the course of its development the ECE theory has also been applied to the interaction of three fields (23) and the effect of gravitation on the inverse Faraday effect and its resonance counterpart, known as radiatively induced fermion resonance (RFR).

The interaction of fields in ECE theory is controlled by Cartan geometry, in the particular case of the interaction of gravitation and electromagnetism, there is a very small homogeneous charge current density in the Gauss law and in the Faraday law of induction.

For all practical purpose in the laboratory this is not observable. However, it has been shown in ECE theory to result in changes of polarization and other optical properties of light grazing a white dwarf, which is an object many times heavier than the sun. Such changes of polarization are not described by the Einstein Hilbert equation.
8. RADIATIVE CORRECTIONS IN FCE THEORY.

During the course of development of FCE theory the anomalous g factor of the electron and Lamb shifts in hydrogen and helium have been explained satisfactorily in a far simpler manner than the standard model and using the causal and objective principles of Einsteinian relativity. The usual approach to the radiative corrections in quantum electrodynamics (QED) has been criticized \([1-12]\), especially its claim to accuracy. The QED method of the standard model relies on assumptions that are not present in Einsteinian relativity, and also on adjustable parameters. The Feynman method consists of assuming the existence of virtual particles and on a perturbation method of quantum mechanics which sums thousands of terms of increasing complexity. There is no proof that this sum converges. It is also claimed in standard model QED that the accuracy of the fine structure constant is reproduced theoretically to high precision. However the fine structure constant in \( \text{S.I.} \) units is:

\[
\alpha = \frac{e^2}{4\pi \hbar c} \tag{187}
\]

and its accuracy is limited by the experimental accuracy of the Planck constant. There is no way that a theory can produce a higher accuracy than experiment, and the theoretical value of the \( g \) factor of the electron is based on the value of the fine structure constant. Thus \( g \) cannot be known with greater accuracy than that of the fine structure constant. These surprising inconsistencies in the standard model data were discussed in detail \([1-12]\) and a brief summary is given here.

The fundamental constants of physics are agreed upon by treaty and are given on sites such as that of the National Institute for Standards and Technology (www.nist.gov).

This site gives:

\[
\alpha (\text{exp.} \pm \varepsilon) = 2. \, \text{exp} \pm 0.23193 \pm 0.045118 \pm 0.005 \, \text{exp} \pm 0.75 \times 10^{-31} \tag{188}
\]

\[
\text{g} (\text{exp.} \pm \varepsilon) = (6.6260693 \pm 0.000066) \times 10^{-27} \text{J} \, \text{s} \tag{189}
\]
\[ e^{\text{expt.}} = (1.60217663 \pm 0.00000014) \times 10^{-19} \text{ C} \quad (190) \]

\[ c^{\text{exact}} = 2.99792458 \times 10^8 \text{ m s}^{-1} \quad (191) \]

\[ \epsilon_0^{\text{exact}} = 8.854187817 \times 10^{-12} \text{ F m}^{-1} \quad (192) \]

\[ \mu_0^{\text{exact}} = 4\pi \times 10^{-7} \text{ T m A}^{-1} \quad (193) \]

with relative standard uncertainties. With a sufficiently precise value of:

\[ \pi = 3.1415926535897 \quad (194) \]

gives, from these data:

\[ \lambda' = 0.00729734 \quad (195) \]

where the result has been rounded off to the relative standard uncertainty of the Planck constant \( h \). This is an experimentally determined uncertainty. The theoretical value of \( g \) from ECE theory was found by using Eq. (195) in

\[ g = 2 \left(1 + \frac{\lambda'}{4\pi} \right)^2 \quad (196) \]

and gives:

\[ g_{\text{ECE}} = 2.0022323(47) \quad (197) \]

The experimental value of \( g \) is known to a much higher precision than the experimental value of \( h \), and is:
\[
g(\text{exp}) = 2.00 \ 23193043718 \pm 0.00000000075 - (198)
\]

It is seen that:

\[
g(ECE) - g(\text{exp}) = 0.00000004 - (199)
\]

which is about the same order of magnitude as the experimental uncertainty of \( h \). Therefore it was shown that ECE theory gives \( g \) as precisely as the experimental uncertainty in \( h \) will allow. The standard model literature was found to be severely self-inconsistent. For example a much used text by Atkins \( (29) \) gives \( h \) as:

\[
\ell (\text{Atkins}) = 6.62618 \times 10^{-34} \text{ Js} - (200)
\]

without uncertainty estimates. This is different in the fourth decimal place from the NIST value given above, a discrepancy of four orders of magnitude. Despite this, Atkins gives:

\[
d(\text{Atkins}) = 0.00729351 - (201)
\]

which claims to be different from Eq. (195) only in the sixth decimal place. Atkins gives the \( g \) factor of the electron as:

\[
g(\text{Atkins}) = 2.00 \ 2319314 - (202)
\]

which is different from the NIST value in the eighth decimal place, while it is claimed at NIST that \( g(\text{exp}) \) from Eq. (198) is accurate to the twelfth decimal place. So there is another discrepancy of four orders of magnitude. Ryder on the other hand \( (18) \) gives:

\[
g(\text{Ryder}) = 2.00 \ 23193048 - (203)
\]
which is different from the NIST value in the tenth decimal place, a discrepancy of two orders of magnitude. One could try to explain these discrepancies by increasing accuracy of experimental method over the years, but there is no way in which QED can reproduce \( g \) to the tenth decimal place as claimed by Ryder. This is easily seen from the fact that \( g \) is calculated theoretically in QED from the fine structure constant, whose accuracy is limited by \( h \) as we have argued. There is also no way in which QED can be a fundamental theory as is often claimed in the standard model literature. This is again easily seen from the fact that QED has several assumptions extraneous to the theory of relativity (1-12). Examples are virtual particles, acausality (the electron can do what it likes, \( g \) backwards in time and so on), dimensional regularization, re-normalization and the largely elaborate perturbation method known as the Feynman calculus. It is not known whether the series expansion used in the Feynman calculus converges. Its thousands of terms are just worked out by computer in the hope that it converges. In summary:

\[
\begin{align*}
g_{\text{(Schwinger)}} &= 2 + \frac{d}{\pi} = 2.002322(8) \quad (204) \\
g_{\text{(CEC)}} &= 2 + \frac{d}{\pi} + \frac{d^2}{8\pi^2} = 2.002323(14) \quad (205) \\
g_{\text{(exp.)}} &= 2.002319843718 \pm 0.000000000025 \quad (206) \\
g_{\text{(Aitchison)}} &= 2.002319316 \pm (?) \quad (207) \\
g_{\text{(Ryder)}} &= 2.0023193048 \pm (?) \quad (208)
\end{align*}
\]

and there is little doubt that other textbooks and sources give further different values of \( g \) to add to the confusion in the standard model literature. So where does this analysis leave the claims of QED? The Wolfram site claims that QED gives \( g \) using the series

\[
g = 2 \left( 1 + \frac{d}{2\pi} - 0.328 \left( \frac{d}{\pi} \right)^2 + 1.181 \left( \frac{d}{\pi} \right)^3 + 1.510 \left( \frac{d}{\pi} \right)^4 + \ldots + 4.393 \times 10^{-12} \right) \quad (209)
\]
which is derived from thousands of Feynman diagrams (sic). However, the numbers in Eq.
(2.6A) all come from the various assumptions of QED, none of which are present in
Einsteinian relativity. The latter is causal and objective by construction. An even worse
internal inconsistency emerges within the NIST site itself, because the fine structure constant
is claimed to be:

\[ \alpha_{\text{(NIST)}} = \left( 7.297352560 \pm 0.000000024 \right) \times 10^{-2} \]

both experimentally and theoretically. This cannot be true because Eq. (2.1e) is different in
the eighth decimal place from Eq. (1.05), which is calculated with NIST’s OWN data, Eqs.
(1.88) to (1.95). So the NIST site is internally inconsistent to several orders of
magnitude, because it is at the same time claimed that Eq. (2.1e) is accurate to the tenth
decimal place. From Eq. (1.84) however it is seen that \( h \) at NIST is accurate only to the sixth
decimal place, which limits the accuracy of \( \alpha \) to this, i.e. four orders of magnitude less
precise than claimed.

The theoretical claim for the fine structure constant at NIST comes from QED,
which is described as theory in which an electron emits a virtual photon, which in turn emits
virtual electron positron pairs. The virtual positron is attracted and the virtual electron is
repelled from the real electron. This process results in a screened charge, a mathematical
concept with a limiting value defined as the limit of zero momentum transfer or infinite
distance. At high energies the fine structure constant drops to \( 1/137 \), and so is not a constant
at all. It cannot therefore be claimed to be precise to the relative standard uncertainty of Eq.
(2.1b), taken directly from the NIST website itself. There is therefore no direct way of
proving experimentally the existence of virtual electron positron pairs, of virtual photons. The
experimental claim for the fine structure constant at NIST comes from the quantum Hall
effect combined with a calculable cross capacitor to measure standard resistance. The von Klitzing constant:

\[ R_k = \frac{h}{e^2} = \frac{\mu c}{2} \left( \frac{5}{2} \right) - (2n) \]

is used in this experimental determination. However, this method is again limited by the experimental accuracy of \( h \). The accuracy of \( e \) is only ten times better than \( h \) from NIST's own data, and \( R_k \) cannot be more accurate than \( h \). If \( \varphi \) were really as accurate as claimed in Eq. (210), both \( h \) and \( e \) would have to be this accurate experimentally, and this is obviously not true.

In view of these severe inconsistencies in the standard model and in view of the many ad hoc and indeed improvable assumptions of QED, it is considered that the so-called "precision tests" of QED are of no utility and no meaning. These include the \( g \) factor of the electron, the Lamb shift, the Casimir effect, positronium, and so forth.

The ECE theory of these radiative corrections therefore set out to reproduce what is really known experimentally in the simplest way. These methods are of course those of William Ockham and Francis Bacon. In the non-relativistic quantum approximation to ECE theory the Schrödinger equation was modified as follows (1-12):

\[ -\frac{\hbar^2}{2m} \left( \frac{\partial^2}{\partial \varphi^2} + \frac{\partial^2}{\partial \varphi^2} \right) \psi = -\frac{\hbar^2}{4\pi^2 \varepsilon_0} \left( \frac{1}{r} \right) \psi \]

in which the effect of the vacuum potential is considered to be a shift in the electron to proton distance for each orbital of an atom or molecule, in the simplest case atomic hydrogen (H).

Computer algebra was used to show that:
\[
\frac{\psi_{\text{vac}}(2s)}{\psi_{s+s(\text{vac})}} = \frac{\psi_{\text{vac}}(2p_{1/2}, s \theta = 1)}{\psi_{s+s(\text{vac})}} = \frac{1}{\frac{\hbar}{4\pi mc}} \frac{1}{r^2} \quad -(2.13)
\]

so that the simple ECE method of Eq. (2.12) gives the correct qualitative result observed first by Lamb in atomic H. This is known as the Lamb shift. Computer algebra was used to show that the ECE Lamb shift is:

\[
\Delta E = \left( \frac{1}{16\pi^{3/2}} \frac{\hbar^2}{mc} \right) \frac{1}{r} = 0.0353 \text{ cm}^{-1} \quad -(2.14)
\]

in the approximation in which the angular dependence of the Lamb shift is not considered.

The potential energy of the unperturbed H atom in wave-numbers is:

\[
\psi_0 = -\frac{1}{r} \quad -(2.15)
\]

and the vacuum perturbs this as follows:

\[
\psi = -\frac{1}{r + r(\text{vac})} \quad -(2.16)
\]

So the change in potential energy due to the vacuum (i.e. the radiative correction) is positive valued as follows:

\[
\Delta \psi = |\psi - \psi_0| = \frac{1}{r} - \frac{1}{r + r(\text{vac})} \quad -(2.17)
\]

This equation was obtained by assuming that the Schrödinger equation of H in the presence of the radiative correction due to the vacuum is, first order in \( \alpha \)
\[ -\frac{\hbar^2}{2m} \left( 1 + \frac{\alpha}{\pi} \right) \nabla^2 \phi - \frac{\hbar^2}{4\pi} \frac{e^2}{r} \phi = E \phi \]  

and that this is equivalent to:

\[ -\frac{\hbar^2}{2m} \nabla^2 \phi - \frac{e^2}{4\pi \epsilon_0 (r + \epsilon \text{vac})} \phi = E \phi \]

It was assumed that \( \epsilon \text{vac} \) is small enough to justify using the analytically known unperturbed wave-functions of \( H(\phi_0) \) to a good approximation. So:

\[ \phi \sim \phi_0 \]

and:

\[ \nabla^2 \phi_0 = -4\pi mc \left( \frac{1}{r} - \frac{1}{r + \epsilon \text{vac}} \right) \phi_0 \]

Using computer algebra this approximation gives (1-12):

\[ \frac{1}{r + \epsilon \text{vac}} - \frac{1}{r + \epsilon \text{23} \text{vac}} = \frac{1}{2\pi \frac{3}{2} mc} \frac{1}{r^3} \]

The change in potential energy due to the radiative correction of the vacuum is thus:

\[ \Delta V = \frac{\hbar}{2\pi \frac{3}{2} mc} \frac{1}{r^3} \]

and the change in total energy is:

\[ \Delta E = \frac{\hbar}{2\alpha^2} \Delta V = \left( \frac{1}{16\pi \frac{3}{2}} \right) \frac{\hbar}{mc} \frac{1}{r} \approx 0.03 \text{s} \]

which is the Lamb shift of atomic H. Here:
\[ r = 1.69 \times 10^{-7} \text{ m} \quad (225) \]

From Eq. (222):

\[ \frac{r_{25} (\text{vac}) - r_{\text{p}} (\text{vac})}{(r + r_{\text{p}} (\text{vac}))} = \frac{1}{\frac{\hbar^2}{2\pi^2/3} \frac{1}{mc}} \quad (226) \]

Eq. (220) implies:

\[ r \gg r_{25} (\text{vac}) \sim r_{\text{p}} (\text{vac}) \quad (227) \]

so in this approximation Eq. (226) becomes:

\[ r_{25} (\text{vac}) - r_{\text{p}} (\text{vac}) = \frac{1}{\frac{\hbar^2}{2\pi^2/3} \frac{1}{mc}} \quad (228) \]

i.e.

\[ r_{25} (\text{vac}) - r_{\text{p}} (\text{vac}) = \frac{1}{\frac{\hbar^2}{2\pi^2/3} \frac{1}{mc}} \quad (229) \]

where the standard Compton wavelength is:

\[ \frac{\hbar}{mc} = 2.426 \times 10^{-12} \text{ m} \quad (230) \]

Thus we arrive at:

\[ r_{25} (\text{vac}) - r_{\text{p}} (\text{vac}) = 3.48 \times 10^{-12} \text{ m} \quad (231) \]

This is a plausible result because the classical electron radius is:

\[ r (\text{classical}) = \frac{1}{4\pi\varepsilon_0} \frac{e^2}{mc^2} = 2.818 \times 10^{-15} \text{ m} \quad (232) \]
and the Bohr radius is:

\[ a = 5.292 \times 10^{-11} \text{ m}. \quad -(233) \]

So the radiative correction perturbs the electron orbitals by about ten times the classical radius of the electron and by orders less than the Bohr radius. The ECE theory also shows why the Lamb shift is constant as observed because for a given orientation:

\[ \cos \theta = 1 \quad -(234) \]

the shift is determined completely by \( 1/r \) within a constant of proportionality defined by:

\[ \mathcal{S} = \frac{1}{32\pi^{3/2}} \frac{\alpha}{a} \frac{\hbar}{mc} \quad -(235) \]

The angular dependence of the Lamb shift in H was also considered \((\text{-12})\) and the method extended to the helium atom. Finally, consideration was given to how radiative corrections may be amplified by spin connection resonance.

Therefore in summary, the accuracy of the fine structure constant is determined experimentally by that of the Planck constant \( h \). The LEAST accurately known constant determines the accuracy of the fine structure constant, as should be well known. There is no way that any theory can determine the fine structure constant more accurately than it is known experimentally. Therefore ECE theory sets out to use the experimental accuracy in \( \mathcal{S} \).

The latter is determined by the accuracy in \( h \), as argued. This was done as simply as possible in accordance with Ockham's Razor. QED on the other hand is hugely elaborate, and its claims to be an accurate fundamental theory are unjustifiable. There can be no experimental justification for the existence of virtual particle pairs because of the gross internal inconsistencies in data reviewed in this section. Additionally, there are several ad hoc assumptions in the theory of QED itself.