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On the determination and value of the fine structure constant

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Abstract

Unlike any other theory of physics, Aetherometry permits a direct check of the expressions employed to obtain the value of the fine structure constant alpha and the fundamental values of physics, by two separate approaches involving very different fundamental quantities. In one of the approaches, Aetherometry determines alpha from only two fundamental quantities, the electron mass-equivalent wavelength and the Compton electron wavelength, neither of which are considered primitive quantities. The same approach also produces a secondary derivation of alpha from Planck's constant h and the fundamental charge e, and a demonstration of how the accepted formulas for alpha must be corrected in order to generate the correct or aetherometric value of alpha. With the second approach, we check our determination of the electron mass-equivalent wavelength by employing other fundamental quantities: the lightspeed invariant c and either the mass-energy equivalent of the electron rest mass in electron-volts, or the Faraday constant. Whether we use the Codata 1986 or the Codata 2006 values, the determination and computation of alpha is substantially at variance with that which is accepted in mainstream physics as being its value and expression. The results are unequivocal: the conventional value of alpha is wrong, and effectively a new physics was necessary for its correct determination and computation.

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COMMUNICATION

1. The value of alpha in current physics

Existing, conventional physics relies upon a fundamental physical relation for the determination of the value of the fine structure constant alpha. Expressed for the reciprocal of this constant, we have in the SI system:

$$\text{SI:} \quad (e^2/2\,\varepsilon_0\,h\,c)^{-1} = \alpha^{-1} = 137.035999679(94) \qquad (1)$$

with 2006 Codata values. This relation relies on the accurate determination of 4 different values, and this is reduced to three if the electric constant or permittivity of the vacuum is taken to be an exact number, $8.854187817*10^{-12}$ F m^{-1}.

In the cgs system, the relation is simplified to rely solely on those three values, since the permittivity is directly one and dimensionless. If we fix c at 299,792,458 m sec^{-1}, then it depends directly upon the values of h, Planck's constant, and e, the elementary charge - that is, if we abstract from π.

$$\text{cgs:} \quad (2\pi e^2/h\,c)^{-1} = \alpha^{-1} \qquad (2)$$

2. The simpler determination of alpha in Aetherometry

Aetherometry challenges the value of alpha - and this challenge, as we shall shortly see, implies a fundamental change in physics, or rather change *of* physics. Aetherometry claims that the accepted value of alpha is derived from illegitimate equations, and pretty much with a hammer. It also claims to be able to derive alpha's value far more accurately than either of the two expressions above, and from a simpler expression that requires only two constants, the electron mass-equivalent wavelength λ_e and the Compton electron wavelength λ_{ce}. The relationship between these two terms - which is derived from other aetherometric functions (mass to length conversion [1], production of photoelectrons [2], electron diffraction waves [3], formation of microwave cosmic background radiation [4], etc) - is succinctly stated as:

$$\lambda_e/\lambda_{ce} = 10\,\alpha^{-2.5} \qquad (3)$$

If we know the value of the two wavelengths, we can immediately ascertain the exact value of alpha.

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3. The aetherometric determination of λ_e, λ_{ce} and the fine structure constant

When we began our aetherometric investigations in 1989-1992, we used the 1986 Codata values, which placed the Compton electron wavelength λ_{ce} at

$$\lambda_{ce} = 2.426310579 * 10^{-12} \text{ m}$$

At the time, the Codata values for Avogadro's number, N_A, and the mass of the electron were:

$$N_A = 6.022136736 * 10^{23}$$
$$m_e = 9.109389646 * 10^{-31} \text{ kg}$$

Using these to determine the electron mass-equivalent wavelength λ_e, as per the general aetherometric relation:

$$\lambda_n = m_n N_A \, 10 \text{ meter kg}^{-1} \qquad (4)$$

yielded for the electron:

$$\lambda_e = m_e N_A \, 10 \text{ m kg}^{-1} = 5.485799003 * 10^{-6} \text{ m} \qquad (5)$$

The possible problem with this was that, in going this route, we had just made our determination of alpha dependent upon, not two constants, *but three*: the Compton electron wavelength λ_{ce}, Avogadro's number N_A, and the mass of the electron m_e. Keeping in mind these limitations, we now obtained:

$$\lambda_e/\lambda_{ce} = (5.485799003 * 10^{-6} \text{ m})/(2.426310579 * 10^{-12} \text{ m}) = 2{,}260{,}963.23 = 10 \, \alpha^{-2.5} \qquad (6)$$

putting the reciprocal of alpha at least [4] at:

$$\alpha^{-1} = (2{,}260{,}963.23/10)^{0.4} = 138.5853745 \qquad (7)$$

This was quite at variance with the then accepted value of alpha, whose reciprocal was:

$$(e^2/2 \, \varepsilon_0 \, h \, c)^{-1} = \alpha^{-1} = 137.0359895 \text{ (Codata 1986)} \qquad (8)$$

and still at variance with that accepted today (already given above).

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4. The aetherometric determination of alpha in relation to Planck's constant h and charge e

As aetherometrists, we had, however, still other procedures at our disposal in order to check on these values and determine what was inconsistent - ultimately, whether the aetherometric or the accepted value of alpha was the correct one.

The first two main aetherometric relations of which we could avail ourselves were the aetherometric suspension of Planck's constant into its constituents, and what it contributes to the aetherometric treatment of the accepted expression for alpha. We have shown elsewhere [5] that one of the functional expressions of Planck's constant h only invokes the lightspeed invariant c and the same two wavelengths, the Compton electron wavelength λ_{ce} and the electron mass-equivalent wavelength λ_e:

$$h = \lambda_e \, c \, \lambda_{ce} \tag{9}$$

If we fix c, as above, at 299,792,458 m sec^{-1}, then with the values of λ_e and λ_{ce}, we readily obtain the aetherometric value for h, in the aetherometric meter-second system of units, as:

$$h = 3.990313212 \times 10^{-9} \text{ m}^3 \text{ sec}^{-1}$$

A specific aetherometric discovery was that the Duane-Hunt constant given by (h/e) actually corresponded to a wavelength, the Duane-Hunt wavelength λ_x [6-7]. This is apparent even if only by dimensional analysis (where the MLT^{-1} dimensionality of charge is extracted from the dimensionality of current, as expressed by the ampere - a basic SI unit, not a derived measure):

$$\lambda_x = h/e = (ML^2T^{-1})/(MLT^{-1}) = L \tag{10}$$

According to the proposed toroidal structure of the electron in Aetherometry [7], the relationship of the Duane-Hunt wavelength λ_x to the other two wavelengths, λ_e and λ_{ce}, is also directly expressible as a function of alpha:

$$\lambda_x = \lambda_e/\alpha^{-2} = 10\,(\alpha^{-1})^{0.5}\,\lambda_{ce} \tag{11}$$

What results is a properly aetherometric equation for the determination of alpha's reciprocal, which was distinct from the SI and cgs equations:

$$\alpha^{-1} = \sqrt{(\lambda_e/\lambda_x)} = \sqrt{(\lambda_e\, e/h)} \tag{12}$$

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The problem was that this determination still relied on the determination of the mass-equivalent wavelength of the electron - via the mass of the electron and Avogadro's number. It also depended - as we saw above - upon fixing the value of another constant, the lightspeed invariant c (a fixing that, incidentally, we do not object to). So, it was not a truly independent check. But, under these conditions, it gave the aetherometric value of charge e in the meter-seconds system of units as:

$$e = h/\lambda_x = \alpha^{-2}\, h/\lambda_e = \lambda_e\, c/[10\, (\alpha^{-1})^{0.5}] = 13.97017654\ m^2\, sec^{-1} = p_e \qquad (13)$$

a value which we usually denote by the symbol p_e in order to signal that it is the value of charge e in the aetherometric meter-second system of units. By employing the sign =∫= to denote that we're changing from the SI system to the aetherometric system of units, or from mass units to equivalent units of length, in meters, with the exact conversions we've proposed, we can write the formal aetherometric relationship for charge (with the 1986 Codata value for charge e in coulomb) as:

$$e = m_e\, c/[10\, (\alpha^{-1})^{0.5}] = 1.602177330{*}10\text{-}19\ C\ =\!\int\!=$$
$$=\!\int\!=\ \lambda_e\, c/[10\, (\alpha^{-1})^{0.5}] = 13.97017654\ m^2\, sec^{-1} = p_e \qquad (14)$$

5. The aetherometric value of h and the Codata value of the molar Planck constant

Nevertheless, at that time, in the early 1990's, we could check our value of h against Codata's value for the "molar Planck constant", (N_A h). The two values (aetherometric value for h and the SI molar Planck constant) should be numerically identical, and they were:

SI: $10\, (N_A\, h) = 3.990313212{*}10^{-9}\ J\ sec\ mol^{-1}$
AToS: $h = 3.990313212{*}10^{-9}\ m^3\, sec^{-1}$

This immediately suggested that the aetherometric value for alpha (or its reciprocal) was correct, and cast doubt upon the accepted value of alpha, since the aetherometric value was consistent with the determination of three fundamental quantities - the Compton electron wavelength λ_{ce}, the mass of the electron m_e and Avogadro's number N_A. As

$$[(m_e\, 10\, N_A)/\lambda_{ce}]\ m\ kg^{-1}\ mol = 10\, \alpha^{-2.5} \qquad (15)$$

and thus

$$[(m_e\, N_A)/\lambda_{ce}]\ m\ kg^{-1}\ mol = \alpha^{-2.5} \qquad (16)$$

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it follows that

$$\alpha^{-1} = \{\sqrt{[(m_e\ 10\ N_A)/\lambda_x]}\}\ m\ kg^{-1} = \{\sqrt{[(m_e\ N_A)/(h/e)]}\}\ m\ kg^{-1} =\int=$$
$$=\int= \sqrt{(\lambda_e\ p_e/h)} = 138.5853745 \qquad (17)$$

In what concerns the number of 'arguments' invoked, this determination was not better off than the conventional one carried out in the cgs system above (equation 2). Both relied on *three* fundamental but *altogether different quantities* - ours fixing the Compton electron wavelength, the cgs formula fixing the value of c (which the first aetherometric formulation of alpha entirely dispenses with); and ours requiring co-dependent determinations of the electron mass and Avogadro's constant, whereas the cgs one required co-dependent determination of h and e. The real bonus was that only the aetherometric formula for alpha received - indirectly, via the determination of Planck's constant in the aetherometric meter-second system of units - numerical confirmation from the Codata value for the molar Planck constant.

6. The aetherometric computation of alpha with 2006 Codata values

What happens to the problem when we consider the 2006 Codata values for all these terms?

Starting from those directly pertinent to the aetherometric mass-equivalent wavelength of the electron, we have that the mass of the electron has been revised to:

$$m_{e2006} = 9.10938215(45)*10^{-31}\ kg$$

If we keep λ_e "fixed" at $5.485799003*10^{-6}$ m, then the value of Avogadro's constant will have changed to:

$$N_A = \{[(5.485799003*10^{-6}\ m)/10]/(9.10938215(45)*10^{-31}\ kg)\}\ kg\ m^{-1} =$$
$$= 6.0221416(89)*10^{23} \qquad (18)$$

In effect, Avogadro's constant *also changed value in the 2006 Codata*, but to a slightly higher value than this, namely:

$$N_{A2006} = 6.02214179(30)*10^{23}$$

such that, with the 2006 Codata values for the mass of the electron *and* Avogadro's number, we get

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the recomputed mass-equivalent wavelength of the electron as:

$$\lambda_{e2006} = m_{e2006}\ N_{A2006}\ 10\ m\ kg^{-1} = 5.4857990(98)*10^{-6}\ m \qquad (19)$$

It is readily apparent that this is not going to rescue the conventional value of the fine-structure constant. Indeed, if we apply the simple aetherometric relation given by ($\lambda_e/\lambda_{ce} = 10\ \alpha^{-2.5}$), we now find that, with $\lambda_{ce} = 2.426310579*10^{-12}$ m as above, we get:

$$\alpha^{-1} = [(\lambda_{e2006}/\lambda_{ce})/10]^{0.4} = 138.5853755 \qquad (20)$$

virtually identical to the previous aetherometric determination (equation 7), and just as much, if not more so, at variance with the accepted value for alpha (equation 1).

What if we employ also the 2006 Codata value for the Compton electron wavelength? This too has changed, to

$$\lambda_{ce2006} = 2.4263102175*10^{-12}\ m$$

so that we may write:

$$\alpha^{-1} = [(\lambda_{e2006}/\lambda_{ce2006})/10]^{0.4} = 138.5853837 \qquad (21)$$

This, again, is in the same ballpark, and just as substantially different from the conventional determination as our earlier computation for alpha was.

7. The Planck numbers with 2006 Codata values

What about confirmation of the numerically identical values of h in the aetherometric system of units, and the molar Planck constant in the SI system? We have for the former:

$$h = \lambda_{e2006}\ c\ \lambda_{ce2006} = 3.990312684*10^{-9}\ m^3\ sec^{-1} \qquad (22)$$

and the new 2006 Codata value for the molar Planck constant in the SI system is indeed identical:

$$(N_{A2006}\ h_{2006}) = 3.990312684*10^{-9}\ J\ sec\ mol^{-1} \qquad (23)$$

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8. Using the Faraday constant to check the aetherometric determination of the meter-second energy content of the electron-volt

Is there, then, another way of verifying the aetherometric determinations that put alpha at such variance with its accepted value? We shall shortly see why this is of such import in determining which physics is correct - the current model or the aetherometric one.

The answer to that question is that, yes, there is another way to verify the aetherometric determinations of alpha. This, as we shall now demonstrate, will only invoke the mass-energy (or rest energy, or self-energy) of the electron in electron-volts (eV), the Faraday constant, and the light speed invariant c. It also relies, therefore, on three quantities, but it shares none of these with the previous aetherometric equation for alpha (or its reciprocal). It will, in fact, provide a check on our determination of the mass-equivalent wavelength of the electron, as we shall now proceed to show.

Employing the old 1986 Codata values, and with the exact value of c that has already been given, we determined the aetherometric relation that converts energy in eV into the energy units of the aetherometric meter-second system. With the original mass-equivalent wavelength of the electron placed at $\lambda_e = 5.485799003*10^{-6}$ m, the energy of the electron rest mass in the meter-second system was:

$$\lambda_e c^2 = 4.930390263*10^{11} \text{ m}^3 \text{ sec}^{-2} \quad (24)$$

Given the then best measure of $m_e c^2$ in eV as 510,994.1496 eV, the conversion factor between eV and m^3 sec^{-2} units of energy was obtained as:

$$(\lambda_e c^2)/(e V_{511kV}) = 964{,}862.3702 \text{ m}^3 \text{ sec}^{-2}/\text{eV} \quad (25)$$

Note that if the energy of 1 electron-volt in the meter-second system (ie 964,862.3702 m^3 sec^{-2}) is divided by the aetherometric meter-second value of 1 volt (1 volt = 69,065.8681 m sec^{-1}), it gives the same aetherometric meter-second value of charge e (viz. p_e = 13.97017654 m^2 sec^{-1}) that was presented above.

Like the molar Planck constant, the Faraday constant is also a molar constant. Its value, if based on the correspondence proposed for charge e in equation 14 ($e = 1.60217733*10^{-19}$ C =∫= p_e = 13.97017654 m^2 sec^{-1}), is given by

$$(N_A e) = (6.022136736*10^{23} \text{ mol}^{-1}) (1.60217733*10^{-19} \text{ C}) = 96{,}485.30957 \text{ C mol}^{-1} \quad (26)$$

which is a strict equivalent to a mole of elementary charges expressed in the aetherometric meter-

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second system:

$$(N_A\, p_e) = (6.022136736*10^{23})\ (13.97017654\ m^2\ sec^{-1})\ mol^{-1} = $$
$$= 8.413031335*10^{24}\ m^2\ sec^{-1}\ mol^{-1} \quad (27)$$

Now, one mole of charges at 1 volt is a mole of electron-volts, or the product of the Faraday constant by 1 volt. In coulombs-volts, we have:

$$(N_A\, e)\ 1V = 96{,}485.30957\ C\ V\ mol^{-1} \quad (28)$$

In electron-volts we directly obtain a value numerically identical to the Avogadro constant:

$$(N_A\, e)\ 1V = 6.022136736*10^{23}\ eV\ mol^{-1} \quad (29)$$

And in the aetherometric system - where 1 volt is expressed as an electric wavespeed W_{v1V} of 69,065.8681 m sec^{-1} [6] - we have:

$$(N_A\, p_e)\ W_{v1V} = (6.022136736*10^{23}\ mol^{-1})\ (13.97017654\ m^2\ sec^{-1})\ (69{,}065.8681\ m\ sec^{-1}) = $$
$$= 5.810533125*10^{29}\ m^3\ sec^{-2}\ mol^{-1} \quad (30)$$

Hence the practically exact correspondences:

$$96{,}485.30957\ C\ V\ mol^{-1} = 6.022136736*10^{23}\ eV\ mol^{-1} = 5.810533125*10^{29}\ m^3\ sec^{-2}\ mol^{-1} \quad (31)$$

It follows that the aetherometric proportionality for coulombs-volts is given by:

$$[(N_A\, p_e)\ W_{v1V}]/[(N_A\, e)\ 1V] = $$
$$= (5.810533125*10^{29}\ m^3\ sec^{-2}\ mol^{-1})/(96{,}485.30957\ C\ V\ mol^{-1}) = $$
$$= 6.022194623*10^{24}\ m^3\ sec^{-2}\ C^{-1}\ V^{-1} \quad (32)$$

which is, or rather should be, exactly 10 times Avogadro's constant times $m^3\ sec^{-2}\ C^{-1}\ V^{-1}$:

$$[(N_A\, p_e)\ W_{v1V}]/[(N_A\, e)\ 1V] = 10\ N_A\ \ m^3\ sec^{-2}\ C^{-1}\ V^{-1} \quad (33)$$

This should therefore permit us, amongst other advantages, to obtain a better approximation for the

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conversion of electron-volts into meter-seconds (and, implicitly, for the value of Avogadro's constant). Note that this aetherometric proportionality for coulombs-volts is the same proportionality that we expressed above for electron-volts:

$$[(N_A\, p_e)\, W_{v1V}]/[(N_A\, e)\ 1V] = (p_e\, W_{v1V})/(1\ eV) = 964{,}862.3702\ m^3\ sec^{-2}/eV \qquad (34)$$

Thus,

$$\begin{aligned}96{,}485.30957\ C\ V\ mol^{-1} &= [(N_A\, e)\ 1V] = \\ &= [(N_A\, p_e)\, W_{v1V}]/(6.022194623{*}10^{24}\ m^3\ sec^{-2}\ C^{-1}\ V^{-1}) = \\ &= (5.810533125{*}10^{29}\ m^3\ sec^{-2}\ mol^{-1})/(6.022194623{*}10^{24}\ m^3\ sec^{-2}\ C^{-1}\ V^{-1})\end{aligned} \qquad (35)$$

a relation which, if it is written with the exact value of 10 N_A $m^3\ sec^{-2}\ C^{-1}\ V^{-1}$, gives instead:

$$\begin{aligned}[(N_A\, e)\ 1V] &= [(N_A\, p_e)\, W_{v1V}]/(10\ N_A\ m^3\ sec^{-2}\ C^{-1}\ V^{-1}\ mol) = \\ &= (5.810533125{*}10^{29}\ m^3\ sec^{-2}\ mol^{-1})/(6.022136736{*}10^{24}\ m^3\ sec^{-2}\ C^{-1}\ V^{-1}) = \\ &= 96{,}486.23702\ C\ V\ mol^{-1}\end{aligned} \qquad (36)$$

This demonstrates that a better fix on the Faraday constant is also possible, since the two results (obtained above as 96,485.30957 C V mol^{-1} and 96,486.23702 C V mol^{-1}) should be the same.

Accordingly, whatever is the aetherometric value of the energy content of the electron-volt, it should be numerically identical to the multiplication of the Faraday constant by the factor (10 $m^3\ sec^{-2}\ C^{-1}$ mol/eV):

$$964{,}862.3702\ m^3\ sec^{-2}/eV = (96{,}486.23702\ C\ mol^{-1})\ (10\ m^3\ sec^{-2}\ C^{-1}\ mol/eV) \qquad (37)$$

Thus with the 1986 Codata values, we get the noted discrepancy between a mole of eV extracted from the Faraday constant and from the aetherometric meter-second energy content of the electron-volt, which we can write as:

$$96{,}485.30957\ C\ V\ mol^{-1} \approx 96{,}486.23702\ m^3\ sec^{-2}/0.1\ eV \qquad (38)$$

but when we employ the 2006 Codata values, we get *a virtual numerical identity that confirms our contention that the numbers should be the same*:

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$$96{,}485.33399(24)\ \text{C V mol}^{-1} \approx 96{,}485.33982\ \text{m}^3\ \text{sec}^{-2}/0.1\ \text{eV} \qquad (39)$$

This totally novel and aetherometric procedure will now permit us to make a direct check on the mass-equivalent wavelength of the electron, λ_e, as determined from the electron-volt value of the electron mass-energy.

9. Using the Faraday constant for aetherometric checks on the electron mass-equivalent wavelength and the aetherometric determination of alpha

With our aetherometric values based on the 1986 Codata, and charge e in coulombs, we had:

$$\begin{aligned}\lambda_e &= [(m_e\, c^2)/c^2]\ (N_A\, e)\ (10\ \text{m}^3\ \text{sec}^{-2}\ \text{C}^{-1}\ \text{mol/eV}) = \\ &= [(510{,}994.1496\ \text{eV})/c^2]\ (96{,}486.23702\ \text{C mol}^{-1})\ (10\ \text{m}^3\ \text{sec}^{-2}\ \text{C}^{-1}\ \text{mol/eV}) = \\ &= 5.485799003 \cdot 10^{-6}\ \text{m} \qquad (40)\end{aligned}$$

This determination depended therefore on the value of the lightspeed c, the electron mass-energy ($m_e\, c^2$) in electron-volts, Avogadro's constant, charge e in coulombs and the value of the volt or electron-volt. Numerically, however, *it depended solely on the values of two constant*s - the electron mass-energy in electron-volts and the Faraday constant.

What would the mass-equivalent wavelength of the electron, λ_e, be with the new 2006 Codata values? This would provide a check on precisely the 'fix' that Aetherometry proposes for the mass-equivalent wavelength of the electron.

The 2006 Codata places the electron mass energy equivalent at 510,998.910(13) eV and the Faraday constant at

$$(N_A\, e) = 96{,}485.3399(24)\ \text{C mol}^{-1}$$

Accordingly,

$$\begin{aligned}\lambda_e &= [(m_{e2006}\, c^2)/c^2]\ (N_{A2006}\, e_{2006})\ (10\ \text{m}^3\ \text{sec}^{-2}\ \text{C}^{-1}\ \text{mol/eV}) = \\ &= [(510{,}998.910(13)\ \text{eV})/c^2]\ (96{,}485.3399(24)\ \text{C mol}^{-1})\ (10\ \text{m}^3\ \text{sec}^{-2}\ \text{C}^{-1}\ \text{mol/eV}) = \\ &= 5.4857991(03) \cdot 10^{-6}\ \text{m} \qquad (41)\end{aligned}$$

It is so close to the earlier determination of λ_{e2006} as $5.4857990(98) \cdot 10^{-6}$ meters in section 6, as to be identical, the difference likely being mostly a function of the limited number of digits employed in the calculation. And in recomputing the reciprocal of alpha, the fundamental aetherometric value

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of the latter remains basically unchanged. With the value of λ_{ce2006}= 2.4263102175*10^{-12} m, we now get:

$$\alpha^{-1} = [(5.4857991(03)*10^{-6} \text{ m})/\lambda_{ce2006})/10]^{0.4} = 138.5853838 \quad (42)$$

Whereas the mass-equivalent wavelength varied by less than half a millionth of a percent, and likewise the Compton electron wavelength varied by less than thousandth of a percent, the two determinations of the reciprocal of alpha - the aetherometric determination and the 2006 Codata value - vary by a substantial percentage:

$$[(138.5853838-137.0359997)/137.0359997]*100 = 1.13\% \quad (43)$$

10. The consequences of the aetherometric determination of the fine structure constant

In light of the preceding, there is no doubt in the mind of the aetherometrist that the value of alpha in current physics remains in substantial error, despite all the consensual Codata revisions. Clearly, these revisions do not impact in any substantial way either the functional relations found by Aetherometry for fundamental quantities or constants [8], nor the role of the alpha proportionality constant in determining these quantities.

What are the implications for current physics, if the fine structure constant is reciprocal to a number on the order of 138, rather than 137?

Dirac wrote on this subject: "The physics of the future, of course, cannot have the three quantities, $\hbar$, e and c all as fundamental quantities. Only two of them can be fundamental, and the third must be derived from those two. It is almost certain that c will be one of the two fundamental ones. (...) From the fundamental constants one can construct a number that has no dimensions (...). That number is found by experiment to have the value 137, or something very close to 137. Now, there is no known reason why it should have this value rather than some other number. Various people have put forward ideas about it, but there is no accepted theory. (...) There will be a physics in the future that works when $\hbar c/e^2$ has the value 137, and that will not work when it has any other value." [9]

Dirac's prediction is a curious one. It is true that the physics of the XXIst century cannot afford to have h (or $\hbar$) and e as fundamental quantities: the whole problem lies precisely in explaining them and accounting for them. Our work demonstrates that neither is a fundamental quantity.

But more important with respect to the above statement by Dirac is the realization that a physics which claims that the expression

$$\hbar c/e^2 \approx 137 \quad (44)$$

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provides a measure of the fine structure constant is a totally wrong physics!, since from all of the preceding we can directly demonstrate its fallacy *in* the only system of units *that is irreducible*, the aetherometric meter-second system (this claim - and its justification for equation 45 - is explained in the Appendix to the present communication):

$$\hbar c/p_e^2 = (3.990313212*10^{-9}\ m^3\ sec^{-1}/2\pi)\ c/(13.97017654\ m^2\ sec^{-1})^2 = 9.75537643*10^{-4} \qquad (45)$$

Indeed, the correct, legitimate or functionally valid expression needed to determine the reciprocal of the fine structure constant is, in fact, a very different and *aetherometric* equation, a much simpler and exact one:

$$\alpha^{-1} = \sqrt{(\lambda_e\ p_e/h)} = \sqrt{(\lambda_e/\lambda_x)} = 138.5853(745)...138.5853(838) \qquad (46)$$

Note therefore that fixing the lightspeed invariant c as what Codata calls "an exact value", is only an added bonus, since one can determine the fine structure constant from only two quantities - the mass-equivalent wavelength of the electron (or, if you will, the electron rest mass via Avogadro's number) and either the Compton electron wavelength or the Duane-Hunt wavelength - without any invocation of c!

Moreover, the near coincidence of the 2006 aetherometric and Codata values for the Faraday constant, its numerical identity to a mole of electron-volts, and its numerical identity to the meter-second energy content of the electron-volt, suggest that one could produce an agreed 'near-fix' for the mass-equivalent wavelength of the electron, at least down to the seventh digit, ie the micron level, placing it at $\lambda_e = 5.485799*10^{-6}$ m.

The Duane-Hunt wavelength is only recognized in physics in the form of a ratio, or proportionality constant, between Planck's constant and the elementary charge e. It is by virtue of this role of the Duane-Hunt wavelength that the simplest expression for the fine structure constant can also be transformed to invoke, instead, three fundamental quantities, the mass-equivalent wavelength of the electron, the elementary charge e and Planck's quantum constant h.

It is this relation that permits the aetherometric correction of the conventional and illegitimate formula for the fine structure constant, which has to be literally revised to:

$$\alpha^{-1} = \{(hc/e^2)\ [\sqrt{(\lambda_e/\lambda_x)}]^{2.5}\}/10 = 138.5853(745)...138.5853(838) \qquad (47)$$

Thus, "the physics of the future" which takes the reciprocal of the fine structure constant as being ≈138, is the physics that has now shown that the "physics" which takes "$\hbar c/e^2$ to have the value 137" is not workable, correct or consistent.

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One might say that whereas the old physics of $\alpha^{-1} \approx 137$ was a still a physics of Matter that *only knew the equivalence of mass to energy* in the form of mass-energy and its *electromagnetic* equivalent, the physics of $\alpha^{-1} = 138.585$ is *the physics of massfree energy* that demonstrates (1) how energy comes in two fundamental varieties, massbound *and* massfree, and (2) how mass-energy has an exact *electric* fine structure.

Most remarkably, the aetherometric treatment shows that the value of the fine structure constant can be simply extracted from two fundamental quantities, the mass-equivalent wavelength of the electron and the Compton electron wavelength, neither of which are currently considered to be a "primitive" quantity or a member of the categories that Dirac thought were fundamental.

These realizations are, of course, implicit in the fundamental aetherometric equations for h and e: in the meter-seconds system -

$$h = \lambda_e \, c \, \lambda_{ce} = p_e \, \lambda_x \tag{48a}$$

and in the SI system - according to Aetherometry -

$$h = m_e \, c \, \lambda_{ce} = e \, \lambda_x \tag{48b}$$

which is an equality not readily apparent or accepted by current physics, since it equates a value in coulomb*meters to a value in kilogram*meter^2 per second.

Lastly, it is remarkable that via the use of the other fundamental quantity, c, and the aetherometric treatment of the Faraday constant, Aetherometry is able to derive an independent check of the electron mass-equivalent wavelength and of the entire set of equations that permit verification of the proposed meter-second energy content of the electron-volt.

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APPENDIX -

The aetherometric concept of irreducible fundamental functions or expressions

With respect to equation 45, its physical illegitimacy and the justification for our argument regarding expressions with irreducible constituents alone (referred to as fine-structure expressions in Aetherometry) being fundamental, we should remark that Aetherometry is not simply another system of units, a method for dimensional translation, or a language of equivalences. It is also (or seeks to be) an articulation of functions (a functional articulation of functions), and as such, it holds that if a function can be described by the interaction of fewer irreducible elements, then its description

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with more elements means cannot be fundamental (Ockham's razor), ie such a description or formula cannot be the fundamental form of the function. This leads, in our minds, to a criterion for the selection of fundamental relations according to three considerations, expressed in the present instance with regard to alpha, the fine-structure proportionality constant:

1. If alpha is meaningful as a proportionality constant, it should be derived from fundamental quantities (and functions) without scaling factors.
2. Fundamental quantities, to be such, must not depend on the system of units, which means the units of these quantities must be maximally reduced, so that they directly coincide with the simplest dimensionality of the functions involved.
3. The function or functions involved must have physical sense.

Now, neither the SI nor the cgs formulas (equations 1 and 2) for alpha are derived from fundamental quantities. Measurement of charge e is not independent from mass, nor is Planck's h. The SI formula contains the permittivity function, which is arguably a scaling factor that, though "fixed as exact" by convention, has been shown by us to be numerically incorrect and, more importantly, to be a variable with a specific function (see Correa P & Correa A (1999) “Aetherometric treatment of the energy radiation output by Tesla coils (3)", Akronos Publishing, Concord, Canada, ABRI monograph AS2-16).

Neither the units of the SI nor those of the cgs expressions for alpha have been maximally reduced, nor coincide with their simplest dimensionality. Moreover, it is far from clear, or from a given, at least, how in the cgs system statcoulomb^2 erg^{-1} cm^{-1} is a dimensionless expression, or likewise coulomb^2 F^{-1} J^{-1} in the SI system.

Furthermore, it is also unclear what exact function either of the cgs or SI equations for alpha expresses.

Next consider the aetherometric expression for alpha: it is a proportionality between wavelengths which invokes no scaling factors, and which is involved in the function for the local production of light (see reference 2 of the communication). No matter what system of units one employs, it will always have the same value measured as a ratio of lengths.

What happens when one compares the two formulas, aetherometric and nonaetherometric? If the function is unclear or muddled, then it is not physically meaningful or sensical. If it is not derived from fundamental quantities that are irreducible in their units and dimensionalities, and thus not directly obtainable in any system of units (as a ratio of wavelengths is), then it is mathematically illegitimate. Both *non*aetherometric, accepted expressions are senseless and illegitimate; and - so we claim to have demonstrated with the present communication - they are also numerically wrong.

This, therefore, is the rationale for presenting that equation 45 (related to equation 2 in the

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cgs system, and whose illegitimacy it demonstrates) with the nonsensical value that it yields, and the correction it requires as expressed in equation 47. For, by the reasoning explained in this Appendix, one becomes entitled to ask - do either of the accepted (nonaetherometric) expressions for alpha give an expression that, in any system of units, only invokes the same arguments, not more or fewer? And if the answer is 'no', as we think we have shown in the present communication, then the expression is not "minimalist", and thus neither fundamental nor functional.

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