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The Uncertainties of the Uncertainty Principle, Part 2: What Heisenberg missed

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Abstract

The world of the quantum, which encompasses all particles of matter at rest or in motion, photons and massbound charges, is thought to be a world of uncertainty. Yet, the present communication treats the quantum as merely an invariant moment situated at the convergence of very different energy (fine-) structures and processes, all of which permit accurate measurement of particle velocities and their associated wave functions. In the aetherometric approach, a particle and its waves form an energy multiplicity. The outcome of the proposed algebraic analysis is a novel, nonclassical and nonrelativistic theory of photoinertial and electroinertial linear momenta that treats heisenberg-ian "path distances" as functions of the de Broglie wavelengths, and all photoinertial and electromagnetic energy events as byproducts of electrical processes. Bohr complementarity is easily avoided, once the Heisenberg Principle is demonstrated to be an erroneous interpretation of the quantum nature of the energy processes associated with massbound particles.

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COMMUNICATION

1. Heisenberg's principle of uncertainty

After **Louis de Broglie**'s critical insight in 1924 that, under certain circumstances, matter behaves like a wave, and the discovery of electron diffraction by **Clinton Davisson** and **Lester Germer** at Bell Telephone Labs in New York, in 1925, solutions for the wave-particle paradox were quickly enunciated by **Werner Heisenberg** and **Erwin Schrödinger**. **Heisenberg** had developed a new algebraic formalism - "matrix mechanics" - particularly suited for treating matter as particles. **Schrödinger** treated matter as waves (the **Schrödinger** Wave Equation) and succeeded in deriving the spectrum of light frequencies emitted by the hydrogen atom, which he published in January of 1926; in the same month, **Wolfgang Pauli** and **Paul Dirac** independently arrived at identical solutions for the hydrogen spectrum, utilizing matrix methods. **Dirac** went further by proposing a more general theory ('Wavicle theory') that included the wave-mechanical and the matrix-mechanical treatments as special cases. Then, **Max Born** interpreted the amplitude of the **Schrödinger** Wave Equation as a "probability function" that specified the chances of locating a particle at some chosen place and time. This marked the leap when Quantum Mechanics abandoned its Newtonian determinism and embraced randomness, a randomness that it now claimed was intrinsic to the physical 'object'. **Einstein** protested that "God [*sive Natura*] does not play dice!", while **Niels Bohr** and **Heisenberg** wrestled with the absurdities and inconsistencies that resulted from the wave and particle treatments of matter (and light).

In early 1927, **Heisenberg** thought that he could at last make the two treatments 'somewhat' consistent. He reasoned that the contradictions only arose because one was applying macroscopic concepts - position, velocity, energy and time - to the atomic level; but the act of detection and measurement was not direct, but indirect; position and momentum were "unobservables": to measure the position x or momentum p of a particle (the basic variables in the Hamiltonian formulation of **Newton**'s mechanics, where energy is the Hamiltonian $H(x,p)$), one had to hit it with another particle; one could thus "observe and measure" these two quantities, but one at a time, because "one cannot fix both quantities simultaneously with an arbitrarily high accuracy" - in **Heisenberg**'s words. His solution was to treat observables (color, intensity) as significant quantities, and treat the unobservables (position and momentum) not as definite numbers, but as derivable from a new rule of algebra. **Heisenberg** argued that a new multiplication (a formal relationship of *production* or *superimposition*, in aetherometric language) was needed, one that took the product of location and momentum to express a joint uncertainty: take the uncertainty Δx in the measurement of a given position x, and take the uncertainty Δp in the measurement of (linear or inertial) momentum; you will find that the product of the two inaccuracies or uncertainties turn out "to be not less than **Planck**'s constant" (**Heisenberg**). The principle of uncertainty is really an *inequality*, expressed as:

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$$\Delta x \, \Delta p \geq h/2\pi \qquad (1)$$

It is a constitutive inequality and, as **Hofstadter** stresses, the fact that it involves **Planck**'s constant means that uncertainty is a microscopic function, a "consequence of the wave-duality of matter (and of photons) and has nothing to do with the notions of an *observer* disturbing the thing under observation" [1]. Uncertainty arose microscopically out of the duality of matter. As an inequation, the uncertainty principle states that if position and momentum are both measured at the same time, their joint uncertainty can never be less than $h/2\pi = \hbar$. This identifies a *joint probability* as being equivalent to a quantity with the *dimensionality of angular momentum* - effectively a *definable uncertainty*, an uncertainty with a *minimum size* of the magnitude and dimensions of **Planck**'s (angular) quantum.

In practice, however, the principle is applied in the form of an equation to determine the approximate momentum of a particle:

$$p = \hbar/x \qquad (2)$$

and this requires, effectively, that one express the principle itself as an equality:

$$x \, p = h/2\pi \qquad (3)$$

The principle was supposed to establish a relation between lengths (which, as **Prigogine** and **Stenghers** say, are "closely related to the concept of coordinates" [2]) - and linear momenta, but it was constrained by the **Einstein-de Broglie** relation $\lambda = h/p$ which connected wavelength to linear momentum while showing that lengths and momenta could not be treated as independent variables. So, quantum mechanics chose to treat the operators corresponding to length and momenta as being expressible only in terms of either the coordinate or the momentum, so that "only one type of quantity appears (either coordinate or momentum), but not both", thus dividing "the number of classical mechanical variables by a factor of two" [2]. Since the operators for length and momentum do not commute (the order of their product matters) no function exists that would be an "eigenfunction of both coordinate and momentum". No state exists in which both could have definite values. As **Prigogine** and **Stenghers** put it: "we can measure a coordinate and a momentum, but the dispersion of the respective possible predictions as expressed by Δx, Δp are related by the Heisenberg inequality $\Delta x \, \Delta p \geq h$. We can make Δx as small as we want, but then Δp goes to infinity" [2].

One may say that it is here that our work definitively parts with quantum mechanics; for, as we shall see below, the "de Broglie relation" is totally misunderstood when wavelengths are reduced to arbitrary lengths or arbitrary coordinate positions, so as to be treated as probabilities. The

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de Broglie relation should have been understood as an indissociable measure of wavelength and momentum, where the wavelength in question is external to linear momentum, but internal to angular momentum and commensurate with a physical quantity that the principle ignores, and which corresponds to the function 'energy' to which both of those types of momenta belong. Thus the wavelength in question is necessarily "endoreferenced", and not reducible to any length or an arbitrary coordinate position (in a system of "exoreference"). The relation clearly shows that angular momentum, linear momentum and wavelength *constitutive of angular momentum* are all quantized, only exist in discrete whole values that manifest the *graininess* or *discrete nature* of quantum energy. Moreover, as we have explained in detail in other venues [3-7], linear momentum and energy are not truly independent variables either. All this signifies that a topological 4D spacetime-type approach to locating position and determining momenta is always bound to fail, because the world of energy constitutes a minimum 5D continuum with distinct but commensurate Space and Time manifolds. Any form of mapping of motion in such a 5D multiplicity would require prior endoreferenced determination of the geometry of the flux and, for any particle interaction (whether it is a field superimposition or a particle collision), the resulting geometric figures could not be separated from specific phase superimpositions of 5D energy 'bundles'.

The probabilistic reduction of the de Broglie relation is at the origin of all the dubious uses of the Heisenberg principle [8]. Even though the principle claims to address momentum, rather than speed v per se, and thus to involve mass (momentum: p = mv) - including taking into account its relativistic increase - the principle is used to ascertain a scale of probability for the dispersion of positions or lengths, which uses the arbitrary magnitude of **Planck**'s constant in the erg-seconds scale divided by 2π, but abstracts its dimensions to employ only the numerical value:

$$\Delta x\ \Delta \mathrm{p} = \Delta x\ (\Delta \mathrm{mv}) = 10^{-27} \tag{4}$$

Then, for the joint uncertainty of velocity and position -

$$\Delta x\ \Delta \mathrm{v} = 10^{-27}/\mathrm{m} \tag{5}$$

If one next proceeds to equate the uncertainty of position with the uncertainty of velocity ($\Delta x = \Delta \mathrm{v}$), then one draws from **Heisenberg**'s principle the dandy 'conclusion' that the uncertainty of location is:

$$\sqrt{(\Delta x)^2} = \sqrt{(10^{-27}/\mathrm{m})} = 3.2*10^{-14}/\sqrt{\mathrm{m}} \tag{6}$$

If mass is next set to unity (corresponding to the unit of 1 gram), then with a magical sleight of hand

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the uncertainty of position becomes -

$$\Delta x = 3.2*10^{-14} \text{ centimeters} \quad (7)$$

- believe it or not. One does not have to be an aetherometrist to realize the total gratuitousness of these leaps of faith, where everything is abandoned - dimensionality of the quantum, dimensionality of mass and the reference to a physical scale - to magically arrive at a completely conjured-up "uncertainty of position". With such axiomatizations, it is little wonder that no consistency could be gained. It is all uncertain anyway.

Now, astonishing as the following statement may appear to be - **Planck**'s angular constant (with its proper dimensions) divided by the mass of a particle,

$$\hbar/\text{m} = 10^{-27} \text{ erg sec/m} \quad (8)$$

is not a readily understood quantity in physics. It is in fact a quantity that contains the wave function intrinsic to the inertial linear momentum of the particle and as well the de Broglie wavelength.

2. An aetherometric treatment of Heisenberg's principle of uncertainty

The problems with **Heisenberg**'s principle are two-fold: those that affect its statement as an inequation, and those that affect its statement as an equation. Both types of problems can only be addressed by understanding the relation - the functionality of the physical relation - that underlies the principle. The fundamental problem is that which concerns the treatment of the principle of uncertainty to generate approximate momenta or locations for a variety of physical situations: the rest energy of a particle of matter; the blackbody spectrum of the hydrogen electron; the energy of a photon; and the motion of particles of matter in the range of so-called relativistic velocities.

2.1. Heisenberg's principle of uncertainty and the rest energy of a particle of matter: $\lambdabar_{Ce}\, m_e\, c = \hbar$

The first problem raised by **Heisenberg**'s principle is that the momentum p is a linear momentum function (inertial for matter, likely noninertial for light [9]) which is measured under dynamic conditions, and thus, in the case of material particles, already integrates the momentum constitutive of the rest energy of the particle with the momentum of the kinetic energy that is added to it and responsible for its motional state. In Aetherometry (as in the classical solution presented by **de Broglie**), these are readily distinguishable components of momentum: there is a linear momentum (called the inertial or rest-state momentum of a particle of matter) which is a constituent of the mass-

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energy (or 'rest-energy') of the particle, and there is a 'kineto-inertial' linear momentum associated to it, which is a constituent of the kinetic energy added to the particle. So, when **de Broglie** proposed the relation

$$\lambda = h/p \tag{9}$$

he was expressing a general principle, much more general than either wave mechanics or matrix mechanics grasped. Indeed, the Compton wavelength λ_C can be seen to be a direct result of this de Broglie relation, once we define the *linear momentum of the rest energy of a particle* as:

$$p_A = mc^2/c \tag{10}$$

and write:

$$\lambda_C = h/p_A \tag{11}$$

Thereby, one has functionally expressed the relation inherent to **Heisenberg**'s principle, with respect to mass-energy or the rest energy of a particle:

$$\lambda_C\ p_A = h \tag{12a}$$

or:

$$\bar{\lambda}_C\ p_A = \hbar \tag{12b}$$

where $\bar{\lambda}_C$ plays the role of a radial vector (note that all three quantities in expressions #12a and 12b are actually vectors). In other words, instead of expressing an uncertainty, the principle permits us to confirm the fine structure and the specific values of wavelength and momentum that constitute the angular momentum (the moment) of a particle of matter at rest. Here, any notion of an indefiniteness Δ or of an uncertainty of size $\hbar$ which arises as the product of the uncertainties of position x and momentum p, becomes replaced by a microscopically characteristic angular momentum function, the arbitrary position x being replaced by a radial vector, and the momentum being a particular instance of p=mv, since it is defined as p_A = mc. In this sense, then, the Compton wavelength of the electron is indeed the limit de Broglie wavelength for X-rays obtained from electrons, only reached when the entire mass-energy of the electron is radiatively diffracted as an X-ray, and obeying the following detailed and definite fine-structure equation:

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$$\bar{\lambda}_{Ce}\, m_e\, c = \hbar \qquad (13)$$

This too, of course, has not been understood in this way. Moreover, if the Compton wavelength can thereby be shown to be a special case of the de Broglie wavelength, none of these relations require any invocation of a principle of uncertainty in order to be extracted and established for the electron's rest energy.

2.2. Heisenberg's principle of uncertainty, the blackbody spectrum of the hydrogen electron and the Duane-Hunt wavelength:

$\lambda_q\, p_{Ae} = h/\alpha^2$ **and** $\lambda_x\, e = h$

However, states of motion of the electron depend on their kinetic energy and the integral inertial linear momentum developed by the complex of rest energy and kinetic energy. An integral treatment of p=mv would, by accepted physics, have to take into consideration the relativistic increase of mass with velocity. But for purposes of understanding the spectrum of photon emissions produced by the orbital electron of the hydrogen atom, no relativistic treatment needs to be invoked. The accepted theoretical formula for the lines of the hydrogen spectrum takes recourse to the base frequency formula (shown below in the SI system) expressing this frequency as a function of the electron charge, mass, electrical permittivity and **Planck**'s constant:

$$\upsilon = (m_e\, e^4/8\varepsilon_o^2\, h^3) = (2.264*10^{24}\ C^4/J^3\ sec^3)/(1.45376*10^{-9}\ Kg\ N^2\ m^4/C^2) =$$
$$= 3.29147*10^{15}\ sec^{-1} \qquad (14)$$

The wavelength corresponding to this base frequency is the **Lyman** wavelength -

$$\lambda_L = c/(3.29147*10^{15}\ sec^{-1}) = 9.108163*10^{-8}\ m \qquad (15)$$

Aetherometry contends that, in fact, the electron frequency is not given by the (nearly unintelligible) CGS or SI formulas:

$$\begin{array}{ccc} & \text{CGS} & \text{SI} \\ \upsilon = & \sqrt{(q^4/r_B^2\, h^2\, n^6)} & = 2\,(m_e\, e^4/8\varepsilon_o^2\, h^3) = 6.578996*10^{15}\ sec^{-1} \end{array} \qquad (16)$$

but by the aetherometric formula for the frequency of the magnetic W_k wave function *intrinsic to the charge* e of an electron [10-11]. W_k is effectively equal to the ratio of charge to mass, e/m_e, when this ratio is expressed in the aetherometric meter-second system of units, as the ratio p_e/λ_e. Here, p_e is

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the aetherometric value of the elementary charge in the aetherometric meter-second system of units (13.97017654 m^2 sec^{-1}), whereas λ_e is the mass-equivalent wavelength [12], a fact that we express by writing, in the case of the electron, the formal conversion as $m_e =\int= \lambda_e$. Then the relation for the magnetic wave is expressed by:

$$W_k = p_e/\lambda_e =\int= e/m_e \qquad (17)$$

with the result that, in contrast to equation #16, the sought after "electron frequency" is actually the magnetic wave frequency of the electron simply given by [11]:

$$\upsilon_k = W_k/\lambda_h = p_e/\lambda_e \lambda_h =\int= e/m_e \lambda_h =\int= 6.433384*10^{15} \text{ sec}^{-1} \qquad (18)$$

Employing the aetherometric eta constant of proportionality [13], we may then write:

$$\eta = h/\lambda_{Ce} e = 10 \sqrt{\alpha^{-1}} \qquad (19)$$

so that, for the electron mass-equivalent wavelength -

$$\lambda_e = \lambda_q \eta = \lambda_q 10 \sqrt{\alpha^{-1}} = \lambda_h \eta^2 = \lambda_h 10^2 \alpha^{-1} \qquad (20)$$

and, formally, for c -

$$c = \lambda_q \upsilon_k \qquad (21)$$

The aetherometric eta constant can also be expressed directly as the gyromagnetic ratio [14], and with the charge e expressed in the aetherometric system of units:

$$\eta = p_{Ae}/p_e = (1644.6 \text{ m}^2/\text{sec})/(13.97 \text{ m}^2/\text{sec}) = 117.7222895 \qquad (22)$$

where p_{Ae} is the inertial linear momentum of the rest energy of the electron. Aetherometry does not recognize $\upsilon_k/2$ as constituting the limit blackbody frequency of the emissions of atomic hydrogen: the limit is υ_k itself. This leads to a simple formula for finding the bands for each emission series from the electron of atomic hydrogen - the aetherometric relation for photon wavelength (where the operators j and k are integers that, as usual, refer to, respectively, the "lower and upper stationary states" of the electron "orbital" in atomic hydrogen):

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$$\lambda = c/[(\upsilon_k/2)\ (j^{-2}-k^{-2})] \tag{23}$$

When compared to the wavelength determinations obtained with the accepted formula

$$\lambda = c/[(m_e\ e^4/8\varepsilon_o^2\ h^3)(j^{-2}-k^{-2})] \tag{24}$$

the aetherometric treatment is not only more accurate, but gives the nearly exact location of the observed bands (this is demonstrated in [15]):

$$\lambda = [(c\ \lambda_h/W_k)\ (j^{-2}-k^{-2})] = [(c\ \lambda_e/\eta^2\ W_k)\ (j^{-2}-k^{-2})] = [(p_{Ae}\ \lambda_{ce}/\eta^2\ \lambda_{ce} W_k)\ (j^{-2}-k^{-2})] =$$
$$= [(h/\eta\ \lambda_{ce}\ c)\ (j^{-2}-k^{-2})] = [(h/\lambda_x\ c)\ (j^{-2}-k^{-2})] \tag{25}$$

Given that λ_x is the Duane-Hunt wavelength we have identified [7, 13] as

$$\lambda_x = h/p_e = \lambda_e\ \alpha^2 = \eta\ \lambda_{ce} \tag{26}$$

the hydrogen spectrum wavelengths are functions defined very simply as λ_q set wavelengths:

$$\lambda = [(e/c)\ (j^{-2}-k^{-2})] = \lambda_q\ (j^{-2}-k^{-2})] \tag{27}$$

where

$$\lambda_q = h/p_{Ae}\ \alpha^2 \tag{28}$$

Aetherometry thus proves that, in what concerns the hydrogen electron, the Heisenberg principle breaks down, and is unable to actually determine the proportional reduction given by the occluded function of the fine-structure constant, which Aetherometry draws to the forefront. This inability signals a lack of understanding of how blackbody photons are expressed or emitted by electrons, specifically from the decomposition of the latter's kinetic energy. It is, therefore, also a signal of the inability of the uncertainty principle to distinguish between the fine structure of matter (ie the Planck relation for the mass-energy of a particle, $\lambda_{cm}\ p_{Am} = h$; and for the electron mass-energy in particular, $\lambda_{ce}\ p_{Ae} = h$) and the fine structure of blackbody photons as they relate to the kinetic energy of the particle (ie the Planck relation for the energy of a photon, a particle of light, as it relates to the particle of matter that emits it, which in the case of the electron gives $\lambda_q\ p_{Ae} = h/\alpha^2$). In the case of blackbody photons issued from electrons, from the shedding of the kinetic energy of electrons, the functional transformation and equation for the photon energy is

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readily obtained, as follows (where W_2 is the voltage-equivalent wave-function of acquired kinetic energy during acceleration by an electrical field):

$$\lambda_x W_k W_2 = h (W_k W_2/p_e) = h\upsilon \quad (29)$$

so that, in electrical terms, it is the Duane-Hunt wavelength itself that conforms to the relation given by **Heisenberg**'s principle, as a constant for all electrical interactions: $\lambda_x = h/e$. Obviously, this demonstrates how electric charge e (or p_e) is a special case, and an invariant one (in fact, it is *relatively* invariant [7, 15]), of linear momentum.

These are, however, the basic functions of the kinetic energy associated with the electron mass-energy when the latter is an 'orbital electron' of the hydrogen atom. Indeed, blackbody photons are nothing but the product of such functions, and that is why the fine-structure constant intervenes as a proportionality.

2.3. Heisenberg's principle of uncertainty and the ("rest") energy of a particle of light: $\lambda\ \mathbf{p_C} = h$

How, then, does **Heisenberg**'s principle fare when one describes the photon's wavelength not as a function of the kinetic energy of a particle of matter - from which kinetic energy the photon dissociates at the moment of emission - but also with respect to the photon's own fine structure?

In this situation, the relation is not any different from that for the mass-energy of the particle of matter. The photon energy is still:

$$h\upsilon = \lambda_y c^2 \quad (30)$$

and the electromagnetic or photon momentum is still

$$p_C = \lambda_y c \quad (31)$$

with the wavelength of the photon defined as:

$$\lambda = c/\upsilon = h/p_C \quad (32)$$

and not as λ_y. Therefore the relation to the Planck constant h implicit to **Heisenberg**'s principle does apply to the intrinsic energy of the photon, just as it did to intrinsic mass-energy:

$$\lambda\ p_C = h \quad (33)$$

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2.4. Heisenberg's principle of uncertainty and the diffraction of particles of matter in substantial motion: the de Broglie matter waves: $\mathbf{p}_{AV}\ \lambda_{AV} = h$

What happens when one considers particles of matter accelerated to speeds that fall "under the relativistic constraint"? Here, things get substantially more complicated; but once again, we can take recourse to a consistent algebraic and functional(ist) treatment of the linear momentum that need not invoke any such thing as a microscopic uncertainty. We cannot proceed to make that demonstration from within the relation implicit to **Heisenberg**'s principle of uncertainty itself. We can only begin by providing a consistent treatment of **de Broglie**'s "matter waves" that invokes no relativistic constraints and is based on a direct synthesis of wave and particle properties for matter, as this synthesis applies to mass-energy, kinetic energy and their integral action.

For a 'mass-bearing' particle at rest in the local electromagnetic field, the photo-inertial momentum (when the quantum number n is set to 1) is:

$$\mathbf{p}_{Am} = (\lambda_m\ E_{\delta m})^{0.5} = \lambda_m\ c = h/\lambda_{cm} =\!\int\!= m_m\ c = (m_m\ E_{\delta m})^{0.5} \qquad (34)$$

where the mass-energy of the particle is defined as

$$E_{\delta m} = m_m\ c^2 \qquad (35)$$

and where λ_m is the mass-equivalent wavelength, and λ_{cm} the Compton wavelength of the mass-bearing particle.

Now, we have elsewhere proposed a nonrelativistic and nonclassical analysis [7, 15-17] of how, for a massbound particle in motion, the *total linear momentum* is a function of the addition (or juxtaposition) of the two energies - mass-energy and kinetic energy - but such that it is modified by a differential index n of the proportionality *between total energy* (the sum of the actual [18] kinetic energy and the mass-energy of the particle) *and mass-energy* (see equation #37). Thus, we write for the total linear momentum that **Heisenberg**'s principle was intended to address, a function that *adds* the *inertial linear momentum of mass-energy* to the *inertial linear momentum of kinetic energy*:

$$\mathbf{p}_T = (n\ \lambda_m\ E_T)^{0.5} = [n\ \lambda_m\ (E_{\delta m} + E_k)]^{0.5} = \mathbf{p}_{Am} + \mathbf{p}_K \qquad (36)$$

where

$$n = (E_k/E_{\delta m}) + 1 \qquad (37)$$

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From this it follows that $\mathbf{p}_K$ must equal $[\lambda_m^{0.5} (E_k / E_{\delta m}^{0.5})]$ [19]- rather than, say, $(\lambda_m E_k)^{0.5}$. Thus, the 'photoinertial' linear momentum of kinetic energy reduces to

$$\mathbf{p}_K = \mathbf{p}_T - \mathbf{p}_{Am} = (n \lambda_m E_T)^{0.5} - (\lambda_m E_{\delta m})^{0.5} = \lambda_m^{0.5} (E_k/E_{\delta m}^{0.5}) = E_k/c \quad (38)$$

However, as presented in great detail in Volume 3 of AToS, the empirically observed inertial linear momentum associated with the electron's de Broglie waves is neither the total inertial momentum or the kinetic inertial momentum, but the integral inertial momentum provided by the geometric mean of the total and kinetic linear momenta. This is determined without resorting to any relativistic transformations, and all strictly-speaking de Broglie wavelengths must be derived from the integral inertial linear momentum given by (in vector form):

$$\mathbf{p}_{AV} = [(\mathbf{p}_T) (\mathbf{p}_T - \mathbf{p}_{Am})]^{0.5} = (\mathbf{p}_T \, \mathbf{p}_K)^{0.5} \quad (39)$$

The correct de Broglie wavelengths for electron diffraction do not operate on the total momentum; they are, rather, a function of the geometric mean or integral momentum which is the result of the relation between total momentum and the momentum allocated to the associated kinetic energy. In fact, when the kinetic energy E_k is treated as being *always identical* to the applied or input energy E_{in}, as both classical and relativistic theories *assume is the case*, then the results obtained with equation #39 are very close to those obtained by relativistic treatments (in fact they are convergent), arguably more accurate (see figure 1 of [16]), and what they demonstrate is that virtually the same de Broglie wavelengths can be obtained *without* any application of relativistic formulations. For example, for a 50keV electron beam, the function $\mathbf{p}_{AV}$ (written as $\mathbf{p}_{AVin}$, since it is derived from the assumption that in all cases $E_k = E_{in}$) corresponds to 72.3% of the relativistic formula for the de Broglie momentum, given by:

$$\mathbf{p}_{RELAT} = h \, [(2 \, E_{in}/E_{\delta e}) \, (E_{in}/E_{\delta e})^2]^{0.5}/\lambda_{ce} \quad (40)$$

(where λ_{ce} is the Compton electron wavelength). For a 511keV electron beam, $\mathbf{p}_{AVin}$ corresponds to 81.6% of $\mathbf{p}_{RELAT}$. For 5.1 MeV, 51.1 MeV and 511 MeV electron beams, $\mathbf{p}_{AVin}$ corresponds to, respectively, 81.6%, 99.6% and 99.95% of $\mathbf{p}_{RELAT}$, and so on. Thus, the aetherometric function for $\mathbf{p}_{AVin}$ is the same as:

$$\mathbf{p}_{AVin} = (\mathbf{p}_{Tin} \, \mathbf{p}_{Kin})^{0.5} = h \, [(E_{in}/E_{\delta e}) \, (E_{in}/E_{\delta e})^2]^{0.5}/\lambda_{ce} \quad (41)$$

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These results clearly show that the relation implicit to **Heisenberg**'s principle of uncertainty is only realized for the geometric mean momentum of the moving particle - not for its kineto-inertial momentum proper $\mathbf{p}_K$ (or $\mathbf{p}_{Kin}$), nor for its total momentum $\mathbf{p}_T$ (or $\mathbf{p}_{Tin}$), but only for $\mathbf{p}_{AV}$ (or $\mathbf{p}_{AVin}$), such that we may write:

$$\lambda_{AV}\, p_{AV} = h \qquad (42)$$

where the real de Broglie wavelengths are expressed as:

$$\lambda_{AV} = h/[(p_T)\ (p_T - p_{Am})]^{0.5} \qquad (43)$$

and thus are a function of a composite geometric inertial momentum.

The profound reason for this is simply that the mean geometric or integral momentum is an electroinertial function that invokes the electric wave structure of kinetic energy for a moving massbound charge that diffracts through matter. Indeed, it is the electroinertial momentum of a moving massbound particle, as shown by a strictly aetherometric equation [15] (also consult equations #'s 26, 29 and 37 above):

$$\mathbf{p}_{AV} = (\mathbf{p}_T\, \mathbf{p}_K)^{0.5} = (h/\lambda_x)\ \ (W_2\ n/W_k)^{0.5} \qquad (44)$$

Since (h/λ_x) is the exact value of the elementary electric charge (expressed as p_e in the meter-second units of the aetherometric system), the inertial mean geometric linear momentum is simply an electric function productive of mass-conservative inertia, that depends on both the energy differential index n and the square root of yet another differential, this time a wave differential between the "field voltage-equivalent" wave and the magnetic wave of the electron. The "field voltage-equivalent" or electric wave W_2 of kinetic energy is a function of the massfree energy of the applied electric field, and the magnetic wave W_k is a function of the mass-energy of a massbound particle, the electron in our case. With equation #44, we have demonstrated the coincidence of two different and independent methods for the correct computation of the *electroinertial linear momentum* associated with the so-called "Matter-waves": one, an *inertial* (or photoinertial) computation, indicates how the *integral de Broglie inertial momentum* functions as *geometric mean of the total and kinetic inertial momenta*; the other, an *electric* computation, indicates how, in motion through matter, the *integral electroinertial linear momentum* results from the operation of two differentials (energy and wave functions) upon the inertial linear momentum characteristic of the *massbound elementary electric charge at rest*.

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3. No uncertainty for light and matter, or for charge

Richard Feynman once claimed that Quantum ElectroDynamics (QED) had made **Heisenberg**'s principle of uncertainty useless or superfluous; once **Feynman** had permitted electrons to travel back in time and present as positrons, or "permitted" photons to "know where they were going and exist there before they got there", once all the little "arrows were added for all the ways an event can happen" [20], nature (light and matter) became even fuzzier, and the Heisenberg principle was no longer needed. That, of course, hardly accounts for the relation - the *physical and functional* relation - that underlies the principle. **Feynman**, too, was good at sleight of hand, and so he glossed over the real energy physics behind the principle.

For our part, we are interested in the *physical senses* of the *principle of variation* of the relation that underlies the so-called principle of uncertainty, and what they tell us about the nature of matter, light and charge which a whole procession of particle physicists managed to miss - from **Heisenberg** to **Feynman** and beyond, to this day.

All the aetherometric expressions discussed in the preceding sections conform to the relation inherent in the definition of quantum angular momentum h and thus inherent also in **Heisenberg**'s principle of uncertainty, but have been developed without invoking it, and in such a way that, for *matter*, they permit two distinct kinds of statements: (1) those concerning the mass-energy of a particle, in the form -

$$\bar{\lambda}_{cm}\, m_m\, c = \bar{\lambda}_{cm}\, p_{Ae} = \hbar \qquad (45)$$

and (2) those concerning the *electroinertial* effects of *a composite of kinetic and rest energies* for any particle of matter, which is responsible for the de Broglie wavelengths, such as are observed in the diffraction of electrons:

$$\bar{\lambda}_{AV}\, p_{AV} = \hbar \qquad (42b)$$

For light or photons, they permit two distinct statements as well: (1) one concerning the structure of the photon, which makes it analogic to that of matter (read mass-energy):

$$\bar{\lambda}\; p_C = \hbar \qquad (33b)$$

and (2) the other concerning the determination of blackbody photon wavelengths, in the form of an upper limit to their expression, and providing the basis for the quantum mechanical operators that extract the hydrogen electron spectrum:

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$$\bar{\lambda}_q \, p_{Ae} \, \alpha^2 = \hbar \qquad (46)$$

Finally, the aetherometric treatment also provides for an invariant relation that underlies all electroinertial interactions [21]: a relation between invariants - the Duane-Hunt wavelength and the Planck constant - that functionally establishes the invariance of massbound charge at rest, and simultaneously demonstrates the validity of Aetherometry's contention that charge is a special form ('electric') of linear momentum:

$$\bar{\lambda}_x \, e = \hbar \qquad (47)$$

Treated aetherometrically, the relation behind the so-called Heisenberg principle applies to light, charge and matter at rest or in motion (in vacuo or through matter), without requiring any relativistic transformations or a probabilistic interpretation, while serving moreover as a clue to understand what we call "the fine-structure of energy", and the subtle differences between one physical case and the others. In all cases, the aetherometric algebraic treatment is functionally consistent - for matter at rest or in motion (without invoking relativistic constraints), for emission of photons and for their internal energy (their electromagnetic momentum), and for all interactions of electric charge(s) [21]. In all instances, the numerical results are either those of accepted relativistic wave-mechanical or matrix-mechanical approaches, or more accurate than these (eg for both the hydrogen spectrum and the de Broglie wavelengths). In all cases the results, instead of being uncertainties, are exact functions that vary according to the physical object (matter at rest or matter in motion; light 'in itself' or light 'whence it comes'; and electrical charge). Thus, Aetherometry proves the relation implicit to **Heisenberg**'s principle of uncertainty, but proves it as a certainty, as a principle of variation ($\bar{\lambda}\, \mathbf{p} = \hbar$), and thus disconfirms the uncertainty and its principle. The principle of uncertainty is just an interpretation of the generic relation $\bar{\lambda}\, p = \hbar$, a weak and unnecessary one. If one asks what the intimate physical sense is of the expression of **Heisenberg**'s principle of uncertainty as an inequality, the aetherometric answer is simple: it permits a plurality of quanta ($n \gg 1$), but also something else that has never been considered: the deeper meaning of the inequation, as regards the correlation of momentum and 'length' (or coordinate) for different cases, is that it gives expression to the inherent relation as a principle of variation that is applicable to matter, light and charge. Specifically, in what concerns the relation as applicable to matter, it is a function either of an invariant momentum (rest energy) characteristic of each particle of matter, or of a variable one (an energy composite in a complex state of motion). The inequality, therefore, does not fundamentally concern the constant $\hbar$, but the functional fine structure that permits the relation of all these variations by the same angular constant.

These novel aetherometric results and functions are full of still other implications. One con-

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cerns the status of scientific or partial observers. **Deleuze** and **Guattari** suggest that "we must avoid giving them a role of a limit of knowledge or of an enunciative subjectivity" [22]. And indeed we should follow their advice. There can be no validation of uncertainty, let alone of complementarity, of duality (dualism) and subjectivism. But this does not impede one from separating the two conventionally accepted principles of (**Heisenberg**'s) uncertainty and (**Bohr**'s) complementarity, since the uncertainty does *not directly claim* a cartesian complementarity: "**Heisenberg**'s demon [partial observer] does not express the impossibility of measuring both the speed and the position of a particle on the grounds of a subjective interference of the measure with the measured". Yet, even as the 'measuring' - or act of detection and measurement - is not to be confused with the observer (as **Hofstadter** cautioned us above not to do), the measured is still not considered as an observable, but as an unobservable that is only indirectly measured (by an intrinsic uncertainty).

What does that do to the measure, or make of it? If, in classical mechanics, the measure was always an exoreferenced metric, with quantum mechanics it became a fuzzy exoreference. The salvation of realism in physics became a profession of faith - the belief that the process of observation or measurement is not separable from a perturbation of the measured or observed, as enshrined in **Bohr**'s complementarity principle. As **Prigogine** and **Stenghers** succinctly put it: "a system was thought to possess intrinsically well-defined mechanical parameters such as coordinates and momenta; but some of them would be made fuzzy by measurement, and **Heisenberg**'s uncertainty relation would only express the perturbation created by the measurement process. (...) This implies a departure from the classical notion of objectivity, since in the classical view the only "objective" description is the complete description of *the system as it is*, independent of the choice of how it is observed"" [23].

We should note that our approach has no argument with the evident insufficiency of the classical notion of objectivity. To achieve a complete description of a system as it is, one would have to be able to (endo)reference the system, and that is simply not possible unless the system is fully and intrinsically comprehended as an energy system - something which quantum mechanics failed to do, even to this day. **Prigogine** himself conceded that the interpretation of **Heisenberg**'s uncertainty afforded by its extension as **Bohr**'s complementarity "seems too narrow", and stated: "it is not the quantum measurement process that disturbs the results". But the problem does not reside in the **Bohr** interpretation of **Heisenberg**'s uncertainty, but rather in the way that **Heisenberg**'s principle treats the de Broglie relation and the latter's reference to **Planck**'s constant. For **Heisenberg**'s principle never comes to consider *how* the wavelength function of the de Broglie relation is constitutive of an energy 'swing' that either composes or carries the particle by, precisely, the 'way' that it couples to a particular form of linear momentum (specific to each energy type). What the relation is telling us is that nature provided for each particle a natural measure of its path, a natural metric of its motion - a specific wavelength determination - and that the same (the existence of a natural metric) applies to the intrinsic structure of the energy of a particle at rest. Further, it means that, if we know the

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energy unit or units involved, and thus the geometric structure of the energy flow, we may indeed map as a function of time, both relative position and momentum with that natural metric.

It is here that Aetherometry parts company with **Deleuze** and **Guattari**, as when they consolidate the **Heisenberg** principle to say that "it measures exactly an objective state of affairs that leaves the respective position of two of its particles outside of the field of its actualization, the number of independent variables being reduced and the values of the coordinates having the same probability". This is now shown by all of the above to be erroneous. Neither the uncertainty, nor the inequality are the consequence of a virtual being of particles that forces a selection and reduction of the measured variables whenever actualization of the particles takes place. There are only energy conversions, and virtual particles are just virtualities of actual particles - in the very sense that a black-body photon is only a virtual particle of the kinetic energy (the “kineton”) of a decelerating electron. Moreover, **Heisenberg**'s principle does not measure, let alone exactly, a state of affairs that is objectively uncertain. It is *the underlying relation that measures*, and does so accurately - since the resulting value is, for a variety of different energy conditions, a microscopic constant of angular momentum, **Planck**'s constant. Nor is **Heisenberg's** principle a fundamental relation between particles (extracted either from a notion that its measurement is always collisional, or that the particles are virtual ones) but a relation pertaining, first of all, to a single particle (and thus a matter of strict endoreference) - whether it is a mass-bearing particle, a photon or a massbound electric charge - and which concerns the simultaneity of measurement of the particle's location and linear momentum (and only secondarily, of its velocity). The fundamental relation underlying the principle can be applied to particle collisions, but its correct application, as we have shown in the treatment of of the Doppler shift of the hydrogen Balmer line in the experiment of **Ives** and **Stilwell** [24], requires determination of the masses of the charge-carriers involved in the collision, as well as determination of the ion velocities before and after collision by the nonrelativistic law of the geometric mean composition of velocities.

Moreover, when particle collision is involved, the particles in question (eg electron and photon, or electron and proton, etc) are not left out in the domain of a virtuality; the de Broglie relation underlying **Heisenberg**'s principle functions as a "general principle of variation" by which different and *actual* particles with distinct energy properties abide. So, it is the relation itself that can be stated in the abstract and which constitutes the domain of a virtuality. The principle, rather, is expressed as a minimum uncertainty of the actual, of the actualized, and this is clear when its expression is that of an inequality. The uncertainty is in the actual, not the virtual (not even the use of imaginary numbers helps us here). The number of variables *is not* reduced; it just happens that the product of momentum by the length of a unit path has the correct dimensionality of the quantum of angular momentum (on this matter, **Heisenberg** used good judgement at first), and thus that the variables are not only not truly independent, but most revealingly, co-variant variables of an endoreference system: the constituents of angular moment.

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Lastly, once one is coordinatizing probabilities of two different sets of dimensions (say, position and velocity) that one arbitrarily equates, one has entered into a veritable daydream of subjectivism and volitionism - and thus abandoned physics and science altogether. So no, **Heisenberg**'s principle most definitely is not an expression of an objective state of affairs, but rather encodes a series of illogical, nonfunctional leaps of imagination that present the illusion of a 'confused objectivity'. This may be "the truth of the relative", but this "relative" is of no real scientific interest or value. One may not want that "truth" to be "a truth of the subject" (and fall into **Bohr**'s trap), yet the interest of that "relative" *is a subjective interest* - the interest perhaps of **Heisenberg**'s demon (if not of **Heisenberg** posing as an 'objective' observer), but not the interest of *a functional scientific observer* who can confirm that the relation underlying the so-called uncertainty *is a principle of variation* that is differently applied to *matter*, *light and charge*, and quite *certain* or exact in all cases... The microscopic observer would smile and conclude that **Heisenberg**'s demon was using very poor lenses, and his algebra (as **Einstein** feared) was so liberal with dimensionalities and leaps of faith that henceforth all idiocies became possible. The mechanical atom had been rejected, but only to the benefit of *ad hoc* combinatories of probabilities or uncertainties, that only permit certain 'stochastic statements' about "physical states of affairs".

In this context, there is another lunacy of the particle physicists: they point to the impossibility of locating exactly an orbital electron, and the necessity of describing yesterday's point-particle as a cloud of wave-probabilities. Then, once the arbitrary location is obtained from the probability function, they continue to think, or believe, that the electron is still a Dirac point-particle, an actualized Bohr planet in a valence orbital. In this respect, Aetherometry entirely destroys the Heisenbergian picture (yes, it was a picture after all, and not a very good one, though perhaps better than the solar-system picture of the Bohr-Rutherford atom): the so-called orbital electrons are toruses of looped energy flux (fine structure of mass-energy, with defined geometry), and their kinetic energy in the atom is not the energy of orbital motion, but the energy related to the integral gyrations or 'tumblings' of the integral torus around the atomic nucleus. So, the so-called 'orbital cloud', and allusions to it in electron diffraction, are real *objective detections* of the integral motion of the torus or toruses; thus, *the electron does not reside in a point* (a location, as if a location were now a path and next a dimensionless point...), *but is the entire torus that occupies an orbital* and entirely surrounds a nucleus.

Uncertainty does not arise from the graininess of the universe; there is no uncertainty in **Heisenberg**'s sense. Energy (or, rather, certain energy manifestations [21]) presents microscopic graininess, by virtue of a minimum quantum of angular momentum (a *constant*) that matter, light and massbound charge uniformly share, preserve and 'reproduce'. Elsewhere [17], we have shown that the graininess of the gravitational field is even finer, or subquantic. The generic aetherometric relation for the quantum is a microscopic function of angular momentum, not a probability, and this function is inseparable from the energy structure involved. It presents us, not with an insuperable and

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Fig. 1.
Photon emission in the electron inertial frame:
globular structure of photon & growth in the 1/v interval

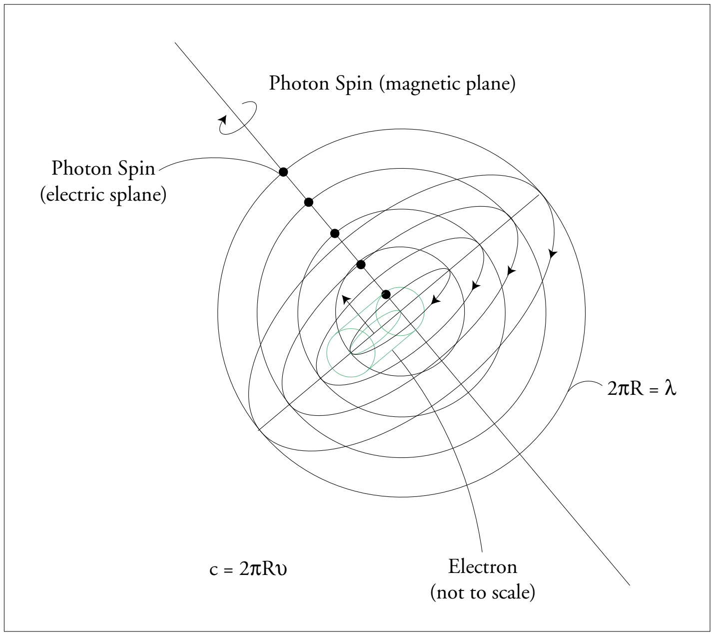
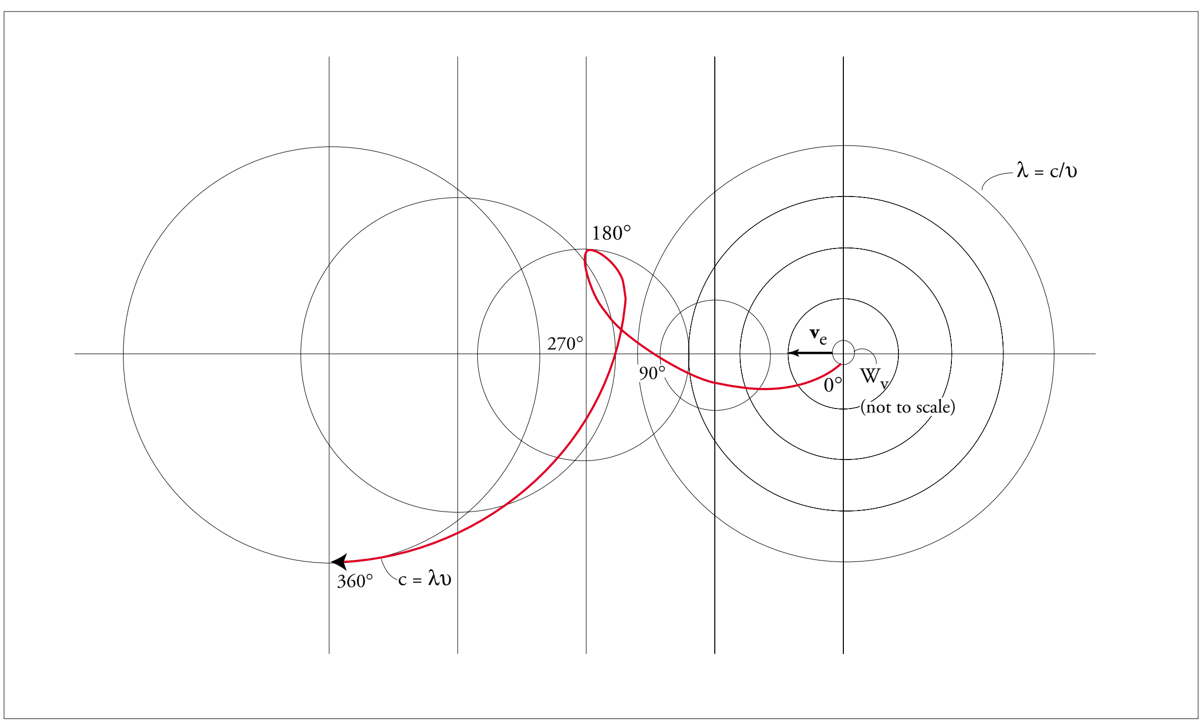


Fig. 2
Planar distortion of a single blackbody photon wavefunction in the direction of electron emitter motion with velocity **v**.



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uncertain duality of particle and wave, but with *a certain and exact energy multiplicity of particle and wave*. It is the energy multiplicity that serves as a principle of variation for the specification of all the quantum momenta, and the endoreferenced locations of matter (at rest or in motion) and of light, including the location and momentum functions for light when exoreferenced to the charge-carrier that emits it (see **Fig.s 1 & 2**). There is *no uncertainty* that can be invoked; the particle and the wave treatments are *compatible* and integrated, *synthesized* together as *an energy multiplicity*; an energy multiplicity is not a duality - where eg the electron "is at once a corpuscle and a wave" - but a superimposition of waves (plural) with an integral particle or momentum function, a superimposition that, for particles of matter, involves the relation between distinct energy components, mass-energy and kinetic energy. The aetherometric predictions or results for the relation(s) that underlie **Heisenberg**'s principle of uncertainty are *certain* and *specific* to different cases, and pertain not just to *matter* and *light*, but also include every *massbound charge*. In the case of *charge*, the interpretation of uncertainty is most clearly nonsense, since the relation entirely concerns microscopic constants. The aetherometric treatment is *closer to the empirical results than are the relativistic particle or wave mechanical treatments*; and there is, therefore, no reason to bother to enunciate anything even remotely like a 'principle of complementarity', as **Bohr** did. A further application - that we address elsewhere - of the aetherometric treatment to the electric structure of kinetic energy and electrodynamic interactions, will also be shown to comply with this functional principle of quantum variation as it applies to electrical charge. **Heisenberg**'s interpretation of the de Broglie relation is wrong, but the relation is real, is a true quantum function whose principle of variation physics has, to this day, failed to completely extract.

4. The functional energy synthesis of compatible wave and particle treatments

The ultimate basis for the error in **Heisenberg**'s principle of uncertainty was and is the inability of existing official physical theory to treat the concepts and functions of particles and waves in a consistent, compatible fashion - physically and mathematically. No such difficulty exists in Aetherometry. A simple demonstration of this fact consists in the enunciation of a consistent synthesis of the two physical realities, and though we cannot here do so in as much detail as we have done in our publications on experimental and theoretical Aetherometry, we will certainly summarize the essential aetherometric steps and concepts.

The first and simplest realization is that physicists are not sure what it is they call a particle. Most of the time they mean a unit of linear momentum, but at other times they mean a quantum (of moment), and at still others they mean a point-mass, or imply an energy unit. What is the photon qua particle? Sometimes it is the energy unit hυ, and at other times the quantum h. What is a particle of mass? Well, sometimes it is a point-mass, at other times it is its inertial linear momentum.

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And so on. Yet, when physicists begin talking about particle treatments, all they are concerned with are the relations between the linear momentum function $\mathbf{p}_A$ and the moment h (or $\hbar$). It is apparent to aetherometrists that 'particle' should just be a term signifying the presence of a linear momentum - what is variously called, and erroneously in some instances, 'the electromagnetic pressure of photons', 'the linear momentum of particles of matter', 'the electromagnetic momentum of relativistic particles', 'the inertial momentum of particles', etc.

But precisely aetherometrists know that the linear momentum function p is a complex function with a principle of variation that affects its intrinsic structure as well as its relation to angular moment. That principle of variation indicates that all energy, whether it is massbound or massfree, deploys a linear momentum function, and thus a particle or the "event-particle". This function may vary in several ways, and one particular kind of 'particle' it produces is electrical charge (yes, this is the correct way of putting it!), which Aetherometry proves to be strictly a near-invariant form of linear momentum.

Let us diagramatize this: a photon, has an electromagnetic linear momentum function simply defined as:

$$p_C = h\upsilon/c = \lambda_y\, c \qquad (48)$$

That is the linear momentum of a photon, and therefore it is called photonic or electromagnetic momentum. It is this function which one encounters in the Compton effect or in the absorption of blackbody photons, etc.

A particle of matter has a rest energy (with respect to its inertial frame or an inertial frame on which it rests), and this rest energy was defined above as:

$$E_{\delta m} = m_m\, c^2 \qquad (35)$$

One is therefore led to conclude (as was **de Broglie**), that there is a linear momentum to this rest energy, defined above by equation #34 and summarized as:

$$p_{Am} = m_m\, c^2/c = m_m\, c \qquad (34b)$$

Obviously this is analogous to and parallel with the photonic or electromagnetic momentum (see equation #45) that defines the photon as a particle. It is what Aetherometry calls the inertial linear momentum of the mass-energy of a particle of matter. Before the advent of Relativity, this would have been considered to be the momentum associated with the 'ordinary mechanical mass' of a particle (eg an electron), or with its inertial mass. After Relativity, this would become the momentum

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associated with rest mass.

A particle of matter, or a mass, in motion also has a linear momentum, which newtonian physics defined as:

$$p_{k'} = m_m \, v \qquad (49)$$

Before the advent of Relativity, there was already a notion that, in addition to inert mass, particles of matter could also acquire a dynamic mass connected to their states of motion. Initially it was supposed that the total mass of a particle in motion was its 'electromagnetic mass, or self mass' [25], but after Relativity, a distinction was made between inert mass as rest mass of a particle, and the 'electromagnetic mass' caused by motion which became called 'relativistic mass'. It was a major semantic confusion - but in essence, the linear kinetic momentum had to be treated as if it seamlessly added 'electromagnetic' or 'relativistic' momentum (and mass) to the 'inert' or 'rest' momentum (and mass). So the linear momentum associated with the kinetic state of a particle of matter could not be that given by newtonian physics. Once Relativity was the dish of the day, **de Broglie** had to search for a solution that incorporated it, and arrived at the relativistic integral linear momentum that explained the observed de Broglie wavelengths -

$$\mathbf{p}_{Ak} = [(2E_{\delta m}E_{in}) + E_{in}^2]^{0.5}/c = h\,[(2\,E_{in}/E_{\delta e})\,(E_{in}/E_{\delta e})^2]^{0.5}/\lambda_{ce} \qquad (40b)$$

where E_{in} is taken as the kinetic energy E_k of the particle (which he assumed, and so does to this day particle physics, fully corresponds to the potential of the accelerating field; or, in aetherometric language, which **De Broglie** assumed was the same as the input field energy E_{in}). We have shown elsewhere [16] how he could have generated virtually the same curve described by his *relativistic* treatment, and which his *classical* treatment could not generate, with a nonrelativistic treatment that does not invoke any relativistic mass increase and at once identifies the *total momentum* (of the particle), as:

$$\mathbf{p}_T = (n\, m_m\, E_T)^{0.5} = [n\, m_m\, (E_{\delta m} + E_k)]^{0.5} = \mathbf{p}_{Am} + \mathbf{p}_K \qquad (36b)$$

and *the integral momentum* that generates *de Broglie* wavelengths indistinctly as *a geometric mean of the total and the kinetic momenta*:

$$\mathbf{p}_{AV} = (\mathbf{p}_T\, \mathbf{p}_K)^{0.5} \qquad (44)$$

or as an electroinertial function (remember that the invariant charge e in the aetherometric system of units is formally expressed as vector $\mathbf{p}_e$), with all vectors shown in bold:

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$$p_{AV} = (p_T\, p_K)^{0.5} = p_e\ (W_2\ n/W_k)^{0.5} \qquad (50)$$

We could no longer call this integral momentum relativistic or electromagnetic, nor continue to suggest that there was an electromagnetic or relativistic mass to be added to the rest or inertial mass as a function of 'inertial acceleration'. Clearly, the inertial effects of this integral linear momentum are ultimately produced electrically by the composition of electric and magnetic waves in the fine structure of kinetic energy. The de Broglie waves are nothing other than the byproduct of the inertially constrained electric waves of the kinetic energy of motion of a massbound particle.

One can see how, having arrived here, Aetherometry could not but part company also with **Harold Aspden**'s interpretation [26] of the significance of **Heisenberg**'s principle of uncertainty. For **Aspden**, the uncertainty is eliminated if one simply admits that there are two references for a particle - the electromagnetic frame and the inertial frame. An ordinary particle at rest in the electromagnetic frame is still in motion in the inertial frame - even if we cannot tell where it is in its motion - so all the mass it has is "inertial"; once in motion with respect to the electromagnetic frame, it develops an "electromagnetic" mass. Aetherometry sees no need to take this route. The *electromagnetic* or photonic momentum of any photon *shares the same exact electromagnetic reference frame* as the *inertial* mass implicated in the linear momentum of rest-energy, or rest-mass:

$$p_C = h\upsilon/c = \lambda_y\, c \qquad (48)$$

for photons, and by the mass-to-wavelength conversion:

$$p_{Am} = m_m\ c =\!\int\!= \lambda_m\ c \qquad (51)$$

for particles of matter in their rest state. They are variations of the same function - expressions for the electromagnetic momentum of photons and for the photoinertial momentum of material particles in any rest frame. So, the two frames, electromagnetic and inertial, are one and the same, and one cannot decode **Heisenberg**'s principle of uncertainty by assuming them to be different, *all the more so as the photon shares the inertial frame of the emitter at the time of emission* [27](see **Fig. 1**).

Instead, one first has to demonstrate how the roots of **Heisenberg**'s principle of uncertainty in **de Broglie**'s theory can be addressed differently [16, 28], so that the relation behind the principle may be clarified in unsuspected but physically consistent ways - which is what we have done with all of the preceding. Hence, one may not call the geometro-integral momentum that generates de Broglie waves (which *are* composite electric waves) a 'relativistic' momentum, or an 'electromagnetic' momentum. It invokes neither a relativistic increase in mass, nor the expression of an electromag-

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netic mass referenced to a frame distinct from the inertial frame. And yet, it is in accord with the 'addition' of kinetic and rest energies! But in a peculiar fashion which underlines how a particle of matter in motion derives its inertial properties electrically by the synthesis or superimposition of field-electric and mass-specific magnetic waves. Clearly, juxtaposition is not a real addition, but a variant of the superimposition of waves and energy.

It follows that the aetherometric analysis permits the exact determination of the wavelengths corresponding to Δx, so that it is not just the *product* of position and momentum that is certain, but also position and momentum. To be *certain* of those, all one had to do was understand the fine structure of energy and momenta, the variation in the intrinsic structures of moment and momentum. For, after all, whether we are talking about the photon energy that defines the electromagnetic frame, or about the rest energy of matter in an inertial frame, photons and massbound particles seem to share not only the fine structure and functions of linear momentum, but also the quantum h of angular momentum, all predicated on the fact that their energy is the result of coupling a quantum frequency to that quantum h. No moment h without a defined, natural, minimum "length-position" provided by a wavelength.

But nature is not so simple when it comes to states of motion and the integration of kinetic energy and mass-energy; here the quantum is completely "epiphenomenal", and the frequency a composite: while the massbound charges move so as to conserve their mass and charge, the coupling of kinetic energy to their mass-energy generates (under conditions of diffraction through matter) a variable integral inertial momentum that increases with increasing kinetic energy and is distinct from its charge property. Specifically, the inertial accelerations of massbound charges, that one speaks of as being substantial, are not mechanical or thermal processes, but electrical ones. So, the kinetic energy one is concerned with is electrical energy. This opens a whole other "can of worms", for electrokinetic energy is not electromagnetic. What is more, there is another question which particle physics has totally ignored and occluded. Particles of matter may well have an electromagnetic energy equivalent, and we may well sense this equivalent in all inertial manifestations, whether by the resistance of inertial mass at rest to being set into motion (p_{Am} function), or, once in motion, by its assumption of an integral linear momentum (p_{AV} function) greater than the linear momentum of inert mass at rest. But particles of matter, specially those one calls elementary, also have another way of being sensed and interacting - namely, electric charge. An electron couples to an electric field to permit acceleration by the field precisely because the electron is an element of mass-energy which carries a charge; and this charge, as shown by Aetherometry, is part of the fine structure of that mass-energy:

$$E_{\delta e} = p_{Am}\, c = m_e\, c^2 =\!\!\int\!\!= \lambda_e\, c^2 =\!\!\int\!\!= \lambda_e\, W_k\, W_x = p_e\, W_x =\!\!\int\!\!= e\, W_x \qquad (52)$$

From this aetherometric functional proposition it follows that:

1. The wave function $W_k =\int= e/m_e$, which aetherometrically constitutes the magnetic wave function intrinsic to the charge e of an electron, is also part of the rest-energy of the same electron (part of the carrier): it couples to the electron inert mass and functions as a "group-wave", the "particle wave" or the wave intrinsic to the particle - which, in this case, is a charge-particle or an electric near-invariance of linear momentum.

2. There is, in the fine-structure of the electron mass-energy, a voltage-equivalent electric wave function W_x (a "phase-wave") which couples to the charge, and thus to the magnetic wave intrinsic to charge. Its voltage magnitude is the established 511kV.

3. The charge e can be functionally treated as the momentum p_e, which demonstrates that charge has dimensionality - the exact dimensionality of linear momentum:

$$e = mlt^{-1} =\int= p_e = l^2 t^{-1} \tag{53}$$

4. Therefore, there is an unsuspected functional relation (not an equivalence, and even less an identity) between rest inertial momentum and electric momentum or charge, as expressed by the proposition:

$$p_{Am} -\int- p_e -\int- e \tag{54}$$

As shown in equation #22, the ratio of the two linear momenta - inertial and electric - is the normal gyromagnetic ratio of the electron, a topic taken up at length in volume 3 of AToS [15]. Moreover, equation #52 also shows that the rest energy of an elementary particle has an electric fine structure. It is by virtue of that structure that the particle can be set into motion by an applied electric field, and that the fine structure of the electrokinetic energy is comparable to that of the mass-energy of the charge carrier:

$$E_k = e\, W_2 =\int= p_e\, W_2 = \lambda_e\, W_k\, W_2 \tag{55}$$

The real de Broglie waves are "functional, geometrico-algebraic derivatives" of this electrokinetic energy that is coupled to the mass-energy of the accelerated particle. In other words, the real de Broglie waves are not the waves that primarily constitute the kinetic energy in its native state, as it were, but the form these waves take up when the massbound particle with which they are associated is detected inertially - whether photoinertially or electroinertially, a topic examined in [15] - as in processes of diffraction and refraction. The real de Broglie waves are expressed (and detected) as a function of the integral inertial linear momentum of the particle, referenced therefore to the inertial-and-electromagnetic (photoinertial) momentum of the particle (relation between p_{Am} and p_{AV}) at the

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moment of detection; whereas blackbody photons and their 'lightwaves' are also "derivatives" of this kinetic energy referenced to the electric structure of the accelerated particle, when this kinetic energy is shed from an emitter. That is why, above, we described blackbody photons as being issued from the kinetic energy of electrons, where the structure of the photon was seen as (1) deriving from the wave-function of the accelerating field, and (2) as invoking the Duane-Hunt wavelength:

$$\lambda_x W_k W_2 = h (W_k W_2/p_e) = h\upsilon \quad (29)$$

And that is also how the wavelength that serves as basis for the hydrogen-electron blackbody spectrum invokes the fine-structure constant, when one takes as its reference the inertial rest-energy momentum of the electron that emitted the photon:

$$\lambda_q = h/p_{Ae} \alpha^2 \quad (46)$$

What, then, is the result of all of this, as it relates to the so-called particle-wave duality? Well, it is simple: as the attentive reader will have realized, these expressions already integrate the wave and particle functions in all cases known to quantum physics - matter at rest, matter in motion, the photon, and *massbound* electric charge. There is no duality; there is an energy multiplicity that provides for the microscopic unity of processes afforded by the invariant quantum.

Hence, for mass-energy we can write two distinct "wave-particle multiplicities" that reveal, for example, the same electron: one for the photoinertial properties of rest-energy or mass-energy,

$$\begin{array}{llll} & \nearrow c = \lambda_{ce} \upsilon_{\delta e} & \searrow & \text{PHASE-WAVE} \\ E_{\delta e} = m_e c^2 = \int = p_{Ae} c & & \int = h\upsilon_{\delta e} & \\ & \searrow p_{Ae} = m_e c = m_e \lambda_q \upsilon_k & \nearrow & \text{PARTICLE+GROUP-WAVE} \end{array} \quad (56)$$

and another for the electroinertial properties of mass-energy (ie with reference to the function of the electric charge property):

$$\begin{array}{llll} & \nearrow W_x = \lambda_x \upsilon_{\delta e} & \searrow & \text{PHASE-WAVE} \\ E_{\delta e} = e W_x = \int = p_e W_x & & \int = h\upsilon_{\delta e} & \\ & \searrow e = m_e W_k = m_e \lambda_h \upsilon_k & \nearrow & \text{PARTICLE+GROUP-WAVE} \end{array} \quad (57)$$

We could just as well integrate the two functions (while replacing mass by the aetherometric mass-

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equivalent wavelength) into their principle of variation as a "particle-waves multiplicity":

$$E_{\delta e} = \int = \begin{array}{ll} \nearrow \mathbf{p}_{Ae}\, c = \lambda_e\, c^2 = \lambda_e\, \lambda_q\, \lambda_{ce}\, \upsilon_k\, \upsilon_{\delta e} \searrow & \text{PHOTOINERTIAL} \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad \int = h\upsilon_{\delta e} & \\ \searrow \mathbf{p}_e\, W_x = \lambda_e\, W_k\, W_x = \lambda_e\, \lambda_h\, \lambda_x\, \upsilon_k\, \upsilon_{\delta e} \nearrow & \text{ELECTROINERTIAL} \end{array} \tag{58}$$

The mass-energy alone of a particle of matter at rest or upon impact presents a characteristic electromagnetic (photoinertial) momentum; but once set in motion by an electric field, it presents an electric momentum (charge).

We should contrast these with the electromagnetic energy *equivalent* of the electron mass-energy (only observable as such, when and if the electron mass-energy is entirely converted into a photon):

$$E_{\delta e} = m_e\, c^2 = \int = \mathbf{p}_{Ae}\, c \begin{array}{ll} \nearrow c = \lambda_{ce}\, \upsilon_{\delta e} \searrow & \text{PHASE-WAVE} \\ \qquad\qquad\qquad\qquad \int = h\upsilon_{\delta e} & \\ \searrow \mathbf{p}_{Ae} = \lambda_e\, c = \lambda_e\, \lambda_{ce}\, \upsilon_{\delta e} \nearrow & \text{PARTICLE+GROUP-WAVE} \end{array} \tag{59}$$

Any photon can also be described either as a function of its intrinsic electromagnetic structure, or as a function of the electric structure of the kinetic energy of its emitter (electron as example):

$$E = \int = h\upsilon \begin{array}{ll} \nearrow \lambda_y\, c^2 = \mathbf{p}_C\, c = \lambda_y\, \lambda^2\, \upsilon^2 & \text{ELECTROMAGNETIC} \\ & \\ \searrow \lambda_x\, W_k\, W_2 & \text{ELECTROKINETIC} \end{array} \tag{60}$$

Lastly, it is apparent that (actual) kinetic energy also has a double reference. For the electron, we may therefore write either a photoinertial or an electrokinetic function with the same exact value:

$$E_k = \int = \begin{array}{ll} \nearrow p_{AV}\, W_{AV} = \lambda_e\, n\, W_{AV}^2 = h\upsilon & \underline{\text{PHOTOINERTIAL}} \\ & \\ \searrow p_e\, W_2 = \lambda_e\, W_k\, W_2 = \lambda_e\, v^2 = p\, v = h\upsilon & \underline{\text{ELECTROKINETIC}} \end{array} \tag{61}$$

with υ being defined electrically and 'quantically' by:

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$$\upsilon = p_e\, W_v/h = W_v/\lambda_x \tag{62}$$

It follows that the electroinertial structure responsible for giving off de Broglie waves - which was shown in equation #48 - can also be paired with the photoinertial function for kinetic energy, since one is the photoinertial description and the other the electroinertial description of the same waves that are experimentally detected:

$$E_k = \int = \begin{cases} p_{AV}\, W_{AV} = \lambda_e\, n\, W_{AV}^2 = h\upsilon & \underline{\text{PHOTOINERTIAL}} \\ (\mathbf{p}_{Tm}\, \mathbf{p}_K)^{0.5}\, W_{AV} = \mathbf{p}_e\ (\mathbf{W}_2\, n/\mathbf{W}_k)^{0.5}\, W_{AV} = h\upsilon & \underline{\text{ELECTROINERTIAL}} \end{cases} \tag{63}$$

These mass-energy and kinetic energy terms and functions are those taken into account in the aetherometric equation #36b given above for the total momentum of the mass-energy of a particle of matter together with its kinetic energy, and for the total energy of such a particle, as given by:

$$E_T = E_{\delta m} + E_k = [(\mathbf{p}_{Am}\, c) + (\mathbf{p}_e\, W_2)] = [(\mathbf{p}_{Am}\, c) + (\mathbf{p}_K\, v)] \tag{64}$$

These functional relations put to rest both **Heisenberg**'s principle of uncertainty and **de Broglie**'s relativistic model of 'matter-waves', thereby making **Bohr**'s complementarity meaningless. It was another algebra that was necessary, not matrix-mechanics. An algebra of energy functions. An algebra that gave us better glasses to see, not one that assured us that we cannot see because things are fuzzy, and there's nothing wrong with our glasses - just with our minds, if we think there should be something wrong with our glasses...

REFERENCES

1. **Hofstadter, D (1981) "Metamagical themes", *Sci Am*, July:18, p. 26.**

2. **Prigogine I & Stenghers I (1984) "Order out of chaos", Bantam Books, NY, NY, p. 223.**

3. **Correa PN & Correa AN (2004) "Nanometric functions of bioenergy", Akronos Publishing, University of Toronto Press, Concord, Canada.**

4. **Correa PN & Correa AN (1999) "The indirect 'ORgone effect' of Tesla radiation: solar spectra for ambipolar Aether and blackbody radiation", Akronos Publishing, Concord, Canada, ABRI monograph AS2-17A.**

 ISSN 1915-8408

5. **Correa PN & Correa AN (2002, 2004, 2006) "The Gravitational Aether, Part II: Gravitational Aetherometry (8), Antigravity Lift and Exotic Flight (III): The Aetherometric Theory of Gravity and the Organized Fear of Knowing", Volume II of the Aetherometric Theory of Synchronicity (AToS), Akronos Publishing, Concord, ON, Canada, ABRI monograph AS3-II.10.**

6. **Correa PN & Correa AN (2004) "A note on the law of electrodynamics",** ***J Aetherom Res*****, 1(4):1-24.**

7. See upcoming publication of **Volume III of "The Aetherometric Theory of Synchronicity (AToS)", Akronos Publishing, Concord, Canada, monograph AS3-III.3.**

8. An example is **Asimov I (1979) "Asimov on physics", Avon Books, NY, NY, pp. 213-215.**

9. **Correa PN & Correa AN (2005) "Photon"**, at:
http://encyclopedianomadica.org/English/photon.php

10. **Correa PN & Correa AN (1999) "The aetherometric approach to the fundamental problem of magnetism", Akronos Publishing, Concord, ON, Canada, ABRI monograph AS2-15.**

11. **Correa PN & Correa AN (1999) "Aetherometric treatment of the energy radiation output by Tesla coils (3): 1° massfree electric-and-magnetic waves, 2° massbound capacito-inductive waves and 3° electromagnetic waves", Akronos Publishing, Concord, Canada, ABRI monograph AS2-16.**

12. **Correa PN & Correa AN (1997) "Non-equivalence between work performed by charge against gravity and the electric energy of the same 'charge gas' ", Akronos Publishing, Concord, ON, Canada, ABRI monograph AS2-01.**

13. **Correa PN & Correa AN (1998) "The volt and the electron-volt: an aetherometric perspective on longitudinal electric waves", Akronos Publishing, Concord, Canada, ABRI monograph AS2-12.**

14. We have shown elsewhere [7] that (p_{Ae}/e) is the actual value of the *normal gyromagnetic ratio* for an electron magnetic moment that is *dia*magnetic (Aetherometry entirely concurs with Aspden's theory on this respect), ie equal to *twice* the Bohr magnetron. In aetherometric theory there are no magnetic monopoles, only electric monopoles (all massbound charges are electric monopoles; all massfree charges are electric ambipoles).

15. See upcoming publication of **Volume III of "The Aetherometric Theory of Synchronicity (AToS)", Akronos Publishing, Concord, Canada, monograph AS3-III.5.**

16. **Correa PN & Correa AN (2000, 2003) "On the wave structure of energy: fundamental differences between de Broglie's theory of matter-waves and the aetherometric theory of wave superimposition", Akronos Publishing, Concord, ON, Canada, ABRI monograph AS2-31.**

17. **Correa, P & Correa, A (1998, 2006, 2008) "The Gravitational Aether, Part II: Gravitational Aetherometry (9) - Quantum & Subquantum Aether (Anti)Gravity: Fine Variation**

 ISSN 1915-8408

and Determinations of G", Volume II of the Aetherometric Theory of Synchronicity (AToS), Akronos Publishing, Concord, ON, Canada, ABRI monograph AS3-II.11.

18. In aetherometric theory, the electrokinetic energy of a particle is a function distinct from the energy of the electric field that accelerates the particle.

19. This follows from:

$$p_T = \{[(E_k/E_{\delta m}) + 1]\ \lambda_m\ (E_{\delta m}+E_k)\}^{0.5} = \{[(E_k+E_{\delta m})/E_{\delta m}]\ \lambda_m\ (E_{\delta m}+E_k)\}^{0.5} =$$
$$= [\lambda_m\ (E_k + E_{\delta m})^2/E_{\delta m}]^{0.5} = [\lambda_m^{0.5}\ (E_k/E_{\delta m}^{0.5})] + (\lambda_m\ E_{\delta m})^{0.5} =$$
$$= [\lambda_m^{0.5}\ (E_k/\ E_{\delta m}^{0.5})] + p_{Am}$$

20. See for example **Feynman, R (1985) "The Strange theory of light and matter", Princeton University Press, NJ, p. 55-56.**

21. A word of caution: in Aetherometry, other than in cosmological processes that give rise to the creation of massbound particles [17], the energy configuration and "fine-structure"of ambipolar massfree charges does *not* obey Planck's constant; but the "field interaction" of massfree charge with massbound charge does.

22. **Deleuze G & Guattari F (1991, 1994) "What is Philosophy", Columbia University Press, NY, p. 129**.

23. **Prigogine & Stenghers (1984), op. cit. pp. 224-225**.

24. **Correa, PN, Correa, AN, Askanas, M, Gryziecki, G, Solá-Soler, J (2008) "A test of Aetherometry vs Relativity, Special and Larmor-Lorentz: the 1938 Ives-Stilwell experiment", Volume I of "The Aetherometric Theory of Synchronicity (AToS)", Akronos Publishing, Concord, Canada, ABRI monograph AS3-I.4. Also in *Aetherom Theor of Synchron*, Vol. I, 4:1**.

25. See **Aspden, H (1969)"Physics without Einstein", Sabberton Publications, Southampton, UK, p. 4**.

26. For example, **Idem, p. 63**. Also, **Aspden, H (2006) "Creation - the physical truth", Sabberton Publications, Southampton, UK, p. 100-101**.

27. **Correa, PN & Correa, AN (2007) "Linear and angular Doppler shifts and the Sagnac experiment: Aetherometry vs Relativity (1)", Volume I of "The Aetherometric Theory of Synchronicity (AToS)", Akronos Publishing, Concord, Canada, ABRI monograph AS3-I.3. Also in *Aetherom Theor of Synchron*, Vol. I, 3:1**.

28. **Correa, PN & Correa, AN (2010) "The Uncertainties of the Uncertainty Principle, Part 1: Improbable Certainty and the Inconsistencies of Quantum Mechanics (a counterpoint to Feynman's Lecture)", *J Aetherom Res*, 7:1**.

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