Einstein right, Heisenberg not quite

By William Gray

Abstract

In 1905 Einstein wrote "We must therefore assume that the kinetic energy of one electron goes into the production of many energy quanta of light"[1] and "If a body emits the energy L in the form of radiation, its mass decreases by L/V^2,"[2] his original $m = E/c^2$ form of $E = mc^2$.

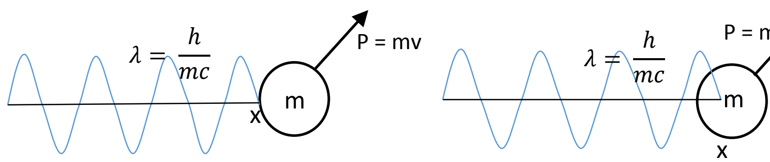
These electron Kinetic Energy "energy quanta of light" and Electromagnetic "radiation carries inertia between emitting and absorbing bodies" perspectives present a Wave-Particle Duality solution in terms of Boltzmann's $P = e^{S/k_B}$ probability principle and Heisenberg's Uncertainty.

Discussion

The basis of Quantum Theory arose from De Broglie's hypothesis that if Electromagnetic waves have momentum then perhaps particles with momentum have a $\lambda = h/p = h/mv$ wave behavior.

Schrödinger realized, if this were true, and Euler's $e^{-ix} = \cos x - i \sin x$ Formula could describe such energy as wave behavior resonating between real and imaginary states, then electron orbital energy states would conform to a Boltzmann $P = e^{S/k_B}$ probability principle distribution, and explain hydrogen's statistical spectra, a particle – EM wave energy transform.

Heisenberg's analysis in turn supported this with his $\Delta x \cdot \Delta p \geq \hbar/2$ Uncertainty principle, that it is not possible to simultaneously know a particle's position and momentum with absolute certainty because if one doesn't know the particle's position, then the point at which the photon interacts with the particle cannot be known with certainty either.



In terms of energy transfer, one cannot know how much light speed energy transfer occurs, since there is no way to know the photon - particle interaction duration; and so there is always a $\Delta E \cdot \Delta t \geq \hbar/2$ half wavelength Uncertainty in any analysis, except for an $\hbar/2$ known energy ½-wave node interaction, in accordance with De Broglie's $E = hf = hc/\lambda \rightarrow \lambda = hc/E = hc/mc^2 = h/mc$ analysis.

Because of this, Heisenberg's $\Delta x \cdot \Delta p \geq \hbar/2$ statistical outcome Uncertainty includes the unique case of $\Delta E \cdot \Delta t = \hbar/2$ wave node interactions, which Hideki Yukawa used in 1935 to predict pions, which means Heisenberg's $\Delta x \cdot \Delta p \geq \hbar/2$ Uncertainty has a non-statistical $\Delta E \cdot \Delta t = \hbar/2$ boundary condition foundation in which ΔE and Δt constitute continuously analytic reciprocal co-variants.

Now Boltzmann's $P = e^{S/k_B}$ principle says probability is a system entropy function. A coin has two sides so each side has a 50% probability, and he derived this in terms of S available system entropies factored by a fundamental k_B normalized energy unit. In gas kinetics, he expressed k_B as $k_B = PV/TN$, system pressure and volume factored by average molecular energy (temperature).

Boltzmann's k_B constant thus expressed the macroscopic system pressure and volume behaviors in terms of each component's average microscopic energy. In the case of coins, k_B represents the average coin energy factored by the S = two possible heads or tails entropic degrees of freedom.

In his analysis, Boltzmann defined each system component as occupying a dx, dy, dz position in a 3-D dV unit volume of space with a corresponding dp_x, dp_y, dp_z momentum. This defines the total system elements as an $N = \iiint f(x,y,z)\, dx, dy, dz \;\iiint f(p_x,p_y,p_z)\, dp_x dp_y dp_z$ integration of all the components' available position and momentum degrees of freedom.

Simplifying this to a single degree of freedom yields Heisenberg's $dx \cdot dp = \hbar/2$ non-statistical E_o ground state behavior boundary, a continuously analytic correlation between normalized $k_B = \hbar/2$ Δx position and Δp momentum energy root covariants. This is Boltzmann's pressure and volume degrees of freedom factored by the average molecular energy quantum. Thus total system energy is $E_{tot} = N(k_B/n^2)$, where N is the number of components, k_B is the ground state, and $1/n^2$ is a $\Delta x \cdot \Delta p$ continuously analytic co-variant product factor of the $\hbar/2$ ½-wave quantum ground state.

When Boltzmann stated his principle he expressed it conversely, as $S = k_B \ln W$ system entropies are a macrostate proportionality function. So if a coin system displays a proportionate heads and tails distribution, then the entropic microstates available for each coin can only be heads or tails.

In terms of the $k_B = PV/TN$ constant, the PV pressure and volume macrostate behaviors thus only exhibit because the component TN energy unit only has pressure and volume entropic degrees of freedom available in which to exhibit. A component may have $\frac{1}{2}mv^2$ KE, but it can only exhibit as a pressure·volume behavior. This expresses as $k_B = S / \ln W$, so the basic quantum energy unit behavior is the system pressure·volume entropies factored by their behavior proportionalities.

In terms of Wave-Particle Duality, particles exhibit proportionate wave and particle behaviors, depending upon the wave or particle entropic observation conditions. Thus, by $k_B = S / \ln W$, the space the fundamental energy unit operates in can only have S = 2 available behavioral entropic degrees of freedom, specifically free space's $\mu_o\varepsilon_o$ permeability-permittivity it operates upon and the 4-D space-time it operates within. If only impedance and space-time entropic conditions are available, the fundamental k_B energy unit can only exhibit as wave and particle behaviors.

Since the energy operates at $c = 1/\sqrt{(\mu_o\varepsilon_o)}$ light speed, it can only resonate between the behavior states at light speed, appear as an $\Delta E \cdot \Delta t \geq \hbar/2$ Uncertainty, and behave as a $k_B = E/m \cdot c^2$ wave field - particle mass duality to observers. If $c^2 = 1/\mu_o\varepsilon_o$, and the energy only operates on space's impedance and 4-D space-time, then it must exhibit $S = k_B = E \cdot \mu_o\varepsilon_o/m$ wave-particle behaviors.

This resolves in terms of Einstein's $ds^2 = g_{ik}dx_i dx_k$ … "Riemann condition,"[3] where "g_{ik} must satisfy certain general covariant equations of condition," "determined by … transformation," over the "11, 12,… up to 44" coordinate indices imposed on a $ds^2 = dx_1^2 + dx_2^2 + dx_3^2 + dx_4^2 = 0$ 4-D "field free" Minkowski space-time metric in terms of (2n + 1) prime number stability states. The Riemann condition represents the general Lorentz transformation effect of energy operating upon a field free metric (mass in the specific case of gravity), right down to the $dx_i dx_k$ covariant energy effect roots of 4-D ds^2 space time. As such, these force, distance, and velocity roots are 1st order $\partial u/\partial x = \partial v/\partial y$ and $\partial u/\partial y = -\partial v/\partial x$ continuously analytical Cauchy-Riemann partials.

This parallels Heisenberg's $dx \cdot dp = \hbar/2$ and $\Delta E \cdot \Delta t = \hbar/2$ non-statistical E_o ground state boundary condition on indeterminable quantum statistical non-nodal photon – particle interactions. In such cases, the covariant $\Delta x \cdot \Delta p$ position and momentum energy roots exceed the $\hbar/2$ ½-wave energy only to the extent that the field energy interaction exceeds the ½-wave node. The "≥" "greater than or equal to" only implies an indeterminable energy transfer, not a non-conservative one.

The point is, both Einstein's Riemann and Heisenberg's non-statistical boundary conditions have continuously analytical covariant energy roots. This is readily seen by interpreting the energy in terms of (2n + 1) prime numbers. "Mathematics, the non-empirical science par excellence … the science of sciences, delivering the key to those laws of nature and the universe … concealed by appearances," (Hannah Arendt) provides us with a logic where we have none.

Prime numbers, factorable only by themselves and one, depict "stability," and are all odd, except for two, which is represented by the 2 in "2n," if "n" constitutes covariant prime number roots. This means all prime numbers are represented by (2n + 1), but (2n + 1) numbers are only prime for specific n covariant root conditions, as determined by Boltzmann's $P = e^{S/k_B}$ principle.

The 2 = (2n + 1) prime number only exists if n = ½, while n ≥ 1 for all other (2n + 1) primes, and an n = ½ denominator condition depicts a logical "two possible state" factoring function, such as "Exclusive Or" heads/tails coin flip entropic degrees of freedom. So, this 2 = (2n + 1) base prime number basis defines the logic function of a normalized energy unit "1" factored by equivalent n = ½ covariant entropies (i.e. the S = 2 represents the available heads or tails entropic outcomes and k_B represents the PE height and KE angular momentum $\Delta x \cdot \Delta p$ position and momentum E_o ground state covariant energy roots of the logic of the $P = e^{S/k_B}$ coin flip function).

This is the most basic quantum state logic of a 2 = (2n + 1) normalized energy unit, like a ground state orbital ½-wave, factored by two equivalent but distinctly different possible states. All other p = (2n + 1) prime numbers however follow an $E_n = E_o/n^2$, for n ≥ 1, $\psi(e^{ix})$ wave function pattern conforming to Boltzmann's $P = e^{S/k_B}$ probability, or $S = k_B \ln W$ proportionality principle.

The $E_o = \Delta x \cdot \Delta p = \hbar/2$ ground state constitutes an $e^{-ix} = \cos x - i \sin x$ "negative energy well," as in hydrogen's $E_o = -13.605698$ eV ground state, where the $\Delta x \cdot \Delta p$ position and momentum roots are covariant denominator entropic degrees of freedom. They are the prime 2 = (2n + 1) quantum function of equivalent but distinctly different covariant energy roots, like the $\mu_o \varepsilon_o$ impedance and $c^2 = 1/\mu_o \varepsilon_o$ construct size energy root forms of Wave-Particle Duality in 4-D space-time.

The $E_n = E_o/n^2$ excited quantum energy states existing within the E_o negative energy well operate upon the E_o condition as excited state $e^{ix} = \cos x + i \sin x$ wave functions. They decay because they are e^{ix} excited states within the e^{-ix} negative energy well. Like a pendulum's motion, they must decay because of the available energy entropic degrees of freedom the E_o condition creates.

The E_o ground state negative energy well logically sets the base $\Delta x \cdot \Delta p$ position and momentum energy root entropic degree of freedom boundary limit, as do Bohr's $F_e = k_e e^2/r^2$ and $F_c = mv^2/r$ electric and centripetal physical forces. It is the basic $P = e^{S/k_B} = e^{-ix/2}$ logic of energy factored into $2 = (2n + 1)$ available entropic degrees of freedom, providing the observed initial $P = 50\%$ probability outcome. S/k_B factors the k_B fundamental normalized energy unit into $S = 2$ degrees of freedom from an entropy logical perspective, while $-ix/2$ does so from an energy perspective. It is only one or the other, depending on when the $\Delta x \cdot \Delta p \geq \hbar/2$ ½-wave uncertainty is observed.

The $E_n = E_o/n^2 = E_o/\Delta x \cdot \Delta p = E_o/\ \hbar/2 = E_o/dx_i dx_k$ excited quantum states exist because all possible $E_n = E_o/n^2$ quantum states sum to E_o, as $E_o = \sum n^2 E_o/n^2 = \sum n^2 E_n$. Together the E_n quantum states constitute a piecewise continuously analytic quantum state summation equal to E_o, whether filled or not. Existence of the entropic degrees of freedom constitute a 0/1 exclusive or logic condition, whether filled or not, because two equivalent entropic degrees of freedom provide the $S = 2$, $P = 50\%$, probability logic. It is continuously analytic whether an excited energy state fills it or not.

Once a quantum state exists, its $\hbar/2$ ½-waves are continuously analyzable as $\Delta x \cdot \Delta p$ position and momentum roots in the "past". When a coin lands it is no longer an unknown. It is continuously analyzable as a 1st order $\partial u/\partial x = \partial v/\partial y$ and $\partial u/\partial y = -\partial v/\partial x$ Cauchy-Riemann function of the past. It is a one-way Einstein time dimension function, like a RSA one-way prime number encryption. If only two prime numbers existed, the encryption and decryption would be equivalent periodic covariant functions, each state defining the other, like a $2 = (2n + 1)$ function for $n = ½$.

If there were only two entropic degrees of freedom, the $\mu_o\varepsilon_o$ impedance and 4-D construct size entropies of the Wave-Particle Duality function, all energy could only be a Wave-Particle state, but this function creates further entropic degrees of freedom by differentiation of the 4-D space-time construct form by the periodicity of $c = 1/\sqrt{(\mu_o\varepsilon_o)}$ in each dimension.

Heisenberg's $\Delta x \cdot \Delta p \geq \hbar/2$ Uncertainty is thus a one-way function. It occurs only by introduction of an undefined ½-wave measurement variable. In physical reality, the quantum states are known $\Delta x \cdot \Delta p \geq \hbar/2 = \hbar/2$ functions. They sum to the $E_o = e^{-ix} = \cos x - i \sin x$ normalized limit of $S = 2$ equivalent energy entropic degrees of freedom, since $E_n = E_o/n^2$ and $E_o = n^2 E_n$. Once a quantum outcome occurs it is a continuously analytic $\Delta x \cdot \Delta p$ position-momentum covariant function, as is the $2 = (2n + 1)$ fundamental prime number $n = ½$ entropic degrees of freedom condition, and $k_B = \hbar/2 = \Delta x \cdot \Delta p = 2(n + 1)$ makes it a $c = 1/\sqrt{(\mu_o\varepsilon_o)}$ light speed Wave-Particle Duality function.

There is something continuously analytic behind all things.

Footnotes:

1) **On a Heuristic Point of View Concerning the Production and Transformation of Light**, p. 196, **Einstein's Miraculous Year**, John Stachel, c. 2005, Princeton University Press.
2) **Does the Inertia of a Body Depend on Its Energy Content**, Id., p. 164.
3) **Relativity, Special and General Theory**, Einstein, Three Rivers Press, c. 1961, p. 175.

Appendix: *A Nuclear-Gravitational Electrodynamic Framework* and *Entropic Calculus*

Particles have five characteristics that interact with or affect their surroundings:
Mass, Charge, Magneton (i.e. a finite magnetic field) , Spin and Density (i.e. size per unit mass)

By Boltzmann's $P = e^{S/kB}$ probability principle, the probability P of something occurring is a function of what it interacts with S (i.e. its circumstances or entropic degrees of freedom) in terms of a common denominator energy unit of measure k_B, like a particle's magneton interacts with external charge and magnetic fields.

The objective was to derive a single mathematical framework that would yield the five particle characteristics and $\int |\psi(x)|^2 dx$ = 100% Schrodinger behavior probability density function as observed (i.e. like coins always having 50/50 heads/tails averages).

All energy behaviors are e^x functions:

- e^x energy transforms, like uranium into plutonium
- e^{ix} energy resonances, like ψ(x) wave functions or a pendulum swinging
- $e^{S/kB}$ statistical energy density distributions, like flipping coins or rolling dice

Each energy domain, nuclear, atomic and gravitational, has a single dominant behavior, particles interacting with each other and very strong nuclear forces, moderate Electromagnetic force atom and molecule interactions, and weak gravitational mass interactions.

Unfortunately no one knew what mass was, why particles behave as waves sometimes and particles at other times, and logical paradoxes like Heisenberg's Uncertainty and Schrodinger's Cat that prevent us from knowing certain things.

Nature doesn't differentiate, it just has energy that behaves in these observed ways and doesn't know what paradoxes are. They are logical obstacles that define the limits of our conventional wisdom, as our wisdom grows they diminish, so we know they converge to solutions. A problem cannot exist without the circumstances which create it, so it must logically interacts with circumstances in some way to create it. A void (chaos) cannot exist within order unless it has an inherent property to differentiate it from the order.

By applying Euler's $e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = \frac{x^0}{0!} + \frac{x^1}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \frac{x^5}{5!} + \frac{x^6}{6!} + \cdots$ Formula we see that, since e^x defines all energy behaviors, including inexplicable ones like $E_n = \frac{E_0}{n^2}$ quantum energy states in a continuously analytical e^x universe, where $E_o = \psi(x)$ and n = integers, we can see that specific differentiated behaviors become apparent when separated or differentiated from the rest of the progression, the remainder or residue. In other words, the first element, a point, can only exist when the rest of the elements are separated from it by circumstances. Since e^x is a progression of calculus integrations, we call this particular type of analysis Entropic Calculus because all the rest of the progression are entropic degrees of freedom (i.e. circumstances).

Notice how each progression element only separate from the next by a one-step addition, like a pyramid only differentiates from a triangle by a unit vertical axis step. But to someone who cannot see this, that single step is an uncertainty. Since Heisenberg's Uncertainty is a logic creation and math is the language of logic, then logic is the venue or schema by which to see or differentiate a solution. Heisenberg defined his uncertainty as $\Delta x \bullet \Delta p \geq \hbar/2$, meaning the Δ particle position measurement error x or its p = mv momentum must always be ≥ greater than or equal to a ħ/2 ½-wavelength of the measuring light photon. The error in this logic is that the Uncertainty is defined in terms of x position and p momentum and has an $E_o = x \bullet p = \hbar/2$ ground state of all the possible $E_n = \frac{E_0}{n^2}$ statistical variations in the $\Delta x \bullet \Delta p > \hbar/2$ ½-wave measurement uncertainties, so they all have a common root solution.

This means the $P = e^{S/kB}$ statistical outcomes that depend on the S circumstances can be defined in terms of the basic $k_B = E_o = x \bullet p = \hbar/2$ fundamental ground state of all the statistical variations. Once this was under stood, resolution of a single framework for the Nuclear-Atomic-Gravitational energy behaviors was in realizing that Electromagnetic (EM) energy was a common denominator to all the domains, they all must have the same α^2 energy density ratios from the E_o ground state to their E_c light speed saturation states, or energy would be flowing back and forth between the energy domains all the time to equalize their relative densities, and then applying this framework to get the equation sets on page 21 of the *Nuclear-Gravitational Electrodynamic Framework* paper.

With this equation sets we now get singularity E_o ground states solutions for everything within the particles (i.e. Higgs boson mass, quarks, gluons and pions) and everything external to them (i,e, atoms, molecules, planets) and come up with ways to control the internal pieces by external circumstances. This means using electric and magnetic fields to synchronize the behaviors of the quarks, etc. to control the frequency and location of the pion generation so we can extract the energy of the nuclear bond they generate with an electron to energize it and obtain electricity directly from particles' nuclear behaviors in a non-statistical synchronized way (i.e. no radiation or radioactive wastes, just conversion of hydrogen mass directly into electrical energy by and $E = mc^2$ transform. Result, very small nuclear fuel cells with very high energy output without radiation.