

Physics by necessity, through exploring the theoretical conceivability which mathematics whittles down to empiricism's provability, has a relatively indiscriminating palate, entertaining temperatures at once positive and negative, light rays which carry no energy individually but sum collectively to significant magnitude (1, p 3) in the spirit of the Dirac delta function of real analysis, Schrodinger's purring dead cats, transport by tunneling of mass-energy across space without passage through that space or even time, and an ever-erupting iconoclastic flow of mind-torquing assaults on macroscopic experience.

Such experimental phenomena evoke the interdimensional contortionist explorations of Victorian England math teacher and political satirist Edwin Abbott (2), presenting a dimensionally hybrid 2d-3d reality in which, like the 3d-4d intersection embraced in both contemporary quantum physics and relativistic gravitation, rational reason meets face-slapping hallucination as objects, like universes, materialize from nothingness.

In the spirit of Abbott's Flatlandish 2d-3d transdimensional outrages at reason, the themes developed below underlie a conjectured topological 4link -- once photons are melted down into their truer nature as waves -- between Riemann and Einstein's supercosmic-scale 4d differential geometry (describing the hyperstructure of the universe) and Castillo (3) and Schrodinger's subatomic-scale wave functions and 4d spherical harmonics (describing the spectrally quantized dynamics of the hydrogen atoms proposed herein to condense from zero-point energy related to that causing the Universe to expand).

The 'Planet of the Apes' cinematic success explores the notion of blending space and time travel into the past by way of the future, while 'Fantastic Voyage' of 1966 explored the limits of dimensional travel as a medical team complete with mobile amphibious lab is injected into the bloodstream of a hospitalized patient to do battle with the properly alarmed immune system. Hybridizing these fictional hyperomps to infinitesimal infinity -- and beyond! -- conjures the "metacosmorphic" notion of linking the infinitely far and large with the infinitely close and small through equating the submicroscopic and supercosmic realms via what can be termed a CMB-quarksoup equivalency of spacetime 4energy sandwiching observable reality between the infinity beyond and the infinitesimal within. Identifying, via spacetime's immanent yet untouchable remoteness, the singularly mass-energy-dense centers of black holes at one extreme of gravity's rainbow with the similarly dense centers of nucleons at the opposite extreme generates a topologically distinct cosmic geometry endowed with a blend of Riemannian and Lobachevskian curvatures that average to Euclidean given appropriately offsetting distributions of divergent (the intergalactic medium between galaxies) and convergent (the perigalactic medium near galaxies) gravitational fields.

Euclid's Fifth thus confronts a hybrid postulate of there existing -- rather than Flatland's single line L both parallel to an arbitrary line and passing through a point not on that line, or Riemann's many such L, or Lobachevski's no such L -- a 4geometrical model of spacetime in which all of these geometries are represented through an edgeless 3space expanding into itself -- bounded topologically above at the black-hole upper limit of observability and below at the nucleon lower limit -- existing as a hypersurface

embedded in 4spacetime's ethereal energy ocean with both substance and boundedness that are (as accepted for that nonexistent space into which the universe is expanding) immeasurable, undefinable and thus not even existentially admissible. As Pauli bitingly observed regarding meaningless questions and unfalsifiable hypotheses, some things are not even wrong.

The gaze of a sufficiently resolving and timeless telescopicist, peering at infinity, would spy reality through a fully-spherical multi-fish-eye compound lens-to-the-n-th degree composed of each of the n nucleons in the universe. A radiation-inert observer -- sufficiently elastic to withstand gravitational compaction -- upon diving into a black hole toward an extremum of gravitational potential would emerge via quantum tunneling onto a geodesic equipotential line between galaxies inside a virtual Hawking-radiation particle spontaneously generated from its energy source of foaming zero-point fluctuations. Just as the event horizons of gravitational collapse split virtual pairs into physical reality defining the standard process by which black holes evaporate, so should gravitational divergence in the intergalactic medium at equipotential points between galaxies split virtual pairs into hydrogen-nucleating particles which would then drain down potential wells and coalesce into stars, supernovae, planets, DNA, essay contests and all that...

The potential of mere mind over matter in motion, as taught and learned in science and math education, empowered Galileo's overthrow of Aristotle's errors on masses in freefall through the staring-off-into-space ease and elegance of the logician's proof by contradiction, requiring no stair-climbing sweat to toss stones through leaning tower windows. The mathematical mind hard at work, reclining on couch behind closed eyes, first assumes correct the assertion that a heavy stone falls more rapidly and hits the ground before a light one. So dropping the two tied together with a short string of negligible mass would therefore slow the heavier and quicken the lighter in order that they land together as tied; but, so tied, they form the equivalent of an even heavier stone. Newton confronts Aristotle with logic's trenchant swagger: "You see how, from your assumption that a heavier body falls more rapidly than a lighter one, I infer that a still heavier body falls more slowly." (4, p 139) Merciless thought-giggles at the thought-experiment gone awry erupt in the respectfully silent audience: escape from absurdity demands rejecting the original assumption, and a centuries-old theory shatters and melts with the fast-fading ballistic glow-burp of Jupiter swallowing comet Shoemaker-Levy in 1994.

The elemental logic of proof by contradiction is as simple, direct and inescapable as a boxer's right hook to the jaw. In the words of G. H. Hardy, "One of a mathematician's finest weapons, it is a far finer gambit than any chess gambit: a chess player may offer the sacrifice of a pawn or even a piece, but a mathematician offers the game" (5, p 94). Identifying a logical absurdity achieves victory: an integer being simultaneously both prime and composite enabled Euclid to prove the infinitude of the primes. What victorious infinitude might wave-particle duality's logical absurdity prove?

Reconsider now -- under the withering and at times foundation-bending Godelian gaze of Hardy's austere and steel-nerved objective logical analysis -- the following assumptions,

some stirring in real-time, briskly simmering debate in the shadowed fringes of contemporary theoretical physics: the necessity of quantum field theory's second quantization, i.e., that of the electromagnetic field in the name of photonic localization, in describing the interactions of light and matter; the interpretation of astronomical redshift (with which is calculated large-scale structure) as due purely to spatial expansion driving galactic recession rather than to a combination of that and the gravitational redshift arising both from improperly theorized distributions and densities of galactic mass-energy and from inconstant gravitational field strength or, equivalently, spatial curvature across the depth of the visible universe; and the lack of significance of radiation density (as referred to immediately above) in the vicinity of galaxies in influencing the shape of rotation curves. Refinements in theory and modeling are proposed in the spirit of cosmology's goals of answering the questions posed by Naselsky et al. in 2006 (6, p 241) regarding statistical features in then-still-fresh WMAP data: "Could they exhibit primordial non-Gaussianity? If yes, then this is of great importance. The physics of their origin would probably be related to the origins of 'dark energy' and 'dark matter'."

Considering the widespread and patiently established familiarity felt in conventional physics for particulate photons, questioning their existence appears as absurd as Hippasus' hypothetical odd number being also even, the Pythagorean absurdity accepted as key to establishing the irrationality of the second root of 2. However, briefly embracing the long-enduring, theoretically justified efforts at refining the notion of light quantization into a more continuous reality will lead toward remarkable observational implications on the interactive relationship between electromagnetism and gravitation, and thus on the interdependencies between primordial quantum fluctuations, the subsequent CMB anisotropies imprinted at reionization, and the current large-scale structure in galactic distribution as heir to CMB treasure of intimations from beyond direct measurability on the cosmos' dynamic history and future.

The cutting of stuff into fundamental nuggets at cuttability's end dates perhaps from prehistory's dawn of self-awareness asking itself "What is it that's in here, and where is here's edge?" Despite lack of self's edge separating within from without, self conjures one to conceive itself and its self-importance, and Newton, taking up the chase of dog spiraling into its own tail, manufactured consent for light corpuscles when waves might have sufficed. As Penrose observes (7, p 17), "...concerning Newton's preference for a corpuscular theory of light to a wave theory, the extent of his insight is most intriguing, and perhaps somewhat debatable. The experimental evidence in Newton's day was inconclusive, yet it would seem that the balance of that evidence should have been in support of a wave theory of light rather than a corpuscular one. Ironically, it was Newton's own discovery and painstaking analysis of an optical interference phenomenon - Newton's rings - which should have provided the strongest evidence in support of the opposing wave theory!... Yet Newton stuck doggedly to a corpuscular view and was led to a picture of light quanta possessing both wave-like and particle-like properties." Debate over the bizarre duality has matured into modern versions entangled in quantum physics.

Toward reaching the widest audience, Feynman's 'QED: the strange theory of light and

matter' (in lower case following book cover's promoting popular accessibility?) focused on barest essentials in presenting the logic behind the photoelectric effect as evidence for light quanta, and therein -- in tandem with intelligence gathered analyzing the original research papers in classes with leading astrophysics researchers and textbook authors -- do underlying assumptions present themselves in starkest relief against data: as light intensity incident on a metallic target falls, the rate of detector clicks signaling ejected electron arrival similarly falls, but not intensity of clicks, i.e., ejected electron energies. Quoting Feynman (8, p 14): "We know that light is made of particles because we can take a very sensitive instrument that makes clicks when light shines on it, and if the light gets dimmer, the clicks remain just as loud -- there are just fewer of them... one instrument is a photomultiplier... when a photon hits a metal plate, it causes an electron to break loose from an atom in the plate."

Clearly inherent in this logic is the a priori assumption that photon-ejected electron energies would have the capacity to fall with falling light intensity were light not quantized, i.e., that detectors would respond smoothly to a possibly continuous, non-particulate spectrum of incident radiation energy. Traditional logic dictates that the lack of energy continuity below the quantum cut-off in the data implies same in the light generating the data. Does the preliminary assumption hold? On the next page, Feynman addresses this question: "You might say that it's just the photomultiplier that detects light as particles, but no, every instrument that has been designed to be sensitive enough to detect weak light has always ended up discovering the same thing: light is made of particles."

The covalently bonded atomic materials and thus unavoidably quantized behavior of "every instrument that has been designed" fails to establish the validity of assuming they would respond continuously to a purely continuous light source, thus permitting the possibility of light's continuity being falsely interpreted as particulate due to the inherently and necessarily quantized instrument behavior. Is the continuous-response assumption even consistent with established theory and experiment? Quantum effects occur throughout any instrument (ionization tubes, photomultipliers, bolometers, charge-coupled devices, etc) composed of covalently bonded atoms conducting discrete electron flow: atomic nuclei oscillate in quantized gamma-scale energy levels (9); elucidation of the Balmer, Paschen and Lyman spectral lines of atomic quantization earned a cascade of Nobels beginning with Bohr; and the covalent bonds of solid state physics vibrate with the units of mechanical energies termed phonons, reminiscently named for the telephone speaker's sound waves propagating through discrete media (9, p 251). Rejecting the traditional assumption admits interpreting the constancy of ejected electron energies as artifact of the quantized nature of both the atoms and their covalent bonding both in the metallic-emitter and the ejected-electron-detector experimental apparatus.

The ensuing analysis unconventionally explores -- in accentuating wave over particle aspects of the classic duality, and in considering the long-demonstrated nonessentiality of QFT's second (i.e. photonic) quantization of the EM field -- the logical consequences of assuming electromagnetism to be entirely a continuous wave phenomenon with quantization effects confined purely to atoms and their bonding into matter-based signal

generation and detection structures (eyes, bolometers, stars, spectrophotometers, etc). In departing moss-covered, ivory-towered tradition for epistemological adventure into treacherous territory uncharted, note that revolutionary ideas almost by definition originate in the shadows of what necessarily appears initially as 'fringe physics' where the debate over the second quantization quietly simmers in corridor and science-news-website-comment-forum conversations stifled from disrupting the decorum of the status quo choreographed in colloquia and conferences.

Repeating a particularly germane exchange with a research cosmologist trained at a prominent New England university in the U.S. (10):

"Esteemed Cosmologist X,

An ever-smoldering debate between myself and a computer scientist colleague on the dual nature of light revolves around the apparent fact that no photon detector can register the arrival of a photon without the intimate involvement of atoms and their quantized nature as functional elements of the detector. How then can any quantized nature of light be separated from that of the atoms in the detector? Quoting Feynman's QED logic (8, p 22): "when experiments were made with very weak light hitting photomultipliers, the wave theory of light collapsed: as the light got dimmer and dimmer, the photomultipliers kept making full-sized clicks - there were just fewer of them. Light behaved as particles." What would prevent non-particulate, continuously waving light from causing the same effect? Why not argue that dimming merely decreases the arrival rate of waves of a constant amplitude-energy, each of them causing a full-size click? Furthermore, couldn't the constancy of click intensity be due not to photon discreteness but to the quantized behavior of detector atoms as the signal indicating the arrival of a light wave is transmitted from the point of absorption, on through the detector mechanism and finally out/up to the indicator light/ bell/ whistle observed by the experimenter?"

"Hi Kevin,

I have always had the same idea, if I understand you correctly. There is 1st quantization (of the atoms) and then there is 2nd quantization ([the photons] of the EM field). I have always suspected that 2nd quantization is not required, or desired, for a proper understanding of the behavior of light and atoms. Physicists have shown that a particulate photon is not required to explain the photoelectric effect.

The belief in 2nd quantization is very strong and I have not bothered to fight a losing battle against it. But I have watched carefully as empirical evidence grew for the view that 1st quantization is all one needs. Whenever I tried to discuss it in discussion groups, I was quickly put down and dismissed."

Photonic reality falls under assault on the Western Front by more prominent authorities at Stanford (11):

"All that is established so far is that certain mathematical quantities in the formalism are

discrete. However, countability is merely one feature of particles and not at all conclusive evidence for a particle interpretation of QFT yet. It is not clear at this stage whether we are in fact dealing with particles or with fundamentally different objects which only have this one feature of discreteness in common with particles."

Pondering the consequences of removing quantization from radiation, and restricting it to atomically confined electronic waves covalently built into matter-based emitters and receivers, leads to the remarkable conclusion that the dark matter needed to explain galactic rotation curves can be interpreted as simple unsensible radiation: if all solid-state materials, biological or mechanical, involved in reflecting, detecting and thereby defining observable reality can process only those frequencies to which atoms and covalent bonds are quantum mechanically tuned, then the door opens to our perception being adrift on an electromagnetic spectral sea of energies only a fraction of which we can detect. Just as the mathematician's quaint set Q of the rational numbers resides comfortably within the innumerably richer set R of the reals, which in turn inhabit the more complex set C of imaginary numbers of even greater depth and structure, so then -- if photonic discreteness is left behind - can observable reality's signals be conceived as a mere spectrally quantized subset embedded in a far more extensive continuity of already well-understood Maxwellian electromagnetism.

Consider the spatial distributions required of and assigned to hypothetical dark matter halos toward resolving anomalous galactic rotation curves, which correspond rather elegantly to observed and well-understood distributions of galactic radiative emissions. Caltech Professor and Einstein collaborator Tolman's relativistic equations -- in Section 114 of his *Relativity, Thermodynamics and Cosmology* (12), entitled 'The gravitational action of a pulse of light' and in a *Physical Review* paper (13) on the gravitational interaction of light rays and particles -- describe the gravitational field strength's dependence on radiation. Explaining measured dependencies -- anomalous in Newtonian calculations -- of stellar orbital velocities on radial distance from galactic centers requires a spherically symmetric distribution of dark matter about the galactic center, coincidentally identical to that of observed electromagnetic energy radiating away with an inverse-square-dependent decline of intensity. With light quanta left behind in the dark -- and replaced with incompletely observable light continuity generating a dark portion of gravity's rainbow not included in conventional computational intragalactic dynamics -- the matter in dark matter can be seen to take on the curious shine of gravitating dark light.

However, like Einstein and all others in pursuit of more complete perceptions of truth, Tolman could be spot-off the mark as shown by his denying gravitational redshift by galactic masses (12, Section 146: Reasons for changing to non-static models): "[Einstein's static model of the universe fails because] it permits no shift in the wavelength of light from the nebulae", disproven by Pound and Rebka (14) and Brault (15) with measurements of gravity shifting radiative frequencies. Regardless, Einstein's cosmic model failed for numerous reasons, but his relativistic gravitation continues to match data in ever finer detail with Gravity Probe B's detection of frame dragging. So let experimenters' data and the equational dynamics of numerical modeling resolve conflicts among theorists safely confined to backs of envelopes.

As modeling of cosmic evolution advances in dynamic realism and computational power, separating foreground noise from the primordial CMB signal depends on properly understanding how galactic light and matter have altered the signal in transit through cosmic time. Whether expressed in degrees or frequencies, foreground noise sources both visible and dark manifest their gravitational influence identically as Wheeler et al. derive (16, p 588): temperature is redshifted by precisely the same factor that the frequency of any light wave is redshifted, whether the cause is Doppler, gravitational or cosmological in origin. Pound, Rebka and Brault reported frequency effects, but the Sunyaev-Zeldovich and related cooling effects noted below reflect identical physics, so are also dependent on fully appreciating the role of radiant energy in affecting redshift.

In presenting galactic dynamics, Binney and Tremaine (17, p 32) note "the mass distribution [including dark matter] in clusters of galaxies can be measured by... the Sunyaev-Zeldovich effect, which is a slight depression in the measured temperature of the CMB at the locations of clusters..." By Tolman's demonstrating the similar impacts of mass and radiant energy on the intensification of gravitational potentials (12, Section 112 'The Gravitational Field Corresponding To A Directed Flow of Radiation), underestimating radiant energy would likewise underestimate gravitational potential. Thus, identifying dark matter's influence on the CMB foreground noise component with proposed 'dark' radiation's strengthening of gravitational potentials relative to current theory -- and with the potentials' consequent cooling of microwave temperature measurements due to (greater-than-appreciated) gravitational redshifting -- potentially impacts present limits of analytical precision in separating microwave foreground noise (18) from the primordial CMB signal.

Krolik (19, p 529) presents gaps in the understanding of processes that concentrate matter to form active galactic nuclei: "A major uncertainty... is whether mechanisms that push matter from, say, a few kpc, to within a few hundreds of pc, are able to hand-off to new mechanisms that carry the matter to a few tens of pc or closer." Unrecognized gravitating radiant energy would provide such a push by pulling from within, and with an inverse-square increase in attractive potential, would need no hand-off to other mechanisms.

Ignoring theory, a direct data-based approach to quantifying dark radiation presents itself via assigning to unobservable 'dark light' just that mass-energy's gravity needed to explain observed rotation curves. Would this quantity match what a similar procedure yields applied on the larger scale of galactic clusters? What might then be the effects at still larger circum-celestial-sphere background scales?

Experimentally, the differences theorized herein in sensitivity to radiant energy between standard, inherently quantized devices and a purely continuous-response sensor -- based on confining a gas in a suitable field through which incident radiant energy passes for laser sensing of gas temperature -- should be technologically feasible both in ground- and space-based settings, and may push into new territory the proverbial envelope of ancient microwave-signal data measurement and foreground noise filtering.

The perhaps more physically realistic modeling so enabled will yield gaussianity predictions falsifiable via increasingly sensitive measurement, toward resolving mysteries as that posed by Rees (20, p 495): “Are there any galactic-mass dark halos with no galaxy visible within them? Such objects might... if their core radius were small enough, account for gravitational lensing of quasars even when no lens is visible.” Such intractable ghosts will reveal themselves as separation of signal from noise progresses.

Adjusting scale, Landau and Lifschitz (21, Section 37 Electrostatic Energy of Charges) observe: “Since the occurrence of the physically meaningless infinite self-energy of the elementary particle is related to the fact that such a particle must be considered as point-like, we can conclude that electrodynamics as a logically closed physical theory presents internal contradictions when we go to sufficiently small distances.” Following derivation of a classically reasonable electron radius, “This dimension determines the limit of applicability of electrodynamics to the electron, and follows already from its fundamental principles. We must, however, keep in mind that actually the limits of applicability of classical electrodynamics which is presented here must lie higher, because of the occurrence of quantum phenomena.”

Addressing the wave problems seen from the particle viewpoint, Shu (22, p 118) offers “This surprising prediction of Maxwell’s equation -- the propagation of light through a vacuum -- proved hard for physicists to accept at the end of the 19th century, so they reinvented Aristotle’s concept of the ether... to give a material medium for supporting the oscillations of light when it travels from the distant stars to us. Notice that no such difficulty exists if we accept Newton’s viewpoint that light consists of corpuscles. Today, we have become familiar with the concept of light as photons; so we have lost the classical sense of surprise that light can propagate in a vacuum. In any case, Michaelson and Morley’s empirical disproof of an all-pervasive ether that provided a substrate for the undulations of light facilitated the eventual acceptance of the special theory of relativity. Particle physics has given rise to the concept of a quantum vacuum seething with virtual particles and even of false vacuums that can generate the real particles of the entire universe; so perhaps an ether in sophisticated guise still resides in humanity’s deepest thoughts about the subject.”

Placing photons in an equally sophisticated, ethereally gravitating guise would impact many open questions, and move closer to realizing Schrodinger’s ruminating (23, p 115-6) “One must, I believe, even be prepared to find that in general no quite clear-cut separation of the various fields exists; that they partly merge into one another in some manner that is difficult to foresee... Insofar as any progress in the more complex features of the electromagnetic interaction with the ultimate constituents of matter (emission and absorption, particle creation and annihilation) has been made at all, it rests not on very complex classical solutions but on much simpler ones, to wit plane sinusoidal waves which are just simple enough to be subjected to certain quantum mechanical considerations.”

Restricting observable reality and all its structured processes to above some close infinitesimal limit and below another distant infinite one, within and beyond which exists

Minkowski's ethereal fluid spacetime energy able to form bubbles -- where both 4-fluid and 4-bubble vibrate in empirically inaccessible dynamics describable via the 4d-mathematically intersecting sets of 1. gravitation's and electrodynamics' field equations and 2. quantum mechanics' spherical harmonics -- may deliver long-sought consistency and falsifiability blending into as accurate an elixir of physical eternity as can be distilled by mere mortals' math.

CODA

"The evolution of the universe can be compared to a display of fireworks that has just ended: some few wisps, ashes and smoke. Standing on a well-chilled cinder, we see the slow fading of the suns, and try to recall the vanished brilliance of the origin of the worlds."

- Abbot Georges-Henri Lemaitre, ca. 1928 as quoted in (6)

Resolving with mathematical truth sweetened with treats of empirical confirmation the yet open question of whether Lemaitre's fireworks display was unique or is destined to be and thus has been continually repeated (or perhaps, with unbridled abandon reminiscent of Bruno and Hoyle, even continuously sustained?) remains among science's most daunting and destiny-defining challenges, the answer to which will prove unprecedentedly revolutionary to all those thorniest of themes cosmological, philosophical, and spiritual along our troubled species' neopolitically stumbling evolutionary path into the history of eternity whose limits and -- in the fructivorous spirit of Ms. Pacman's screen-bending toroidal geometry -- topological self-connections await definition.

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