

# Quantum Nonlocality and Buddhist Emptiness: Toward a Foundational Middle Way Quantum Ontology

## **Choosing Reality: Ontological Extremism, a Middle Way, and the Light of the Mind**

In Buddhism the *Abhidharma* of the *Sarvastivada* and *Vaibhashika* Schools, the Greek Democritus and his master Leucippus, along with Western functionalist Material Local Realism (Metaphysical Scientific Local Realism/Scientific Materialism/Physicalism), all hold the realist atomist position wherein reality consists of indivisible, physical/material atomic baryonic matter particles (atomism) that have an ultimately physical, objectively real, permanent, even absolute and eternal existence. This is the ontological legacy of Greek Materialism/Physicalism that has almost entirely colonized the Western mind. Here, appearing reality is ultimately real and purely physical, or reducible to purely physical electrochemical brain structure and function. Dismal metaphysics indeed.

We shall see that this Modernist European Enlightenment paradigm known to the philosophy trade as Scientific Local Realism, and Scientific Materialism, is a failed paradigm that not even post-Standard Model quantum physicists and cosmologists take seriously, at least theoretically; although most are still ideologically committed. Scientific and sociocultural 'paradigm shifts' require a couple of generations to fully establish themselves in the 'global web of belief' of a culture. (Thomas Kuhn 1962)

So some Buddhist schools believe that atoms are eternal; and some particle physicists believe that electrons and protons within these atoms are eternal, that they do not decay. In the case of recent quantum physics, the existence of ordinary atomic baryonic matter—our beloved protons and neutrons—is believed to be *observer-independently* real as it emerges from the 'nearly empty space' of the quantum vacuum potential, the zero point energy field (ZPE), apart from any perceiving, experiencing, experimenting consciousness, or mind. Such realists, whether Theravada Buddhists, Hindus, or physicists, are *essentialists*, believing that reality exists essentially and independently of an observer-experiencer—just as it appears from its own side, of its own power, independent of any observer consciousness. A tree in the forest really exists when there is no one about to observe it. This view is known as 'common sense realism'—Bertrand Russell's "Metaphysics of the Stone Age".

On the other hand, Mahayana *Prasangika* Middle Way Buddhists argue that physical and mental reality arises *observer-dependently* as a result of an infinite sequence of interdependent prior causes and conditions arising within a vast interconnected physical and mental causal matrix.

In other words, the realist, materialist, essentialist view is *observer-independent*. This world of spacetime stuff is a separate 'real world out there' (RWOT), whether or not it's observed by a sentient consciousness, while the Middle Way *Prasangika Madhyamaka* view, and the quantum view (the wave function  $\Psi$ ) is *observer-dependent* or 'ontologically relative'—relative to observation/measurement. For this view, stuff exists not independently, but relative to the consciousness of an observer/perceiver/experimenter.

Spooky post-empirical 'consciousness' is thereby introduced, by both Buddhist and quantum philosophy, into four centuries of settled 'classical' European Enlightenment 'scientific' realist/materialist observer-independent dogma. Local realist-essentialist Einstein hated it. Antirealist non-essentialist Bohr loved it. They debated the correct ontology for the emergence of spacetime for decades in the legendary Einstein-Bohr debates. The debate continues today.

On the essentialist, usually realist and materialist/physicalist view, reality as it appears to our senses is a perfect 'mirror of nature' (Rorty), a kind of 'immaculate perception' that represents an eternal barrier between inherently unitary human consciousness and an essentially separate Platonic RWOT. This observer-independent, theory-independent, realist/materialist view is opposed by the ontological Idealism of the Hindu *Sanatanadharma*—the hoary Vedas, the Upanishads, and the dualistic Vedanta of Madhva's *Dvaita Vedanta*, but not Shankara's nondual *Advaita Vedanta*.

This essentialist realist/materialist view is also opposed by Buddhist Idealism, the *Yogachara/Chittamatra* or 'Mind Only' school of Asanga and Vasubandhu. (Boaz 2020, Ch. V) It is as well opposed by Western Objective Idealists—Bradley, Royce, McTaggart—who also construe arising material objective reality as unreal, a subjective apparition or illusion of a sober, sentient perceiving consciousness.

For Buddhist *Chittamatra* Idealism, appearing relative-conventional physical spacetime reality is relative and illusory (*avidya maya*) as it arises from our *concept* of its basal nondual ultimate 'groundless ground' (*vidya maya*), which is also illusory.

Ironically, for Middle Way *Prasangika Madhyamaka* both emptiness and its arising form are established by conceptual imputation. Neither of these Buddhist Two Truth reality dimensions—Ultimate Truth formless emptiness, and Relative Truth spacetime form—is *ultimately* real, although relative spacetime stuff is *relatively* real. As The Buddha famously told in his nondual *Prajnaparamita Heart of Wisdom Sutra*:

Form is empty (*stong pa, shunya*) ; emptiness  
(*stong pa nyi, shunyata*) is form...all dharmas  
are emptiness; there are no characteristics.  
There is no birth and no cessation...  
In emptiness there is no form...no ignorance,

no end of ignorance...no path, no wisdom, no enlightenment, and no non-enlightenment...

Well, ontologically speaking, if "Form is emptiness", what *is* real? What indeed. As such a non-essentialist view is clearly utterly 'beyond belief', Buddha asks us to 'abide by means of *Prajnaparamita*', numinous indwelling clear light wisdom Presence of the basal primordial awareness-consciousness ground, always already present in the mindstream of the human being. It is through practice of the Buddha's love-wisdom Path that we "Fully awaken to unsurpassed, true, complete enlightenment."

And yes, it takes a bit of trans-conceptual practice to directly experience (*yogi pratyaksa*) the depth of this prior and present ontic unity of the Buddha's Two Truths—relative form and its ultimate emptiness ground—as utterly empty of essence; or as Nagarjuna told, without 'a shred of inherent existence'. Spacetime form is *relatively* really real. We exist. But form is *ultimately* absent and empty of 'any shred' of intrinsic existence. An ontic Middle Way. This then is the essence of the non-essentialist Buddhist view.

And that's the good news. While form is *ultimately* empty and absent of intrinsic existence, it is, fortunately for all of us, *relatively*, conventionally really real. Spacetime stuff is not just an illusion. So we have a *qbit* of relative time in which to wake up.

We've seen that for non-essentialist, antirealist Buddhist *Chittamatra*, all this appearing phenomenal reality is 'Mind Only'. There can be no objectively knowable real things in themselves. Only appearances to mind. And for Buddhist realistic centrist Middle Way *Prasangika*, spacetime phenomena do indeed exist *relatively*, conventionally, just not absolutely or ultimately. This then is the great *Prasangika Madhyamaka* Middle Way, a fine centrist balance between the nihilistic non-existence of Indian Idealism, and of substantialist eternalist permanence of the existing stuff of Scientific Local Realism, and of Scientific Materialism. (Boaz 2020 Ch. V) We shall soon see that *Prasangika* is the very foundation of nondual Buddhist *Dzogchen*.

Immanuel Kant's Transcendental Subjective Idealism—a duality of realist, material objective *phenomena*, and the perfectly subjective and unknowable, utterly transcendent *noumena*, 'the thing in itself'—is a Western (Platonist) version of our Primordial Wisdom Tradition's 'Two Truths' duality—objective relative and subjective ultimate. Kant's ontology parallels the 'Neutral Monism' of William James.

Kant's incipient middle way 'Subjective Idealism' also parallels the non-essentialist, yet pragmatically realist centrist Buddhist Middle Way *Prasangika Madhyamaka* view of Nagarjuna and Chandrakirti. As we have seen, here reality arises and appears interdependently—Buddha's 'Dependent Arising' (*pratitya samutpada*). It is ontologically relative and observer-dependent, that is to say, our realities are dependent

upon the linguistic semiotic 'global web of belief' (Quine 1969) of the consciousness of a reflexively self-conscious observer—whether Buddhist, or quantum.

Is such a 'middle path' between these perennial Two Truths of relative form and formless ultimate emptiness/boundlessness cognitively realizable? Is there a centrist 'middle way' between our seemingly competing paradigms, the metaphysical extremes of the descending, substantialist, objective Metaphysical Materialism of Science (form), and the ascending Metaphysical Idealism of subjective Spirituality (emptiness)?

Yes. Between these two philosophical extremes—the realist/materialist reification of a permanent, absolute, substantial, eternal and independently existing physical and mental phenomenal reality 'out there', and the idealist nihilistic negation of it—abides the mean that is *Prasangika* Madhyamaka, the centrist Nalanda Buddhist Middle Way Consequence School. (H.H. Dalai Lama 2009)

*Prasangika* is the foundation, according to Longchen Rabjam (2007), and His Holiness Dalai Lama (2009) of the utterly nondual view and praxis of Buddhist *Nyingma* School's *Dzogchen*, the Great Perfection, or Great Completion, often seen as the pinnacle of the Buddhist view. *Dzogchen Ati Yoga* is often viewed as the acausal, trans-conceptual, nondual 'correction' or completion of the inherent duality of the Two Truths trope that is Middle Way *Prasangika*, and indeed of the entire great Buddhist Causal Vehicle. (Boaz 2020 Ch. V)

Thus, in Buddhist *Dzogchen* we have not only a centrist *Prasangika* synthesis of the Two Truths—Relative and Ultimate—that constitute exoteric Realism/Materialism (matter), and esoteric Idealism (mind/spirit); but an optimistic and freeing soteriology—an 'innermost secret' or greater esoteric 'fruitional' (the happiness we seek is already present) view and praxis for an expedited human liberation/enlightenment, selfless ultimate Happiness Itself—the karma free harmless happiness that cannot be lost.

Human Happiness Secret: our happiness is present only here and now. The past is gone beyond, but a present memory. The future is but a present anticipation of that which has not yet arisen. The future never shows up! It's always becoming the present, and then almost immediately it is past. Therefore, we cannot *become* happy and enlightened in the future; we can only *be* happy and enlightened now. Human happiness, along with everything else, happens only here and now. Nothing happens in the future.

Yes, wonder of wonders, as 1st century *Dzogchen* founder Garab Dorje told, "It is already accomplished from the very beginning. To rest here without seeking more is the Meditation". Happiness is deep within us, here and now. Our inherent happiness abides now as this indwelling love-wisdom mind/Buddha mind (*samatajnana*) Presence (*vidya, rigpa*) of the primordial awareness ground, nondual whole itself, by whatever name or concept. That is the *Dzogchen* fruitional view. (Ch. 3) The fruition or result of

our seeking strategies is present here and now! The dualistic 'spiritual' practice of the Path is our trans-conceptual nondual awakening to That! And 500 years before, Shakyamuni Buddha told: "Let it be as it is and rest your weary mind, all things are perfect exactly as they are."

As things are far from perfect in the spacetime dimension of Relative Truth, Buddha was here describing the realm of Ultimate Truth which embraces and pervades it. And these are always already an ontic prior, and epistemic and phenomenally present unity. As Nagarjuna told, "There is absolutely no difference between (relative) samsara and (ultimate) nirvana."

Leibnitz' view of such a perfect 'best of all possible worlds', and recent cosmology's tautological but non-trivial Anthropic Principle (both weak and strong versions), point out that our unlikely universe with its highly improbable 'super-fine-tuned' physical constants that favor life forms must perforce exist in order that human consciousness arise to reflexively ask such impudent questions. Both Leibnitz and the Anthropic Principle suggest that a nondual noetic (no *essential* subject-object separation), non-essentialist view of this ineffable perfect subjectivity is a good bet.

On the accord of Tibetan Buddhist Vajrayana epistemology, this perfect understanding is Buddha mind (*buddhajnana*), the Great Perfection of the *Perfect Sphere of Dzogchen*, nondual awareness dimension of Ultimate Truth (*paramartha satya*). Indeed, this may be seen as the very Nature of Mind (*cittata, sem nyid, sugatagarbha*) in whom this all arises. And That is who we actually are—our 'supreme identity' of that all-pervasive 'supreme source' (*kunjed gyalpo*). Bright indwelling Presence of That (*tathata*).

Heady wine indeed to dualistic concept mind ensnared as it is in the prodigious quest for absolute objective certainty within this dimension of merely realist/materialist 'concealer' Relative Truth (*samvriti satya*).

It is perhaps a bit sobering to remember that all of this heady conjecture is mostly just self-stimulating concepts prior to contemplative direct experience (*yogi pratyaksa*) of the primordial ground. Still, there is this unreasonable cognizance or brightness of the Nature of Mind that is always present to our obsessively thinking mind. It is a contemplative meditative 'felt sense', (*samadhi, satori, dhyana*) beyond our concepts and beliefs about it.

Indeed, this nonlocal, nondual awareness Presence penetrates and embraces all four mind states and life stages of our entire human cognitive consciousness processional: 1) pre-conceptual ordinary direct attention/perception, prior to naming; 2) exoteric, objective conceptual cognition; 3) esoteric emotive, intuitive, and contemplative cognition; and 4) innermost esoteric, perfectly subjective direct nondual cognition (*yogi pratyaksa*). These four states/stages embody the lustrous display of the light of the mind that illumines human cognitive life.

“Everything that exists lacks an intrinsic nature or identity” asserts Alan Wallace (2003) explicating Nagarjuna’s Buddhist selfless (*anatman*) centrist Mahayana *Madhyamaka* Middle Way ontology. The appearance of objects arising from the basal primordial awareness ground (boundless whole, *dharmadhatu*, *dharmakaya*, *chittadhatu*) abide in a relation of interconnected interdependence (*pratitya samutpada*). Their reality is 'ontologically relative' (established by conventional conceptual minds), and thus observer-dependent upon our relative concepts and beliefs, and other related events and processes in a vast *kosmic* matrix of 'prior causes and conditions'. The 'universal quantum wave function' of Quantum Field Theory demonstrates an objective mathematical understanding of this great process, as we shall soon see.

In short, human discursive mind conceptually imputes, designates, then reifies these appearances into observer-independent, objectively 'real' physical/mental/emotional spacetime existent realities in accordance with our atavistic, deep background (pre-conscious) cultural assumptions. Thus arises what W.V.O. Quine (1969) terms our semiotic (logical *syntax* of language; *semantics*/meaning; *pragmatics*/usage) 'global web of belief', which dictates our Western Realist/Materialist worldview with its pursuant predictable beliefs and anti-metaphysical, anti-mystical cognitive biases. Ontological relativity indeed.

Just so, we habitually reduce and reify our bright subjectively real original noetic direct experience to objectified discursive semiotic/linguistic cognitive entities abiding in an emblematic, seemingly separate 'real world out there'. With a bit of mindfulness meditation practice we may learn to *choose our reality*; that is, we learn to maintain the initial nondual noetic purity, poetry, and peace of our basal primordial wisdom ground as it arises spontaneously through ordinary direct perception, prior to conceptual intervention and judgment. With a bit more practice we can do this simultaneously with all the distractions of our parallel conceptual dualistic relative-conventional dimension of a RWOT—our beautiful lives as special guests of the phenomenal world.

*Our Noetic Imperative.* We live in two worlds—self, objective conceptual, real/material; and no-self, subjective mental/spiritual—at once; whether we are presently cognizant of the prior and present unity of these two dimensions, or not. The dualistic objective local world of self-ego-I in time is always already embraced in the nonlocal nondual timeless no-self world, bright always present Presence of That. That is our 'human condition'. Great joy! And yes, it's a real balancing act.

Is not our noetic (body, mind, spirit unity) imperative the recognition, realization and compassionate expression of the primordial unity of these two reality dimensions? To divide or not to divide, that is the noetic question of nondual primordial wisdom (gnosis, *jnana*, *yeshe*)—this very light of the mind. As we learn the 'placement of attention/awareness'—through 'mindfulness of breathing'—upon our nondual love-

wisdom mind Presence, recognition and compassionate expression naturally and spontaneously arise. And that is harmless, karma free Happiness Itself.

Thus do we choose a centrist 'middle path' that avoids the ontic extremes of Absolute Local Realism, and the nihilism of Antirealism and Absolute Idealism. We practice skillful, compassionate expression of the prior unity of our always present *noetic cognitive doublet*—relative, objective conceptual, and subjective ultimate contemplative. Thus do we choose our realities.

Hence, from the metaphysical ontology you choose, arises the phenomenal world you deserve. Karma/action is a human happiness choice.

### The Two Truths and Dōgen's Being-Time

Dōgen Zenji, perhaps Japan's greatest Zen master, spoke of this arising, descending dimension of relative time and its phenomenal contents—the spacetime dimension of Relative Truth (*samvriti satya*)—as “a being-time moment flashing into existence” from the vast spacious expanse of the basal, non-logocentric, nonlocal primordial emptiness (*shunyata*) base or ground, boundless awareness whole—nondual reality being itself—the all-embracing dimension of Ultimate Truth (*paramartha satya*).

This Ultimate Truth is nothing less than Dōgen's *Ugi*, or 'Being-Time'. Dōgen's *Ugi* is the here now, always already present prior and present unity of the Buddhist Mahayana 'three times'—past, present, and future. So there is no beginning, and no end to this interdependent vast expanse of reality itself. The dimension of spacetime Relative Truth, including all of us, instantiate this primordial awareness emptiness 'groundless ground' of everything that arises and appears to a sentient participating consciousness. Yes, we are luminous primordial awareness embodied manifestations of that whole *kosmic* process. Human body-mind consciousness embodies That (*tathata*).

For Dōgen Zenji (and for Tibetan master Padmasambhava), the eternal present moment exists for us only relative to a past and a future. Being-Time/*Ugi* is a simultaneous array of all three. Thus we live in a single vanishing instant now. Yet, this precious moment now derives its meaning from the inter-subjective context of a personal and collective past, and of a possible future. This momentous present moment is so significant because all of our past and future are interdependently, causally enfolded within it, while always unfolding in the timeless continuum of this same moment. Yes, we live in the moment, but not only in the moment. To live only in the moment, without awareness of our past and future is to 'make our life meaningless.' Not to live in the moment now, is 'to lose reality itself'. We must learn from our personal and collective past; and we must learn not to fear the future. (Dōgen 1986)

Philosophers of physics and cosmology, if not always physicists and cosmologists, are now discovering a post-empirical *kosmic* 'presentism'—reality is only now—in Dōgen Zenji's syncretic Being Time/*Ugi*. Such a view unifies the timeless Three Times, past, present, future; and bespeaks the prior unity of our two cognitive voices—objective and subjective—of this inherently reflexive, all-embracing spacious consciousness whole (basic space of *dharmadhatu*) of reality being itself, the very Nature of Mind and all that arises within it. That is after all who we are, our 'supreme identity'.

Dōgen's great insight is this: prior to the superimposition (*vikshepa*, *distraction*) and intervention of concept-belief cognition, ordinary direct perception bestows the inherent (*sahaja*), immediate, luminous, 'primordially pure' noetic emptiness/*shunyata* Nature of Mind, vast ultimate awareness ground of relative mind and all its relative conventional experience.

*Dzogchen* masters agree. Here, in the 'bare attention' of basal 'naked awareness'—ontologically prior to subject/object separation and habitual conceptual imputation and reification—abides trans-rational nondual noetic reality itself! This pristine awareness is the very aperture into our primordial awareness wisdom ground (*jnana*, *yeshe*, gnosis). This vast *dharmakaya* whole manifests as our nondual intrinsic awareness love-wisdom mind, 'Big Mind', Buddha mind that knows this great truth. We awaken to That, breath by mindful breath, through the practice of the Path.

Such immediate perception, an instant prior to conception and naming, is pure perception. And we all do this, all the time, with every perception! Wonder of wonders, we are all 'primordially awakened' (*bodhi*, *vidya*) to this always 'already accomplished' innate and perfect clear light mind! That is our actual 'supreme identity'. The rub? We must recognize, realize and compassionately express this perfectly subjective truth.

How shall we accomplish this? We consult the experts and follow their injunctions, of course. In short we establish an effective meditation practice, and assiduously practice it. As H.H. Dalai Lama (2009) told, "The clear light mind which lies dormant in human beings is the great hope of humankind." Lord Buddha, Dōgen Zenji, Guru Padmasambhava, Jesus the Christ, and indeed all the sages and saints of our great Primordial Wisdom Tradition have taught this great nondual truth.

Hence, there is always, through all of our cognitive mind states and life stages—perceptual, conceptual, emotional, and transpersonal trans-conceptual contemplative—an ontic prior unity of past, present, future, always being here now. We learn to be present to the nondual noetic Presence of That. And yes it requires a little selfless mindfulness (*shamatha/vipashyana*) contemplative practice. Who am I? That I Am. But don't *believe* it. Buddha told, "Don't believe what I teach...come and see (*ehi passika*)."

## **Toward an Integral Noetic Science of Matter, Mind, and Spirit**



Physics and cosmology are quantitative. 'The qualitative' (value, volition) is active yet largely suppressed and denied in the common orthodoxy of the physical sciences. At long last, physics is now beginning to recognize and strategically develop the inherent qualitative dimension in science.

*Real Clear Ontology.* What is now urgently required for recognition of the prior and present interdependent unity of Science and Spirit/spirituality is a settled integral noetic (matter/mind/spirit unity) quantum ontology with a centrist epistemology and methodology that accounts for both faces of our human experience—objective conceptual, and subjective contemplative/spiritual. We require an ontology that includes both objective mathematical description of phenomena, and subjective trans-rational, trans-conceptual yet contemplatively knowable phenomena.

In other words, we must utilize the methods and noetic technologies of contemplative science to engage and explore subtle subjective phenomena that are inherently 'hidden' from, and beyond the reach of our objective conceptual cognition. Such contemplative praxis gradually reveals the perfectly subjective, formless, selfless ultimate reality matrix emptiness base or ground of all arising, evolving spacetime form. In due course this emerging spacetime matter/energy form ( $E = mc^2$ ) evolves self-conscious human beings who desire to know and realize their relationship with the ultimate primordial awareness ground or 'supreme source' in whom their relative spacetime being arises. Human beings have evolved a cognitive life that bestows both objective conceptual, and subjective contemplative modes of understanding their experience of this ground.

In the West it is the 'scientific' objective conceptual 'global web of belief' that has almost entirely colonized the Western heart and mind. The mostly missing subjective contemplative technology and practice restores a balance. Without such a balance inherently subjective ontology—the pursuit of untrammelled recognition then realization of the ultimate ground of being—remains encaged in mere concepts and beliefs *about* it; if it is considered at all. Sadly, that is the present state/stage of our collective human cognitive evolution.

As to the four state/stages of our human cognitive life—direct attention-perception; objective conceptual, quantitative; subjective contemplative, qualitative; and perfectly subjective nondual unity—we remain substantially fixed in the first two. Entering in state/stage three marks the beginning of a our grail quest for a real, clear, complete personal and collective ontological understanding of the whole *process*.

Be that as it may, the ontic 'groundless ground' of everything—the implicate, enfolded, ultimate boundless awareness-consciousness whole and 'supreme source' of our wisdom traditions—may be seen as that 'basic space' of *dharmadhatu*. Herein arises all unfolding objective physical relative spacetime particulars—energy, mass, force,

charge, particle-waves, the universal quantum wave function, and the experience of embodied beings. Herein all of this arising stuff of being participates, and interacts.

Our ordinary human cognizance is not other than that basal primordial ground. Embodied mind arises unbidden and continuously from that vast 'supreme source'. Let us recognize, then realize the interconnected unity of this intrinsic ontic relationship. "No small matter is at stake here. The question (of ontology) concerns the very way that human life is to be lived." (Plato, *The Republic Book I*)

Viewed mereologically (part-whole relations), the panpsychic prior ontic unity that is this great awareness whole subsumes and embraces its *relative* parts, while the parts perforce participate in and instantiate the *ultimate* vast nondual primordial whole itself. The prior and present unity of the Buddhist Two Truths.

The prodigious quantum wave function  $\Psi$  may be seen as the objective, mathematical conceptual voice of the trans-conceptual, trans-empirical perfectly subjective nondual whole, primordial awareness-consciousness ground of being itself.

Recall, our noetic cognitive doublet—dualistic, quantitative, objective, conceptual; and qualitative, subjective, contemplative, and nondual. Yes. Know and experience this doublet as always an ontologically prior and phenomenologically present complementary interdependent reality unity.

Clearly, such a Noetic Science of Matter, Mind and Spirit requires a methodological, 'post-empirical' relaxing of the adventitious limits of obsessively objective positivist 'scientific' view and praxis with its prosaic 'taboo of subjectivity' regarding *a priori* contemplative knowledge. This waning 'old paradigm' Scientific Local Realism and Scientific Materialism/Physicalism dogma still obstructs our emerging inchoate 21st century Noetic Revolution that now arises phoenix-like from the ashes of Greek ontic Materialism. New Paradigm indeed. Such a Kuhnian 'scientific revolution', is part of the Noetic Revolution that is now upon us. (Boaz, *The Noetic Revolution* 2021b)

The basal quantum emptiness of the 'zero point vacuum energy field' (ZPE)—constant density dark energy, Einstein's cosmological constant  $\Lambda$  of Quantum Cosmology's lambda  $\Lambda$ -CDM Standard Model—along with the parallel pre-modern wisdom of Buddhist boundless emptiness (*shunyata/dharmakaya/kadag*) is a good beginning for a unified objective/subjective quantum ontology understanding of that diaphanous primordial ground of physical, mental, spiritual *cosmic* reality that is the unity of the whole. The quantum quantitative dimension is embraced and subsumed within the qualitative dimension of the nonlocal, nondual "implicate order of the unbounded whole", as David Bohm told it.

*Toward a Foundational Quantum Ontology.* The physical quantitative cosmic spacetime ground that is the universal quantum wave function  $\Psi$  arising from nearly empty ZPE vacuum field are thereby grounded in a subtler, all subsuming trans-

quantitative, trans-rational, post-empirical, formless primordial awareness emptiness *kosmic* 'groundless ground' in which, or in whom it arises and participates. Recognizing then realizing this great truth requires noetic contemplative technologies and research methodologies that utilize both quantitative objective third person data sets, and the qualitative, though still objective data sets of personal, subjective, introspective, even contemplative first person reports of highly experienced meditation practitioners and masters who naturally weave their nondual primordial wisdom mindstream into the splendid fabric of sociocultural space and time.

Thus are the Mahayana Middle Way *Madhyamaka* Two Truths—spacetime Relative Truth, and post-empirical, all-pervading nondual Ultimate Truth—unified in the Buddhist *Perfect Sphere of Dzogchen*, spacious unbounded whole (*dharmadhatu*), nondual ultimate reality itself (*dharmakaya*) in which this all arises and participates.

Mereologically speaking, the multiplicity of form—the particular cosmic parts—are perforce subsumed by the greater primordial, all-embracing, formless, selfless, boundless *kosmic* awareness-consciousness whole itself. So many words for That that cannot be told in words.

Of the twenty or so foundational 'interpretations of quantum mechanics' that are bandied about, there are six or so on offer that receive the most critical attention. These are: 1) the original antirealist 'collapse' Copenhagen Interpretation of Bohr and Heisenberg; 2) hidden variables models (Bohm-deBroglie) 3) Stephen Hawking's antirealist, or quasi-realist Model Dependent Realism (MDR) view (*The Grand Design* 2010); 4) realist GRW and 'collapse models'; 5) stochastic Quantum Bayesianism (QBism); and 6) radical hyper-realist mechanistic MWI or the Many Worlds Interpretation.

Each of these is an attempt to demystify and explain Schrödinger's ineffable quantum wave function  $\Psi$  of the 1927 Quantum Field Theory (QFT) of Dirac and Heisenberg. QFT is here to stay. A settled foundational theory will certainly utilize quantum quantities common to each, but must now at long last engage a qualitative post-empirical, post-formal, holistic ontology that is prior to, yet includes and subsumes any revisions of the requisite mathematical quantum formalisms.

Thus do we begin to heal and unify objective quantitative cognition with subjective qualitative cognition. These two modalities of our unified human cognition have been hitherto torn asunder under sway of the prevailing belief system of Modern Science. And that deep background cultural 'global web of belief' (Quine 1969) includes the dualistic metaphysical 'scientific' dogmas of Local Scientific Realism and Greek Scientific Materialism/Physicalism that has beset our Modern and Postmodern Western mind and its culture.

This paradigmatic 'mind change' has proven exceedingly difficult after 400 years of European Enlightenment physics—'the idols of the tribe'—encaged as it is in the scientific realist/materialist ideologies that are our Greek metaphysical legacy.

Quantum Field Theory (QFT) is physics' still inchoate *relative* epistemic cognitive architecture for accomplishing an *ultimate* ontological understanding of the whole nature of appearing reality, both objective and subjective. QFT mathematical formalisms must now be integrated with the trans-quantitative ultimate whole itself—nondual primordial awareness-consciousness itself whence relative spacetime stuff and our theories about it emerge. (Boaz 2021b)

I shall argue herein that panpsychic (monistic cosmopsychic) nondual Buddhist *Dzogchen* as it arises from Buddhist Middle Way *Prasangika* Madhyamaka philosophy constitutes an *ultimate* ontic foundation for the *relative* epistemic 'universal quantum wave function' mathematical formalisms. (Boaz 2020) I have termed such a 'post-empirical' ontology the "Middle Way Interpretation" or foundation of QFT.

The immeasurable challenge is this: that greatest of human intellectual achievements, the prodigious Standard Model of particles and forces, with its recent lambda  $\Lambda$ -CDM (cold dark matter) Standard Model of Cosmology still clings to the orthodox, old paradigm dogmatic materialist metaphysic that is extreme objectivist Scientific Local Realism—the metaphysical Physicalism/Materialism of a bygone classical Newtonian cosmos of objectively 'real' purely physical objects existing observer-independently, permanently, and eternally in an absolute, objectively real 4-D spacetime manifold.

Good news! This classical view is now being integrated with the quantum view with the advent of our 21st century Noetic Revolution in Science and Spirit.

A purely objective observer-independent classical spacetime has fallen on hard times. Physicists are at last beginning to hear Einstein on time: "Time, past, present, future, is an illusion; albeit a very persistent one." With new work in quantum cosmology many physicists have thrown out space as well. The ontic result leaves our beloved spacetime realities relatively real, yet not ultimately real. Sounds like Middle Way Madhyamaka Buddhism. (Boaz 2021b)

In any case, the notoriously perverse mathematical incommensurability of QFT/QED with Einstein's General Relativity Theory (GRT)—required to unify these two great pillars of modern physics—will continue to remain separate and contradictory without a continuing ideological softening of Modern Science's hyper-objectivist monistic metaphysical Scientific Local Realism and Physicalism. This waning classical paradigm view is now considered by most philosophers of physics, and a few theoretical physicists, to be a failed ontology. How is this so? 1) It contradicts the inherently random acausal and therefore the inherent subjectivity of quantum theory, to wit, 'always correct' QFT. 2) It fails to engage the nondual, basal, perfectly subjective primordial awareness-consciousness ground in which, or in whom our objective, conceptual and mathematical worlds arise. Science must surrender its 'taboo of subjectivity' in order to approach a unified understanding.

Yes, we desperately need a unifying Quantum Gravity Theory (QGT) to heal this seeming epistemic split between the minute microcosmic realm of Planck's Planck Scale quantum, and the vast large scale macrocosmic dimension ruled by Einstein's gravity.

Some physicists, and most philosophers of physics, along with Buddhist philosopher/practitioners know that there is no innate dimensional separation between appearing microcosmic and macrocosmic phenomenal regimes. Indeed, the whole of physical spacetime appearing reality, with its quantum wave function and its measurement instruments, is always already unified and subsumed in the formless, boundless, indivisible, trans-conceptual, nondual primordial awareness-consciousness whole in which this whole shebang arises. It is that holistic metaphysical understanding that must be integrated into the metaphysics of the universal quantum wave function with its arcane mathematical formalisms.

Here is the rub. Contemplative blissing out in the perfectly subjective ground of being is not enough. We must skillfully engage our objective cognitive capacity to conceptually and mathematically explicate that prior unity of objective quantum form and its subjective quantum emptiness while remaining present to the prior trans-conceptual, nondual truth of the matter. That is, we maintain an awareness of the present state of nondual unity of our perennial Two Truths—relative spacetime form, and its formless emptiness ground. We build upon that prior unity.

Consider for a moment that you awaken now to a hitherto impossible, but now real cognitive choice in which you hold a potentially present eigenstate condition of an utterly unified relative objective form reality dimension, with its formless ultimate subjective emptiness ground. You see clearly that the ultimate relationship of these seeming separate reality dimensions is one of nondual interconnected, interdependent identity. Your previous cognitive bias for purely objective form is absent.

Notice that your choice is not between the objective or the subjective dimensions. Your opportunity is to recognize the already present unity/identity of all that appears in spacetime reality, both objective and subjective, and its all-subsuming primordial ground, by whatever grand name—nondual God, Samantabhadra, Tao, Parabrahman, and the rest. You now have a choice to see and experience the nondual subjective unity, interconnectedness, and interdependence of what appears to human perception and conception as a dualistic, objective, separate and chaotic 'real world out there' (RWOT).

Do it now for 60 seconds. Close your eyes and place all of your awareness upon the breath in your belly, and at the crown of your head. Now feel your present heart-mind connection to the primordial ground of everything. Rest now in Presence of That. As thoughts naturally arise, say 'distraction', and return to your breath. How does it feel to enter in the actual Nature of Mind? What is your mind? That is your mind! Who am I? That I Am! (Boaz 2021, *Mindfulness Meditation: The Complete Guide*)

QFT and the history of both Western and Eastern philosophy and religion have told it well: reality is not as it appears! Ordinary perception sees only the parts. Our wisdom clear light direct perception (*yogi pratyaksa*) sees the interdependent parts arising within, and as the whole (*pratitya samutpada*, Interdependent Arising).

Is it possible to live in a confusing seemingly chaotic RWOT while abiding in such peaceful equanimity? An open, mostly bias free contemplatively trained mind may enjoy such an impossible choice. Buddhas and *mahasiddhas* live here all the time. But don't believe this. As Buddha told, "Come and see." (*ehi passika*).

A complete quantum ontology that embraces this aboriginal ultimate *kosmic* ground of the emerging relative physical spacetime dimension of reality—both microcosmic and macrocosmic—shall greatly facilitate our understanding of the way in which gravity and QFT are already unified. What is certain is that the task exceeds the conceptual limit of pure mathematics. The task will require both of our human cognitive faculties, our *noetic doublet*, objective conceptual and subjective contemplative.

Thus begins our recognition of the present unity of these two innate awareness dimensions of mind, our human mind as it arises in and through the nondual primordial awareness ground or base (*gzhi rigpa*) that is the very Nature of Mind.

Well, what are these two cognitive worlds that embody our human condition? You guessed it! 1) Exoteric, objective, material, dualistic, conceptual; and 2) esoteric, subjective, trans-conceptual, nondual, contemplative/'spiritual'. In short 'objective' and 'subjective'. May I say it again? These two seemingly separate modes of understanding our arising realities are already a prior yet always present unity, when we choose to enter in, and clearly see.

*Shifting Our Global Knowledge Paradigm.* Twentieth century Quantum mechanics has subsumed three of the four fundamental forces/particles of the wondrous Standard Model of particle physics, namely Electromagnetism, the Strong Nuclear Force that atomically binds the worlds, and the Weak Nuclear Force of radioactive decay. Only the Newton-Einstein 'Big G' gravity 'force' remains to be tamed by the sublime quantum theory with its universal quantum wave function  $\Psi$ .

Quantum theory clearly obtains in both of these dimensional regimes—the three forces of the very small, and large scale gravity. But we need a providential new math theory of the *relative in the quantum*. The quantum conundrum? How can relativistic gravity be 'quantized' and shown to be quantum in nature?

Or can it? Perhaps such penultimate wisdom lies beyond our wondrous scientific methods of quantification. Perhaps nature possesses subjective qualities that preclude objective quantification. In any case that has been my argument.

In short, we require a new quantum spacetime that reveals how the hitherto smooth non-quantized classical gravity continuum of Aristotle, Newton, and of Einstein's GRT gravity waves may be quantized—course grained into discrete quantum

bits, Einstein's 'lightquanta', discrete foundational qbits, like photons and gravitons. Indeed, the physics desideratum devoutly to be wished.

Yet, it may be asked: is it logically, or empirically possible to grasp the whole of our limited experience of reality by way of mere conceptual mathematical means, no matter how skillful? Is the prodigious quantum gravity dilemma a 'category mistake'? If the nonlocal metaphysical abstractions of the inherently subjective qualities of vast multidimensional nature cannot be ultimately reduced to the local objective physical/material quantities of Scientific Local Realism/Physicalism, then the quantum dilemma is some species of category mistake.

In any case, it's clear to 'those who know' that modern physics has at last hit its paradigmatic brick wall. Thomas Kuhn (*The Structure of Scientific Revolutions* 1962, 2012) has described the process wherein periods of 'normal science' (e.g. objective classical mechanics) are rudely interrupted by a 'scientific revolution' (e.g. quantum mechanics).

Cases in point, the Copernican Revolution; the Newtonian Revolution that unified the relativity paradigm shift begun by Galileo and Kepler, and continued by Einstein; and the Quantum Revolution—the present scientific and cultural paradigm shift from objective classical mechanics to the subjectivity of quantum mechanics.

Such 'anomalies' or contradictions in the waning old paradigm beget a new ascending revolutionary 'scientific paradigm'. This gradual, then sudden sociological process Kuhn termed a scientific 'paradigm shift'. A global seismic shift in scientific thinking influences not only the scientific culture, but in due course (before the next more inclusive shift descends) pervades the 'global web of belief' (Quine 1969)—the ideology and idiom—of the 'global' whole culture.

Old and new paradigms are so different as to be utterly 'incommensurable'. The ideology of each one is foreign to the other. Each has its own semiotic gloss that is nearly incomprehensible, and entirely unbelievable to the other.

Such a radical shift in perceiving and thinking is now upon us as the descending objectivist classical relativistic physics paradigm is replaced with the ascending subjectivity of the quantum physics paradigm. This Quantum Revolution has caused the next global revolution in science, culture, and religion. I have come to call it *The Noetic Revolution in Matter, Mind, and Spirit*. (Boaz 2021)

A new paradigm shift requires two generations to become a settled dogmatic orthodoxy as the old paradigm tenured acolytes expire, and new paradigmatic blood enters the hallowed halls of academic learning.

May this process be somehow expedited in our own present case? We shall see that it may. Indeed, the random, acausal and antirealist subjectivity of the global quantum metaphysic has dethroned the prevailing Scientific Local Realism and 'common sense' metaphysic of Newton's and Einstein's real world out there (RWOT).

The next step in this urgent process of change must be a reasonable, imperfect quantum ontology that unifies the conceptual, objective dimension of quantum

mathematical formalism with the subjective dimension of the more inclusive primordial awareness ground in which it arises and manifests. It is this 'grounding relation' to which the subjectivity of the universal quantum wave function points. Such a providential quantum ontology shall facilitate our emerging inchoate scientific and cultural paradigm shift; to wit, The Noetic Revolution.

Einstein himself failed to accomplish the syncretic mathematical consummation that is a universal quantum theory of gravity, although his GRT predicted the discrete particle gravitons of his continuous gravity waves. These have now been discovered. (LIGO gravitational wave detectors 2015)

None of the twenty or so epistemic interpretations of QED have done any better. What in heaven and earth could a graviton 'particle of space' possibly be? We might visit Buddhist *Abidharma* and explore their objectively real 'space particles'. (Boaz 2020)

What *is* certain is that at the miniscule Planck scale, the classical, smooth spacetime continuity of Aristotle, Newton, and Einstein is now *kaput*, a new scientific quantum paradigm emerges, and the waning objectivist, Greek realist-materialist dogma finally becomes relegated to the trash bin of history. May it rest in peace.

Well, what replaces the *absolute* existence dictated by observer-independent Scientific Realism and Physicalism? A centrist Middle Way observer-dependent *relative* existence ontic view, of course. Kuhnian paradigmatic 'scientific revolution' indeed.

The bad news is that at the empirically and even logically impossible theoretical Planck scale, time and distance are immeasurable. How then may we determine which, if any, of the several quantum gravity theories are tenable? Here the 'spooky' subjectivist, logic-defying quantum anomaly that is the quantum nonlocality/entanglement of a system of two or more quantum qbits (the basal two-state or two-level basic unit of quantum information), will continue to play an important role. If gravity can be shown to possess the quantum property of entanglement, then it must be quantum in nature. And that's a big order.

In the late 1940s Richard Feynman fully developed Paul Dirac's 1927 superb Quantum Electrodynamics (QED). This refinement suggested that if gravity, the warping of spacetime, is indeed quantizable then a nonlocal entangled particle existing in its logically absurd two 'space-like separated' locations at the same moment in time must produce two co-existing entangled spacetime gravitational fields simultaneously. If this subjective superposed quantum eigenstate does not instantly collapse into an objective reality eigenstate, then it must be nonlocally entangled revealing that gravity is indeed a quantum phenomenon. Several recent experiments have settled the matter. (Scientific American *Extreme Physics*, Spring, 2019) Gravity is indeed a 'spooky' nonlocal quantum event. Einstein would have hated it.

However, we still need a mathematically consistent Quantum Gravity Theory (QGT) to show how. (Boaz 2021)



Still, what if our much valorized quantum theory itself is in need of modification? What if, like gravity, it breaks down in the mathematically impossible infinite gravitational extremes of neutron stars, and black holes, and at the primordial Big Bang singularity? What if it is QFT that must be modified and adapted to General Relativity as a few theoretical physicists believe? What is certain is that in the course of seeking the grail of a unified QGT both QFT and GRT will evolve; if such a unification is mathematically possible at all. Time—if it exists at all—will tell. And so it goes.

Our understanding of gravity was greatly enhanced by Einstein's GRT. Kuhnian scientific revolution or no, we've seen again and again that what is painfully slow to change is science's cultural zeitgeist, namely classical, objectivist Scientific Local Realism, and Realism's epistemic handmaiden—monistic observer-independent, Greek Metaphysical Scientific Materialism/Physicalism. Notable exceptions to this unwholesome course may be the antirealist, ontologically relative quantum views of Bohr, von Neumann, Wheeler and Barbour. Not to mention Buddhist 'ontologically relative' Madhyamaka Middle Way philosophy.

Of the many physicists and cosmologists in recovery from this afflictive obsessive reductive 'scientific' physicalist/materialist metaphysic, relativistic physicist and cosmologist Stephen Hawking's story is perhaps the most inspiring.

Upon analysis of Kurt Gödel's two 1936 incompleteness theorems Hawking became disabused of his grail quest for a logically impossible Theory of Everything (TOE) with its realist/materialist metaphysical bias, and at last embraced an antirealist view. This epistemic reversal of his hitherto ardent Scientific Local Realism of *A Brief History of Time* (1988) became an ever so reticent antirealist 'Model Dependent Realism' (MDR) ontology revealed in his excellent book, *The Grand Design* (2010). Such rare intellectual openness and honesty in a great mind is indeed a joy to behold. Stephen Hawking, you will be missed!

Well, what might the culture of 'old paradigm' Modern Standard Model physics and cosmology, and post-Standard Model physics—Supersymmetry/M-Theory, Multiverse Theory, dark sector ZPE vacuum energy—look like with this methodological enrichment of the ontology, psychology and contemplative science of pre-modern Buddhist Middle Way philosophy? Stay tuned.

Therefore, let particle physicists, cosmologists, philosophers of physics, neuroscientists and Buddhist scholar-practitioners dialogue in academic symposia. That such symposia are nonexistent demonstrates the tenacious grip of Scientific Realism/Materialism that so profoundly hinders our emerging paradigmatic Noetic Revolution in Science, Culture, and Spirit.

Still, there is now arising in the West a new integral knowledge paradigm. It is based in the providential coming to meet of Eastern esoteric Buddhism and Western exoteric Science. The resultant, if inchoate unified integral noetic ontology,

epistemology, and methodology, with its Contemplative Science, and its new Science of Consciousness, presents a propitious opening for the noetic science of matter, mind and spirit of our emerging Noetic Revolution; and the healing wisdom that abides therein. (Boaz 2021b) Let it be so.

### **Quantum Form and Buddhist Emptiness: The Unity of Science and Spirit**

*Variations on a Theme of Wholeness: Quantum Field Theory.* Let us now engage quantum emptiness and the emergence of spacetime.

"Form is empty; emptiness is form." The Buddha's Two Truth dimensions: relative spacetime form, and its ultimate boundless emptiness whole. The world of Science may be seen as the dualistic dimension of spacetime relative form. The realm of Spirit then is the nondual primordial dimension of the vast formless ultimate reality awareness-consciousness ground that embraces spacetime form, and in whom it arises and is instantiated.

Broadly construed, the province of objective Science with its matter-energy ( $E = mc^2$ ) form, abides in relationship with perfectly subjective Spirit that is its formless primordial awareness all-embracing 'all-ground'. Viewed ultimately, that relation is one of identity. The relative dimension of form/matter and ultimate primordial Spirit are an ontologically prior yet phenomenally present unity. Told the Buddha, "Form is not other than emptiness; emptiness is not other than form."

I have argued here and elsewhere that the epistemic evolution of the physics revolution that is Quantum Field Theory (QFT) with its mysterious 'universal quantum wave function  $\Psi$ ' expresses this nondual perennial wisdom ontology in its exoteric, relative, conceptual dimension. The universal quantum wave function is thus a dualistic, conceptual, mathematical expression of the emergence of physical *relative* spacetime from its nondual fundamental ontological ground, *ultimate* primordial awareness-consciousness itself.

However, physicists and philosophers of physics have failed to produce a settled quantum ontology in their various philosophical interpretations of QFT that serves as a grounding relation for their quantum formalisms. This failure is the result of physicists refusal to venture beyond physics and engage consciousness, that is, philosophy of consciousness. Ontology is by its very nature metaphysics, literally beyond physics. The inherent subjectivity of metaphysical ontology has from the beginning been taboo in objective physics generally, and in quantum physics particularly. The formidable fundamental subjectivity and 'uncertainty' of the non-causal randomness of quantum mechanics has forced an unbidden confrontation with subjective human consciousness, and therefore with the primordial awareness-

consciousness ground of that. This ontic and epistemic conundrum has become known as the 'quantum mystery', or the 'quantum enigma'.

The *observer-dependent* freedom of the quantum view is indeed an unforeseen revolution in a hitherto physicalist/realist *observer-independent* 'classical' physics universe of discourse. QFT follows our human wisdom tradition of a spacetime reality that is essentially dependent upon mind, the consciousness of a relative sentient observer arising in and not separate from its ultimate primordial awareness ground; Suzuki Roshi's 'Small Mind' participating in 'Big Mind' in whom it arises and participates. These are the 'Two Truth' dimensions—relative and ultimate—of the vast all-embracing original whole. It is the monistic ontology of this nondual ('not two, not one, but nondual') aboriginal source or ground that is fundamental. Such a metaphysical ontology is conspicuously absent in the recent metaphysics of the wondrous, 'always correct' quantum theory.

If we are to provide a bridge between the human cognitive dimensions of relative, dualistic, objective Science, and ultimate nondual perfectly subjective Spirit in whom it arises we require a more or less settled quantum ontology.

Moreover, such an ontology is requisite to a mathematically consistent Quantum Gravity Theory (QGT) that quantizes Einstein's gravity—General Relativity Theory (GRT)—thereby unifying these two foundational pillars of physics into a mathematically commensurable GRT and QFT. This is, as Hamlet told, the monumental physics "consummation devoutly to be wished".

In the alternative, instead of quantizing gravity perhaps we should be 'gravitizing' the 'quantum of action'. Is great gravity sequestered somewhere in quantum mechanics; deeply hidden in the nonlocally entangled universal quantum wave function? Are there sunny quantum fields out there, or in here, merrily propagating in the dark recesses of Einstein's gravity field equations? Some physicists think so.

*What is Quantum Mechanics?* "The dreams that stuff is made of". Quantum mechanics is the very foundation of post-classical modern physics. All disciplines of physics use it. It's the basis of much modern technology. Quantum mechanics (mechanics is the sector of applied mathematics that describes physical motion of matter-energy and its forces) represents a seismic paradigm shift in how we view our relative conventional world of spacetime reality. Quantum mechanics has forced upon us a new, not so realistic worldview. How shall we understand this?

The mechanics of the receding Newtonian 'classical' (non-quantum) physics paradigm views the world of appearing reality as existing objectively 'real' and independent of any conscious observer. It is thus *observer-independent*. Philosophers of physics know this prevailing metaphysical view as Scientific Local Realism, the view of our everyday common sense worldview of a separate 'real world out there' (RWOT),

whether or not it is observed by a conscious observer. The proverbial tree in the forest remains objectively 'real', whether or not it is observed by a sentient being. Our much beloved Local Realism ontology.

But no. The quantum theory has shown that our appearing realities are indeed dependent upon the consciousness of a sentient observer. Appearing emerging spacetime reality is thus *observer-dependent*. Without such observation, stuff cannot be said to truly exist! Now that's a scary thought.

It is here that quantum theory engages the mysterious subjectivity of 'consciousness'. The 'always correct' nonlocal, counterintuitive 'mystical' view of quantum mechanics challenges this comfy realist view of ours that is the very foundation of our cognitive deep background cultural 'global web of belief'. Einstein called such an antirealist view "spooky" (*spukhaft*).

We shall soon see that this quantum mystery of the observer is displayed for all to see as the prodigious *quantum measurement problem*. What precisely constitutes a quantum measurement, and what does it reveal about the 'deeply hidden' quantum reality, and its metaphysical ground, existing ontologically prior to such measurements? When we observe a quantum system its behavior appears entirely different from the same system when it is not 'disturbed' by a sentient observation. Somehow observation/measurement 'changes' the system being observed. How is it that quantum systems evolve deterministically in accord with the universal quantum wave function before we observe them, then mysteriously 'collapse' into objective space and time when we measure them? The weird result is that what we see objectively is not what actually existed before we look! That is the 'quantum mystery', the 'quantum enigma': Appearing objective reality is not as it appears! Spooky indeed.

No real surprise here. The history of human inquiry into the ultimate nature of appearing reality has told this counterintuitive truth almost from the beginning. The quantum enigma may be seen as a modern out-picturing of the ancient ontic engagement between metaphysical Local Realism, and nonlocal metaphysical Antirealism/Nominalism, and metaphysical Idealism.

Still, the radical shift from the Local Realism of classical Galilean, Newtonian, Einsteinian mechanics to the Antirealism of the final 1928 Copenhagen Interpretation of quantum mechanics represents a seismic Kuhnian 'Scientific Paradigm Shift'. (Thomas Kuhn *The Structure of Scientific Revolutions*, 1962)

There is still no agreement among the many 'interpretations of quantum mechanics' as to a resolution of the measurement problem.

If this all seems too complicated; well, it is. But please don't give up. It's not as bad as it seems. Our challenge is to expand our thinking about the nature of the world so as to embrace both its objective and subjective dimensions. We'll see that there exists a 'middle way' between the false dichotomy of the metaphysical extremes of *either* common sense absolute observer-independent, locally real objective existence (Local

Realism), or absolute observer-dependent, subjective quantum nonlocal entangled (universally interconnected) nonexistence (nonlocal nominalist Antirealism).

Meanwhile, let us warm up to this propitious 'middle path' by beginning to think of arising spacetime form as *relatively* objectively truly real as it emerges from its formless *ultimate* perfectly subjective all-subsuming primordial awareness-consciousness ground, by whatever grand name. Let us begin to directly see and feel the prior and present indivisible unity of these Two Truth dimensions of the nondual boundless whole of reality itself in which, or in whom we all arise and participate.

After all, the primordial nonlocal interconnected emptiness of the universal quantum wave function  $\Psi$ , and the interdependent (*pratitya samutpada*) emptiness/*shunyata* of Middle Way Buddhism are two ways of expressing this single providential emergence of form in space and time. The first represents an epistemic Relative Truth dimensional description; the second an ontic Ultimate Truth dimensional description. We shall learn to view and relate to these two complementary voices of truth as an indivisible, conceptual *and* trans-conceptual, nondual one truth unity.

Therefore, recent relativistic Quantum Field Theory (QFT), which includes Paul Dirac's Quantum Electrodynamics or QED, has clearly demonstrated that our appearing realities—both micro-phenomena like electrons, and macro-phenomena like molecules, trees and stars and all of us—are indeed wholly dependent upon observation by a sentient consciousness. Conscious awareness is fundamental to the nature of appearing reality. This most unwelcome epistemic imperative has been forced upon us by the very nature of quantum observation/measurement, which has been proven to be 'always correct'. As physicist Sean Carroll has said, "We don't choose quantum mechanics; we only choose to face up to it." (Carroll 2019)

What hath God wrought?! What in heaven and earth is this strange new 20th century quantum mechanics that has subsumed classical physics, and bequeathed to us the mixed bag of blessings that include the computer, the laser, and the bomb? It is said that about a third of the Western economy is due to products that are the legacy of QFT. The practical result of the theory is astounding. Yet few quantum physicists have bothered to consider what it actually means to the nature of reality. Such an ontic knowledge exploration is taboo in the mathematical world of physics. "Shut up and calculate" is still the anti-intellectual norm.

Nonetheless, a few philosophically minded quantum physicists, along with some peripatetic philosophers of physics got to work on more than a few 'interpretations of quantum mechanics', the sector of physics now known as 'Foundations of Quantum Mechanics'.

*The Quantum Wave Function.* So, before we consider what quantum mechanics means about the subjective nature of *ultimate* reality, let's see what it says about objective *relative* reality.

Quantum mechanics describes the whole of continuously arising emerging spacetime as a universal, smooth, vibrating wave—Irwin Schrödinger's all-embracing *universal quantum wave function*. Broadly construed the wave function is a *relative* mathematical process of *ultimate*, nonlocal, basal universal interdependence and interconnectedness of all arising spacetime physical reality. Schrödinger's singular universal wave equation ( $\Psi$ ) rules the evolution of a plurality of infinitely many constituting quantum wave functions that embody our physical realities.

If the mighty universal quantum wave function describes the objective *relative* behavior or mechanics of the matter-energy stuff of arising 'emerging spacetime', what then is the subjective *ultimate* nature of that prior more fundamental ground from which, or in whom this all arises and emerges? What is the relationship of the vast boundless whole to its participating parts arising herein? Are we parts of that whole separate from, or connected to and immersed in it, and to one another through it? How is it that such ontic inquiry may enhance relative human happiness? Such are the urgent questions of quantum ontology as they naturally arise from obscure epistemic quantum mathematical formalisms.

It may be useful to think of questions about and descriptions of the objective behavior of arising physical matter-energy as relative *epistemology*; and the investigation into and engagement with the fundamental subjective nature of the all-subsuming ground of emerging spacetime matter and energy as ultimate *ontology*, the inquiry into the ultimate nature of being itself. Epistemology guides and interprets the *relative* scientific, objective, empirical observation and investigation of appearing phenomena while ontology is the subjective, metaphysical conceptual and even direct contemplative exploration of the *ultimate* nature of phenomena and our body-mind that experiences it. Human cognition naturally and inherently includes both of these objective and subjective dimensions of our human awareness/consciousness processional—our *cognitive noetic doublet*. And Science necessarily includes both. Let practitioners of Science do so as well.

In any case, the universal quantum wave function presumes to describe the epistemic, objective, relative conventional face of spacetime reality as it arises from its ontic perfectly subjective ultimate primordial ground. Unfortunately this ground of reality is taboo to most quantum practitioners, as we have seen. Is it enough just to build quantum computers, and speculate about quantum gravity? Is not an awareness of our interconnectedness within that vast ultimate awareness-consciousness ground of the relative quantum process also important to human happiness and well-being?

Irwin Schrödinger was a serious student of Hindu Vedanta philosophy. He was as well familiar with Buddhist philosophy. His wave function equation  $\Psi$  (Psi) has demonstrated a conceptual and intuitive understanding of the Buddhist Two Truths—primordial unity of the dimension of relative physical and mental phenomena (Relative Truth), and the formless ultimate dimension (Ultimate Truth) in which or in whom it

arises, is subsumed, and instantiated as spacetime form. The Buddha told, "Form is empty; emptiness is form." QFT sees this aboriginal reality relationship of spacetime stuff to its formless ground as: form is quantum emptiness; quantum emptiness is form. (I have termed the physically impossible distance and time of the Planck Scale regime, quantum emptiness.)

Moreover, QFT views form is observer-dependent and ontologically relative, that is to say, spacetime form does not exist as a physical reality prior to a sentient, conscious observer's observation, or to an experimenter's measurement which then 'collapses' the superposed subjectivity of  $\Psi$  into really real objective stuff. Thus are both quantum and Buddhist emptiness, as H.H. Dalai Lama has told, "established by conventional human minds". Ontological relativity. Here the 'problem of consciousness' arises as the vexing 'quantum measurement problem'. How does an observer consciousness 'collapse' the subjective linear 'superposed' wave function of many potential quantum 'eigenvalues' into a single objectively real eigenstate of being in classical real time?

Observation/perception by a sentient consciousness somehow 'creates' our realities. How this quantum mystery is so constitutes the prickly quantum measurement problem. Such a view is 'antirealist' and proto-idealist in that it violates our unscientific ontic presumption that is the 'scientific' dogma of Scientific Local Realism—an absolutely RWOT.

Local realist Albert Einstein vigorously argued the quantum measurement problem with his antirealist antagonist Niels Bohr, discoverer of the prodigious Principle of Complementarity and the Copenhagen Interpretation of quantum mechanics, for two decades (the Einstein-Bohr EPR debates).

Mahayana Buddhists agree that our appearing realities are 'ontologically relative'—established/created by perceiving conceptual minds—but they don't see a problem here because they do not indulge a local realist cognitive bias in the first place.

Erwin Schrödinger's quantum wave function, the basis of Quantum Field Theory (QFT), has codified the Bohr-Heisenberg quantum foundational principles—respectively, the Principle of Complementarity and the Principal of Uncertainty—introducing to the physical sciences, and our modern collective consciousness a new post-classical, non-objectivist scientific knowledge paradigm! QFT constitutes a propitious conceptual bridge between objective Science and subjective Spirit, as we shall soon see.

"Saving the appearances" of the prevailing classical ontology that is Scientific Local Realism from the Antirealism of Bohr and his student Heisenberg has become a quantum cottage industry fabricating seemingly endless 'interpretations of quantum mechanics'—for those who care to cease calculating quantum formalisms long enough to consider the deeper meaning of their mathematics.

Everyone now agrees that the 'classical' universe/multiverse is now and has always been quantum in nature. QFT has not replaced classical physics but has transcended and included it. This quantum nature of our classical atomic world of spacetime—both microcosmically and macrocosmically—is 'created' or perceptually and conceptually reified by sentient conscious observation, as we have seen. It does not exist observer-independently, 'from its own side'. Spacetime somehow arises from this mysterious quantum foundation. Counter-intuitive to say the least.

The point-like particles of classical mechanics reveal "something deeply hidden" (Einstein), something intrinsically fundamental. Wave-like particle-fields are now the 'basic building blocks' of spacetime stuff. And the universal quantum wave function points directly at their nature, and presumes to describe just what it is that is 'waving'.

Add Einstein's classical (non-quantum) universal gravitational field and we have a post-Standard Model 'Core Theory' of the physics of particle-fields and their interactions. Recall that we desire a Quantum Gravity Theory that unifies QFT and GRT. The problem is that the present physics  $\Lambda$ -CDM Standard Model Theory doesn't work at intergalactic distances, and in extreme gravitational fields, like black holes, neutron stars, or at the instant of a 'Big Bang' creation of a new universe participating in a now respectable multiverse.

Moreover, in such extreme gravity classical 'locality'—particles and their fields interacting causally only when in proximity to one another in space—becomes 'nonlocal', known as 'quantum entanglement', the primordial ultimate indivisible interconnectedness and interdependence of all spacetime located form. Thus does quantizing gravity require Einstein's "spooky nonlocal action at a distance." Einstein hated it.

In any case, we do indeed already have a Quantum Gravity Theory (QGT). And that is expressed in Einstein's gravity equations of his wondrous GRT. It works fine in relatively weak gravitational fields—earth to solar system distances, but not at extreme intergalactic distances, nor in extreme gravity black hole situations where our notions of classical spacetime utterly collapse into primordial 'Planck scale' quantum emptiness.

The 'old quantum mechanics' of Planck, Einstein (before he turned coat), and Bohr (1900-1925) became Quantum Field Theory (QFT) in 1925 with Werner Heisenberg and Max Born. It was enhanced by the Quantum Electrodynamics (QED) of Paul Dirac in 1927, and further developed by Richard Feynman in 1953.

The quantum mathematical formalism of QFT has proven to be an astounding predictive mechanism for developing new and practical technologies for humankind. But, as Sean Carroll has pointed out, "As a fundamental theory of the world it falls woefully short." And physicists have been woefully remiss in addressing its deeper meaning and ontological foundations. We've seen that a sociological 'taboo of subjectivity' has settled over the theoretical physics community that almost entirely precludes such inquiry. Any attempt to illumine the post-classical, nonlocal nature of



quantum entanglement—the quantum 'measurement problem'—is still taboo. "Shut up and calculate" became the prevailing cognitive posture for the last half of the 20th century. Let quantum inventions suffice. Leave philosophy alone. 'There be dragons'.

This began to change in the 1980s with the emergence of a new cognitive discipline known as 'philosophy of physics'. The emerging dialog between philosophers, physicists, and philosophers of physics soon produced over 20 'quantum mechanics interpretations', or foundations. There are six that are generally considered viable interpretations. All are attempts to address the quantum uncertainty and complementarity inherent in the original and still prevailing quantum interpretation that we have come to know and love as the Copenhagen Interpretation of Niels Bohr and Werner Heisenberg. Few physicists are aware of its antirealist ontology.

These six interpretations, or 'foundations' are, as we have seen: 1) the default Copenhagen Interpretation; 2) dynamical collapse models (GRW theory); 3) hidden variables models (non-collapse, nonlocal nondual Bohmian mechanics or the deBroglie-Bohm pilot wave theory); 4) Quantum Bayesianism or QBism, the non-objective, non-ontic probabilistic epistemic approach as to our 'degrees of belief' (Fuchs, Caves and Mermin); 5) the Model Dependent Realism (MDR) of Stephen Hawking presented in his 2010 book *The Grand Design*; and 6) quantum decoherence or the branching, multiple, alternate universe theory called the Many Worlds Interpretation (MWI) of Hugh Everett, Bryce DeWitt, David Deutsch, and Sean Carroll. (For a detailed exploration of the foundations of quantum mechanics see Boaz 2021)

All of these interpretations of quantum mechanics engage objective *relative* human consciousness, and all fail to engage its 'deeply hidden' *ultimate* ontological primordial awareness-consciousness ground. All are perforce conceptual attempts at grasping an ultimate ontology that embraces the relative quantum formalism of the universal quantum wave function. None have done so. I have elsewhere referred to this 'post-empirical' quantum predicament as "the problem of quantum ontology"—the hitherto largely ignored challenge of addressing the ultimate essence, nature, and ground of Schrödinger's formalist universal quantum wave function—the very conceptual epistemic heart of QFT. All 'foundational quantum mechanics interpretations' require a foundational quantum ontology if we wish to know "that which is deeply hidden" within the formalist mathematics.

Real clarity in any profound physical theory requires a cognitive amalgam, a middle way that engages both voices of our human noetic (nondual, body, mind, spirit) cognitive doublet—objective conceptual-mathematical cognition, and subjective, intuitive, contemplative, nondual cognition.

Therefore, we shall herein attempt to discover how this revolutionary quantum worldview may enable us to bridge the knowledge gap—Heisenberg's *schnitt*—between relative objective experience, and the subjective fundamental ultimate ground of reality

itself; between objective Science and perfectly subjective Spirit, by whatever grand name, in which or in whom this all arises and is instantiated.

*Physics Meets Consciousness: "Come and See"*. Each of the several competing 'philosophical' interpretations of quantum mechanics engages consciousness—1) phenomenal human experience, and therefore 2) the ontic all-pervading basal consciousness ground or 'supreme source' of all our arising experience. Told physicist Eugene Wigner, "It is not possible to formulate the laws of quantum mechanics without reference to consciousness." We'll see that each of these 'interpretations' engages *relative* human consciousness conceptually, but fails to engage its relationship to the formless *ultimate* primordial awareness-consciousness ground in which, or in whom it arises, participates, and is instantiated in spacetime physical and mental form.

We shall soon see that the universal quantum wave function ( $\Psi$ , Psi) is a dualistic conceptual formulation of the inherently uncertain, conceptually but not contemplatively unknowable primordial awareness-consciousness 'groundless ground' of the nondual boundless all-embracing whole of appearing physical and mental reality.

We have already seen that this "vast implicate order of the unbounded whole" (David Bohm) is eminently approachable, and may be relatively practiced and thereby ultimately realized via direct human contemplative cognition. It is here that human conceptual knowledge (*doxa, kalpana*, our relative conventional 'global web of belief') is embraced by ultimate primordial awareness wisdom (*jnana, yeshe, gnosis*), the direct human knowing feeling awareness-consciousness (*yogi pratyaksa*) of that whole.

Cases in point: the Buddha, the Christ, and the countless buddhas, *mahasiddhas*, saints, and sages of our great Primordial Wisdom Tradition. After all, the indwelling Presence (*vidya, rigpa, christos*) of that fundamental foundational nondual aboriginal ground (*dharmakaya, shunyata, gzhi, Tao, Yahweh, Abba*) in which this all arises is *ipso facto* naturally already present at the 'spiritual' Heart of even the most cynical physicist; not to mention all of us peerless, bias-free intellects. Yet it remains ungraspable by mathematics and the semiotic logical syntax of language. As Hamlet told Horatio, "There are more things in heaven and earth that are dreamt of in your philosophy."

Sadly, under sway of our objectivist, realist classical cognitive bias such contemplative technology is still taboo to most theoretical physicists and philosophers of physics, as we have seen. This 'scientific' objectivist Local Realism bias is here quite cognitively paralyzing, even as the inherently subjective wave function is a lone quantum voice crying out in a formalist wilderness: "nonlocal nondual"!

Therefore, let these good minds make a quantum leap into 'contemplative science', the branch of the emerging Science of Consciousness that objectively investigates such spooky subjective phenomena. For an Open Science no experienced phenomena can remain taboo. The prodigious quantum wave function, whatever it is,

has opened that cognitive door. Let us enter in the 'many mansions' of mind and see what abides here. As the Buddha told, "Do not believe what I teach...Come and see."

If quantum mechanics is "lucid mysticism" (Pauli), let us not fear the trans-conceptual, 'post-empirical' foundational real thing—that nondual ontic ground which abides beyond the conceptual grasp of even the greatest scientific minds of our kind.

Well then, what else is quantum mechanics? It's a shiny new conceptual model upgrade of our 400 year old European Enlightenment (The Age of Reason) 'classical mechanics'. It is based in the radical conception of Max Planck and his pal Einstein's 1905 assertion about the quantum nature of light.

Classical physics has mostly understood light as a wave—Aristotle's smooth continuous wave-like flow. Planck and Einstein forever ended that view. The birth of the quantum revolution that transcended yet included Newton's classical particle ('corpuscular') view was the discovery that light arises from, perhaps, the primordial 'zero point energy field' (ZPE) ground as particle-like discrete energy packets—'quanta of light energy'—now known as massless 'photons'. By 1930 the inherent nature of this particle nature of quantized light is subsumed in the wave nature of Schrödinger's universal 'quantum wave function'. We shall conceptually unpack this quantum conundrum below.

The theory of the quantum nature of the whole of spacetime reality was truly a scientific revolution. We proceeded from the 'classical' local realist knowledge paradigm at the end of the 19th century, to the all-subsuming quantum knowledge paradigm in about 30 years!

In 1865 James Clerk Maxwell had finalized the classical wave theory of light. Light was electromagnetic radiation, waves spread out in space. Utilizing Lorentz' Force Law, Maxwell unified electricity and magnetism in his prodigious Maxwell's Equations. He showed that both electric and magnetic fields move through space as light waves traveling at the finite velocity of light. Well, what pray tell is that?

*Relativity.* Maxwell's relativistic equations proved that the velocity of all electromagnetic signals, indeed all massless particles, including photons of light, and gravity particles/gravitons in the vacuum of space travel at a finite velocity, and cannot exceed it. This represented a new universal physical constant  $c$ , with a finite value of 299 792 458 meters per second, or about 300,000 km/s, or about 186,000 mph.

Maxwell's Equations, and the mathematical framework of Henri Poincaré, Hendrik Lorentz (Lorentz invariance)—along with the absence of a 'luminiferous ether' in which light was thought to propagate (the null result of the Michelson-Morley Experiment)—prepared the foundation for Einstein's 1905 Special Relativity Theory (SRT) with its two history altering postulates.

The second relativity postulate: the velocity of light in a vacuum is invariant for all observers, independent of the motion of the light source or of the observer. Light is not absolute but relative to the perceptual 'frame' of an observer. Electromagnetic particles and waves travel at  $c$  regardless of the source or the 'internal reference frame' of an observer. In short, the velocity of light in a vacuum is identical for any observer, regardless of the motion of the light source or of the observer.

Further, such particle/waves/photons can approach  $c$ , but cannot exceed it. Physicists call this 'locality'. 'Nonlocality' is the exceedance of this finite locality limit.

The first relativity postulate of Einstein's SRT: The laws of physics (including the constant  $c$  of his second postulate) are invariant in all inertial (non-accelerating) reference frames. These two postulates represent Einstein's two assumptions of Special Relativity. Quoth the Master: "The insight fundamental for the special theory of relativity and light speed invariance...is contained in the Lorentz transformations." (universal Lorentz covariance) Thus did Maxwell, Poincaré, and Lorentz lay the ground for Einstein's SRT, unlike his prodigious General Relativity Theory (GRT) whence sprang purely and spontaneously from the master's mind. Or so it is said.

That said, Einstein was not adept at the subtleties of non-Euclidian Riemannian geometry and the tensor calculus required for his GRT field equations. He missed to many classes at the Federal Polytechnic School. Indeed his is famous math professor Hermann Minkowski, who later helped Einstein to understand the implication of GRT for a '4-D spacetime continuum', called him "a lazy dog".

Fortunately, Einstein's erstwhile classmate Marcel Grossmann, a professor of mathematics specializing in non-Euclidian geometry and tensor theory mentored Einstein in the absolute differential calculus. Grossmann is said to have expressed to Einstein his concern that a mere physicist may not have the level of intelligence to grasp such advanced mathematical theory. Without his old friend Grossmann the sublime GRT field equations may not have happened. After all, Einstein's main GRT competitor and pal David Hilbert had an equally consistent theory at the same time. He graciously declined to publish it until after Einstein published in 1915. Without his friend and benefactor Marcel Grossman—who got a broke Einstein his job at the patent office—General Relativity Theory may well have had David Hilbert's name on it.

Einstein's 1905 SRT grounded his 1915 revolutionary General Relativity Theory (GRT) which generalizes his first SRT postulate to include non-inertial or accelerating reference frames. Here he describes Newton's universal law of gravity, 'Big G', as the geometric curvature of a four dimensional spacetime.

Maxwell's Equations of 1865 thus began our *kosmic* quest. We arrived in 1930 to find a fully fledged Quantum Field Theory (QFT), complete with Paul Dirac's astounding relativistic Quantum Electrodynamics (QED).

The next step in our quest is the union of QFT with GRT in a prodigious QGT. We must then further unify great gravity with the other three fundamental forces of

nature, the non-gravitational physical interactions or forces, namely: the Strong Force, the Weak Force, and the Electromagnetic Force. The result of such a unification is said to be an empirically if not logically impossible Theory of Everything (TOE). A Grand Unified Theory (GUT) is the unification of the Strong Force and the Weak Force. Such a GUT epoch may have obtained a moment after the Big Bang beginning of this present universe, just prior to the separation of the Electroweak Force from the Strong Force.

At extremely high energies the Weak Force and the Electromagnetic Force are unified as a single force/interaction—the Electroweak Interaction/Force. Glashow, Salam, and Weinberg received the Nobel Prize in Physics in 1979 for their mathematical unification of these two fundamental interactions.

The four fundamental forces/interactions of nature are then: 1) Great Gravity that binds together the worlds. All bodies with mass/energy are 'attracted' to or gravitate toward one another. Einstein demonstrated Sir Isaac Newton's gravity 'force'  $G$  is not an 'attractive force' (the inverse square law), but is the physical result of masses of differing sizes following geodesic lines in curved 4-D spacetime in accordance with their masses. 2) The Strong Nuclear Force which binds quarks (mediated by massless gluon particles) into hadron particles, like protons and neutrons to create the atomic nuclei (the nuclear force) of atoms of which matter and energy is comprised. 3) The Weak Nuclear Force is the subatomic interaction that regulates nuclear fission and radioactive decay of atoms. 4) The Electromagnetic Force is carried by electromagnetic fields which produce electromagnetic radiation, like light. It attracts atomic nuclei to orbital electrons binding atoms together. This causes chemical bonds between atoms producing molecules and intermolecular forces. It is the foundational theory for electronics and digital technology.

*Relativistic Quantum Field Theory (QFT)*. It is usually dated 1927 with Paul Dirac's quantization of Maxwell's electromagnetic field. Dirac was 24 years old. QFT unifies Maxwell's classical field theory, Einstein's Special Relativity Theory (SRT), and non-relativistic 'old quantum mechanics'. As to Dirac's 1928 relativistic wave equation—the justly famous 'Dirac Equation'—he used the term relativistic Quantum Electrodynamics (QED) to describe his work. It unified the 'old' non-relativistic quantum theory with Einstein's Special Relativity Theory, and so became the foundation of 'relativistic quantum mechanics'. QED was henceforth an integral part of QFT. Dirac's QED describes not just atomic spectra (electrons), but light quanta/photons as well. The Dirac Equation also predicted the existence of antimatter, and so of the antiparticle of the electron, to wit, the positron which has given us medical PET imaging.

In 1929 a 27 year old Werner Heisenberg (matrix mechanics) and Wolfgang Pauli then established the foundational structure of QFT with the first general theory of quantum fields and the method of their 'canonical quantization'. Quantization is the process of limiting energy to discrete particle-like values rather than continuous wave-

like values. The individual discrete 'light quanta' energy packets we call photons are thus seen as particle-like 'quantized' light waves.

Schrödinger's wave mechanics with its revolutionary 1926 Schrödinger Equation was similar to Heisenberg's matrix mechanics. The two geniuses at first disparaged one another's theories. Later both Schrödinger and Dirac demonstrated that they are mathematically equivalent. Schrödinger's version is more mathematically friendly and is now used exclusively. Dirac's unification of Heisenberg's matrix mechanics with the Schrödinger Equation into a single equation—his profound QED Dirac Equation—thus became an integral part of QFT.

Quantized light is particle-like photons. But matter moves as a series of physical waves. An electron's motion is wave-like; yet at the instant of observation/measurement it is particle-like. Schrödinger's foundational universal wave function equation  $\Psi$  rules the motion of microscopic electrons within atoms, and atoms and molecules, cats, people, stars, and the entire physical universe/multiverse. Universal indeed.

It was not until 1953 that Richard Feynman tamed the unruly QFT/QED 'problem of infinities' with his 'path integral formulation' and a quite uncomfortable 'renormalization' strategy (Dirac called it "bogus"). QFT bloomed as a near complete and hugely successful probabilistic theory with astounding predictive capacity.

Will QFT/QED as it evolves toward perfection, in the fullness of time, quantize even the eternal mystery of great gravity itself resulting in physics' grail quest for a consistent Quantum Gravity Theory (QGT) unifying at long last QFT and General Relativity Theory (GRT)? And then the green grass grows all around, all around; and all's right with the quantum world! Or is it?

Is QFT but another of our perennial objective desire strategies to penetrate and enter in the primordial depths of perfectly subjective reality itself and 'know the mind of God'? Is QFT a relative quasi-objective quantum exercise in search of a perfectly subjective ultimate ontology? Can any objective cognitive strategy measure and conceptually grasp such perfect subjectivity? Will such impudent questions never end?

The probable answer to the first three questions is no. QFT has woefully neglected ontology; and perfect relative conceptual knowledge does not exist. How so? The ultimate nondual Nature of Mind and its arising experience is *ipso facto* beyond the relative dualistic grasp of even the highest virtuosity of mere conceptual understanding. That concepts can grasp the inherently non-conceptual is known to those in the philosophy trade as a 'category mistake'. QFT itself has revealed this perennial wisdom truth. For QFT, truth is relative and stochastic. Ultimate Truth is ignored, or denied, or explained away. Let philosophers of physics reveal a settled quantum ontology, that theoretical and experimental physics may again move forward.

In other words, the great Primordial Wisdom Tradition of humankind has told again and again that our nondual, aboriginal, perfectly subjective awareness-

consciousness that is the ultimate ground of being cannot be grasped by inherently dualistic relative conceptual mind. Try as we may.

However, our perennial desire to unify our hearts and minds with the indwelling Presence of this 'supreme source' of all reality has already lead us to more suitable ontic trans-conceptual contemplative modes of knowing that ultimate ground. Mahayana Buddhism has accomplished such an ontology. (Ch. 3) Trans-rational food for post-quantum thought.

Be all that as it may, quantum mechanics is Quantum Field Theory which is 'quantum measurement'.

*Wave-Particle Duality, Complementarity, and Uncertainty.* What does it actually mean to measure a quantum system of particle-fields? What we find is that the stuff of our emerging spacetime dimension is not at all as it objectively appears. What we see in the quantum measurement of an electron, the foundational particles of physical matter, is not at all the objectively real 'point-like' particle of classical physics. Quantum measurement reveals that the precise location/position and the precise velocity/momentum (momentum is mass x velocity) of a given measured electron cannot be accurately predicted; an insult to the empirical predictive certainty of the noble endeavor of Newtonian classical mechanics. All that quantum measurement can do is to predict the *probability* of finding our diaphanous electron's position/location, or its velocity/momentum, but not both at the same time in the same measurement.

Stranger still, the more accurate a measurement of an electron's position, the less accurate the measurement of its momentum! If we pin down its absolute position we can know nothing about its momentum. And vice versa. This curious situation is not simply that we don't know the electron's exact position or momentum. On the accord of Werner Heisenberg's foundational *Principle of Uncertainty*, they simply *do not exist* simultaneously! Their quantum state is intrinsically uncertain. But it's not that 'everything is uncertain'. There can be absolute certainty as to electron position, and no absolute certainty as to electron momentum that may be ascertained at once, although a precise value for either may be separately certain.

Moreover, a particle's wave function may present as particle position, or as particle momentum, but not both at once. Just so, particles (electrons) present as particle-like, or as wave-like, but not both at once. Niels Bohr's foundational *Principle of Complementarity* clarifies this relation as one of complementary. Quantum entities have pairs of complementary properties which cannot be observed or measured simultaneously. We can set up an experiment to measure the position of an electron, and that excludes the possibility of measuring its momentum. A measuring of position disturbs/changes the value of the particle's momentum. Furthermore, in Bohr's view, subatomic and atomic objects cannot be separated from the measuring instruments. The indivisibility of the 'quantum of action' precludes a definitive separation between the

behavior of a quantum system and its interaction with the measuring instruments. Bohr's complementarity engages this epistemic quantum problem. This 'quantum uncertainty' of which Heisenberg spoke—the quantum Principle of Uncertainty—was for Bohr a manifestation of the more fundamental reality of complementarity, which became in 1927 his lapidary quantum Principle of Complementarity (indeterminacy).

Physicist, cosmologist, and popular author Sean Carroll (Carroll 2019):

The lesson we learned (from the uncertainty principle) was that 'position' and 'momentum' aren't properties that an electron has; they are just things we can measure about it. In particular, no particle can have a definite value of both simultaneously. The same is true for 'vertical spin' and 'horizontal spin'. These are not separate properties an electron can have; they are just different quantities we can measure...The uncertainty principle expresses the fact that there are different incompatible measurements we can make on any particular quantum state.

Both the Uncertainty Principle and the Complementarity Principle apply to the nature of a quantum 'eigenstate', not to the physical act of measurement itself.

*The Schrödinger Wave Function.* A wave function is a mathematical entity that yields a probability distribution, by way of the Born Rule, for each possible 'superposed' measurement outcome of a quantum system. Therefore, ultimately there is only the prodigious singular *universal quantum wave function*  $\Psi$  of the Schrödinger Equation. It describes the motion of matter as wave-like. It rules QFT, the unity of both quantum mechanics and Special Relativity. It works with both relativistic and non-relativistic equations.

The Schrödinger Equation provides a means to calculate the wave function of a quantum system and how it evolves dynamically in time. The spacetime particles and fields of appearing physical reality are an oscillating wave function evolving in classical real time (t). And the propitious 'double slit experiment' demonstrates objectively that the wave function is not just a theoretical conjecture. There's something 'real' in it that accurately describes the motion of micro-physical and therefore macro-physical spacetime stuff as it emerges from the ineffable ground of being.

How shall we interpret this mysterious universal wave function  $\Psi$ ? Does it represent an objective observer-independent 'real world out there' (RWOT), whether or not an observer is measuring it; or merely the subjective observer-dependent experience of the 'consciousness' of an observer? Niels Bohr and the Copenhagen Interpretation view  $\Psi$  as a mathematical probability of the wave function 'collapse' into an objective definitive quantum 'eigenstate'. There is here no presumption of an existing reality. This



'antirealist', 'operationalist' view opposes Einstein's classical (non-quantum) 'local realist' view; that nature is not utterly random. "God does not play dice with the world". Einstein argued with Bohr for twenty years that Schrödinger's universal quantum wave function fails to provide a complete physical description of appearing reality; therefore quantum mechanics is not wrong, just incomplete. There's something missing, a "hidden variable" that explains the wave function in a local realist way. Reality cannot be only the quantum wave function. There can be no one-to-one correspondence between  $\Psi$  and the nature of spacetime reality. For Einstein and Bohm, and the acolytes of Scientific Local Realism quantum mechanics is incomplete as a description of appearing spacetime reality.

Thus the real meaning of the Schrödinger Equation and the actual relation of its mathematical entities to our physical spacetime realities is a question of which of the many incomplete 'quantum mechanics interpretations' we choose. Bohr's Copenhagen Interpretation is the original default view. We shall glimpse some of the others below. None of them addresses the ontic elephant in the room, namely, in what, or in whom does the universal quantum wave function with all of this spacetime stuff arise?

As physics and Buddhism continues its felicitous dialogue we shall see a new Middle Way foundational quantum interpretation arise in which  $\Psi$  is seen as a mathematical description of an observer-independent, *relative* locally really real existing spacetime reality emerging within an observer-dependent, formless, vast, nonlocal, *ultimately* nonexistent primordial awareness-consciousness 'groundless ground'. I have suggested the rudiments of such a program below.

A quantum wave function may be an 'eigenvector' of an 'observable'—a particle's position, momentum, energy, and spin—in which case it is called a quantum 'eigenstate'. The eigenvalue represents the value of the observable of a given eigenstate. A linear combination of such eigenstates constitutes the 'quantum superposition' of all possible eigenstates. When an observable is subjected to an objective quantum measurement by a conscious observer the subjective wave function superposition somehow 'collapses' into an objectively 'real' eigenstate. The measurement result will be one of its eigenvalues with a probability expressed in accordance with the Born Rule. Although the post-measurement wave function cannot be known prior to measurement, the probabilities can be accurately calculated and predicted using the Born Rule.

Well then, what has this spooky mind-boggling quantum wave function ever done for us? How about computers, smart phones, the internet, laser communications, GPS, MRI scans, atomic clocks, microwave ovens, guided missiles and nuclear bombs. A mixed bag of quantum benefits, to be sure.

The Born Rule (1926) named after Einstein's philosophy mentor Max Born, is an integral postulate of quantum mechanics that gives us the *probability* that the measurement of a given quantum system will yield a result that is proportional to the square of the magnitude of that particle's wave function at that point in classical time.

That the Born Rule can be derived from the radical Many Worlds interpretation (MWI) of quantum theory remains controversial.

So, the Born Rule applies to all of our primary foundational 'quantum mechanics interpretations' except perhaps the MWI.

Hence, particle position and momentum are the classical physics expression of Schrödinger's all-inclusive universal quantum wave function ( $\Psi$ )—the quantized unity of the point-like particles and their fields of a bygone classical mechanics.

Local Realist Einstein hated it. He was intuitively certain that quantum mechanics was 'incomplete'; that the quantum wave function merely demonstrated that something was missing in the quantum probabilistic theory, some overlooked "hidden parameter" or "hidden variable" that would restore our ontologically comfy old deterministic, non-random, causal, non-stochastic classical view.

Einstein hated was the Uncertainty Principle of Heisenberg, that God would 'play dice with the world'; but mostly he hated quantum 'spooky action at a distance' that was quantum nonlocality/entanglement, which violated his Special Relativity Theory (SRT) prohibition on the finite speed of light. How in heaven and earth can a quantum system of two entangled particles 'space-like separated' by many light years 'know' its partners' spin state instantaneously? After all, the speed of light is finite.

Einstein and his philosophical nemesis Niels Bohr argued this point in the legendary Einstein-Bohr EPR Debates for decades. For Herr Professor Doctor Einstein the quantum wave function  $\Psi$  was not but an expression of our present ignorance of the 'deeply hidden' nature of appearing spacetime reality. He believed this to the end.

Therefore, the emergence of spacetime reality is fundamentally a wave, the quantum wave function. But when we consciously observe it through a quantum measurement apparatus it appears as a particle. Particles move through space as waves. When we measure them they display their particle nature. Thus, every quantum entity may be described as either a particle, or a wave. At first it seems that

We have two contradictory pictures of reality;  
separately neither of them fully explains the  
phenomena of light (electromagnetic radiation),  
but together they do. (Einstein)

Physicists understand this complementary nature of light as the *wave-particle duality*. It expresses the inability of the concepts of 'particle' and 'wave' in classical physics to describe the diaphanous probabilistic nature of quantum entities and states.

All elementary micro-particles display a wave-like nature, and all waves display a particle-like nature. This is true as well for macroscopic atoms and molecules, trees and stars. This 'duality paradox' is fundamental to the very nature of spacetime reality; and it is the foundation of the formalism of Quantum Field Theory (QFT) with its

Quantum Electrodynamics (QED). Elementary spacetime particles interact through their wave-like fields. These nonlocal fields—magnetic, electric, and gravitational—pervade all of spacetime. Indeed they *are* spacetime.

Thus does classical scientific certainty about point-like particles and field-like waves become a single universal quantum wave function. For QFT the universe of space and time are simply that. The nature of matter/energy is a spooky cosmic quantum '*cloud of probability*'. This formless indefinite mass is not other than the monumental universal quantum wave function' ( $\Psi$ ), a 'probability wave' that evolves in real time. Form is quantum emptiness; quantum emptiness is form. We shall see that this view closely parallels Mahayana Middle Way Buddhism where, as the Buddha told, "Form is empty; emptiness is form".

Schrödinger assigned a 'wave amplitude' number for every possible measurement result of a particle's position and/or velocity. Before a quantum measurement all of these possibilities 'exist' in a subjective 'superposed' potential state of what I have termed quantum emptiness. At the instant of an observation-measurement by the 'consciousness' of a sentient observer the wave function instantly 'collapses' into a 'locally real' objective spacetime reality. This is known as the 'collapse postulate' of QFT. Note that 'collapse' is *caused* by the human consciousness of an observer-experimenter. As Eugene Wigner has told, "Consciousness causes collapse."

The five essential questions for quantum mechanics are then: 1) What constitutes a microscopic quantum measurement? 2) How is it that such a measurement appears to 'disturb' or change the data being measured? 3) What is the role of human consciousness in this quantum measurement process? 4) How are micro-measurements of electrons related to macro-phenomena, like trees, stars, and conscious beings? 5) What will a settled quantum ontology that describes the interdependent interconnectedness of human consciousness to its primordial awareness-consciousness ground actually look like?

These persistent and as yet unanswered questions arise from the '*quantum measurement problem*' which has, as we have seen, created an entire quantum physics sector—the 'Foundations of Quantum Mechanics' or 'the interpretation of quantum mechanics'—which include the 'consciousness causes collapse' (of the quantum wave function) theories, and the ultra-spooky 'Many Worlds' interpretation. We need a quantum metaphysical ontology that transcends yet includes the waning classical metaphysic that is the objective Scientific Local Realism paradigm.

The history of philosophy has clearly demonstrated that reality is not as it appears. Quantum mechanics is no different. QFT shows that what we observe is not at all what is. Relative 'classical' human perception and conception of phenomenal reality is *prima facie* illusory, just as Greek, European, Hindu, and Buddhist philosophical Idealism has told for 25 centuries. But QED does not reveal the *ultimate* underlying ontological ground of emerging spacetime. We require a metaphysically robust view of

the essence and nature of the ultimate original ground of our appearing relative spacetime realities, including the mathematical formalism of the quantum wave function. Such formalist *relative* cognition does not constitute an *ultimate* quantum ontology. In what, or in whom does the wondrous universal quantum wave function arise? If  $\Psi$  is 'universal' an ontology is required to illuminate and to ground it.

So, let quantum theory continue with its formalist relative calculations. But let it not fail to observe the ontic elephant in the room, namely, the non-classical ultimate nature of the reality that its wave function calculations presume to describe.

We need to know how a theory of micro-phenomena maps onto our relative conventional macro life-world, and the ultimate ontic foundation of that world. Let quantum mechanics make a 'quantum leap' out of our cognitive classical biases and classical textbook quantum mechanics—our deep cultural background local realist 'global web of belief'; and out of its mathematical quantum formalism—into a post-formal, post-empirical ultimate foundational ontology.

We have seen that until quantum physics produces such a settled quantum ontology there will be no Quantum Gravity Theory (QGT) to unify modern physics—to quantify 'that which is deeply hidden' in the great mystery of gravity—the Bhagavad-Gita's "creator and destroyer of worlds". Somehow the secret of the nature and essence of gravity lies hidden in the dark recesses of QFT.

Hence, QFT has indicated that micro and macro spacetime stuff does not truly exist until it is observed by a consciousness, whether an individual awareness, or by natural extension, when there are no sentient beings about to observe the universe, by the all-pervading perfectly subjective primordial awareness ground itself, vast whole in which all objective appearing spacetime reality manifests and is instantiated.

Broadly construed, the QFT view is known to the quantum philosophy trade as 'Antirealism'; although few quantum physics practitioners have made this subjective 'leap in fear and trembling' (Kierkegaard) from the objective consciousness of an individual observer to the original primordial awareness-consciousness whole itself in which, or in whom the whole process of observing subject and its objects observed arises and participates.

The metaphysical ontology of Antirealism aligns itself with perennial Philosophical Idealism in its many vestments, the metaphysical view that arising and appearing reality is founded and grounded in the ontological priority of mind, or awareness-consciousness over against physical matter. Mind over matter. The Buddhist Mahayana *Yogachara Madhyamaka* school with its 'Mind Only' (*chittamatra*) view represents Buddhist Idealism. Western Idealism is perhaps best represented by German Idealism—Hegel and Kant.

A bit ironically Bohr's Copenhagen Antirealism of relativistic Quantum Field Theory (QFT) is a proto-Idealism that opposes the prevailing Scientific Materialism/Physicalism of modern 'classical' science. These habitually realist and

materialist minds—only recent residents of the Quantum House—are still trying to cram the nonlocal antirealist freedom of the quantum into an old procrustean bed of Scientific Local Realism. The sad result is that the grail quest of modern physics for a Quantum Gravity Theory that unifies the two hitherto mathematically incommensurable pillars of physics—the QFT/QED of Dirac and Feynman, and Einstein's General Relativity Theory (GRT)—has been utterly stalled.

Caveat Lector: From the metaphysical ontology you choose arises the phenomenal reality you deserve. What you think is what you believe, is what you do, is what you get. Well, that's inexorable karma for you. Ontology is always here now.

*Bell's Theorem: Spooky Action at a Distance.* John Stewart 'Bell's Theorem' is arguably "the most profound discovery in science in the last half of the 20th century." (Steven Weinberg) Bell's Theorem 'proves' spooky quantum superluminal (faster than light) universal nonlocality/entanglement/interconnectedness. Quantum Theory predicts that entangled quantum systems violate Local Realism which holds that all particle-fields have definite properties and locations for any possible measurement; and interactions between particle-fields cannot exceed the speed of light. Thus does Scientific Local Realism stand refuted as an ontology for spacetime existence. Bell and the many experimental confirmations of his theorem have demonstrated that Niels Bohr was correct about 'spooky' nonlocality/entanglement and Einstein's classical Local Realism was incorrect in their legendary EPR (Einstein, Podolsky, Rosen) debates. Einstein hated it.

Our relative spacetime reality is pervaded by an ultimate primordial universal interdependent connectedness! Name it as you will. Spacetime physical reality is 'ontologically relative'. It is established, even 'created' by sentient perception and observation. Physical objects exist by way of the sentient consciousness of a sentient observer; and there 'exists' a basal causal matrix ground that subsumes and in which, or in whom everything abides in a relationship of interdependent interconnectedness. *Kosmos* is observer-dependent, and ontologically nonlocally entangled and interconnected! As H.H. Dalai Lama told, "Emptiness (Buddhist or quantum) is established by conceptual minds." Ontological relativity indeed.

So, we now have an incipient ultimate quantum ontology that transcends yet includes relative quantum formalisms. When will philosophical interpreters derive a settled post-formal ontology that unifies the conceptual in the trans-conceptual of quantum theory and praxis? Bell has provided the data on which to construct such an ontic foundation. Such an ontology requires that we surrender our local realist biases. Thus do we enter our emerging 'scientific revolution' that is nothing less than a paradigmatic 'noetic revolution in science, culture, and spirit'.

So, nonlocal entangled quantum emptiness parallels Buddhist emptiness/*shunyata*. As Buddha told, "Form is emptiness; emptiness is form." Quantum

local form may be viewed as quantum nonlocal emptiness. There is no ultimate separation! Form and emptiness are a prior ontic unity. Quantum Field Theory admits of 'no boundary' between the microscopic dimension of particle-fields and the macroscopic dimension of the physical reality of all of us bundles of particle-fields.

Thus does post-Bell's Theorem Quantum Field Theory offer a bridge between relative objective Science and its ultimate perfectly subjective primordial awareness-consciousness spirit ground. Yes. These aboriginal Two Truths—relative form and its ultimate formless awareness 'supreme source' ground—are always already a prior ontic and phenomenally present indivisible unity. The relative parts are in the ultimate. There is no inherent separation between Science and Spirit; try as we may to split them. This is the emerging scientific and soteriological (enlightenment, salvation) View.

However, this primordial quantum "lucid mysticism" (Pauli)—universal nonlocal quantum interconnectedness—does not mean that quantum mechanics 'proves' the mystical holism view of our Primordial Wisdom Tradition. Our non-conceptual Primordial Awareness Wisdom (*jnana, yeshe, gnosis*) cannot be derived from, or verified by conceptual/mathematical quantum electrodynamics. These are parallel views. The concepts of the dimension of relative Science cannot 'prove' the trans-conceptual direct experience of the dimension of ultimate Spirit in whom it arises. Nondual Spirit is ontologically prior, yet embraces the dualistic domain of Science.

Therefore, recent relativistic quantum theory—QFT/QED with its bizarre nonlocality/entanglement connectedness—is based upon the now nearly universally accepted 1964 'Bell's Proofs' of the great Irish physicist John Stewart Bell. 'Bell's Proofs' have been verified by eighteen 'Bell test' laboratory experiments—from 1972 to 2019. All of the 'Bell test loopholes' have now been closed. All have found that the hypothesis of possible 'local hidden variables' developed by Einstein, David Bohm, and others to save classical Metaphysical Local Realism from the dragon of antirealist quantum mechanics cannot be correct.

The counterintuitive quantum mechanics of QFT is proven by Bell's Theorem to be inherently correct. And quantum theory, in some formulation is here to stay. Moreover, Bell's Theorem has shown that any future quantum theory theme variation—and there will be several as the theory evolves toward nonduality—must necessarily describe our world of space and time as universally nonlocal and interdependently entangled. In short, the prodigious quantum theory must represent a physically real reality that is intrinsically, ultimately interconnected, interdependent, inseparable, and indivisible. In a word, nondual.

What was it that inspired Bell's Theorem?

Theoretical physicist David Bohm attempted to prove that his friend Einstein's 'hidden variables' represented a realist, physicalist, deterministic viable alternative to the indeterminate 'spooky action at a distance' (quantum nonlocal entanglement) of quantum mechanics' universal wave function global quantum connectedness. Bohm

denied wave function 'collapse', as well as the bizarre 'branching' or splitting of worlds of MWI. Yet Bohm's holism affirms the universal connectedness, interdependence, and indivisibility of both the subatomic world, and the macro world of trees and stars and self-conscious beings. (Boaz 2021b) It was this brilliant effort, along with the Einstein-Bohr EPR debates, that inspired John Bell to derive his now famous Bell's Theorem. He began by attempting to prove the possible existence of a deeply hidden variable that would save the classical Local Realism of Einstein and Bohm. What he discovered changed our worldview forever.

We've seen that Bell's Theorem has demonstrated that quantum nonlocal (faster than light speed) entanglement—Einstein's "spooky action at a distance"—actually obtains in nature. A 'hidden parameter' to refute quantum nonlocal entanglement with its global interconnectedness cannot mathematically exist! Classical physics' local realist 'separability' of physical objects stands refuted. An event/cause occurring anywhere on earth can instantaneously produce an event/effect elsewhere on earth, or in deep space, without any physical electromagnetic force/signal to connect them. For example, a quantum measurement executed on earth may instantaneously, superluminally cause an effect in a galaxy far away, violating Einstein's second postulate of his Special Relativity Theory (SRT) as to the finite velocity of light. Quantum universal indivisible interdependent interconnectedness indeed. Madhyamaka Middle Way Buddhists agree.

Clearly, such a view casts a pall over the essential scientific principle of causality—cause and effect—the very foundation of the methods of Science, and of Scientific Local Realism. A scientific sticky wicket indeed. You can see the cause for concern by Einstein and Bohm, and the entire assembly of classical scientific local realists. So, the desperately needed 'hidden parameter' to restore real sanity to science is permanently *kaput!*

In other words, Bell's Theorem and its many subsequent experiments demonstrate that quantum nonlocal entanglement is instantaneous! A photon in an entangled quantum system of two photons 'knows' its 'space-like' separated partners' spin state on Alpha Centauri directly and immediately without having to wait 4.37 'time-like' light years for verification.

However, two conscious human observers attempting to measure such superluminal photon behavior, one on the earth and one on Alpha Centauri, may only become aware of the photon signal result at the speed of light. They must wait 4.37 light years for the physical result; a prime exemplar of the quantum 'measurement problem'.

There is no logical or empirical proscription on embodied human beings with 'highly advanced' subjective contemplative minds—'omniscient' Buddha's for example—to spontaneously 'know and feel' many superposed quantum consciousness states simultaneously. Such an inclusive all-pervading nondual mind would remain free of any dualistic quantum measurement problem. On the accord of the great

Primordial Wisdom Tradition of humankind such omniscient embodied *buddic* minds have existed in this and other worlds almost forever.

But don't believe this. It's clearly beyond belief; transcending the limit of mere human concept and belief. Gautama the Buddha of this present age told it well: "Do not believe what I teach...come and see (*ehi passika*)."

Subjective contemplative cognition is such a post-semiotic, post-empirical wisdom technology. We prepare for such a cognitive quantum leap by training conceptual mind in the relevant contemplative philosophical foundation, as we are doing here. Indeed, for scientists of all stripes, engaging the far out spooky metaphysics of the prodigious universal quantum wave function with its natural conceptually ineffable measurement problem is the most reasonable preparation for super-spooky post-quantum nondual wisdom. Meanwhile, we 'bracket' our still classical realist quantum cognitive biases and proceed to post-rational contemplative mindfulness meditation under the guidance of a qualified meditation master.

This wisdom adventure is definitely not for the metaphysically squeamish! Understandably, most 'scientific minds' have chosen to remain in the comfy cognitive cabin that robust reason built in a dense forest of cognitive uncertainty. After all, 400 years of European Enlightenment (the Age of Reason) rationality can be habitually quite persuasive.

Be that as it may, this is all little more than conceptual self-stimulation before actual trans-conceptual practice is mindfully established. Course minds have a contemplative 'hidden parameter' already present within the Nature of Mind itself. Yes, Buddha told, "Come and see."

Moreover, from an Everettian MWI view, an all-pervading omniscient *buddic* mind abides in, and is always already in a state of nondual unity with all possible wave functions in all possible worlds; all of this embraced and included in the *ultimate* dimension of the primordial awareness-consciousness ground itself, Bohm's "vast implicate order of the unbounded whole" in which or in whom this *relative* spacetime dimension arises and appears to the 'many worlds' of ordinary dualistic mind.

Please recall that many subsequent experiments since 1964 have removed all of the possible 'loopholes' regarding Bell's Theorem. (Scientific American Dec. 2018; Special Spring issue 2019) Bell's Proofs have now become quantum orthodoxy. How it is that this perplexed orthodoxy integrates such post-empirical, even nondual global quantum connectedness with 'old paradigm' Scientific Local Realism and Scientific Materialism/Physicalism remains to be seen. We need a new 'interpretation' or 'foundation' of quantum mechanics that dares to tread the path of our nondual primordial wisdom to which it has been pointing from the beginning. It's a big step.

Bell's Theorem rests upon three metaphysical assumptions of modern classical physics: 1) *causality* is local, effects follow their causes and must be proximate in space and time to their causes; 2) *determinism*: all physical events are pre-determined by an



external physical force; 3) *locality*: no measurement may have more than one result in any given spacetime location in which the measurement is made—the 'one world' stipulation. Causal results happen in the local world in which they are made, and not elsewhere. If Bell's Theorem is true, then QFT is correct and at least two of these three assumptions must be false. How is this so?

We've seen that quantum entanglement/nonlocality demonstrates that in a quantum system consisting of a pair of measured 'entangled' particles, each particle causally effects the other, even when the two particles are 'space-like separated'—not connected by a causal electromagnetic (light) signal—by hundreds of light years. Such counterintuitive, inscrutable 'spooky' (Einstein's term, *spukhaft*) noncausal, nonlocal quantum behavior clearly violates both 1) and 2) above—locality and local causality—for it shows that entangled particles can effect one another's measured states (e.g. spin-up or spin-down) under *nonlocal, acausal* superluminal—faster than light—conditions. And this violates Einstein's sacrosanct second principle of relativity, namely, that the velocity of light is finite.

Clearly, we need a bit of quantum therapy to assuage our anxious cognitive dissonance, and our ontopathological fear of nonexistence.

*The Many Worlds Interpretation.* My own cognitive biases being as they are, far too many quantum physicists and cosmologists now believe that the fundamental local causality and Scientific Local Realism that we have come to know and love can only be salvaged by adopting an even spookier and more surreal, radically objectivist and deterministic Many Worlds Interpretation (MWI) of Quantum Field Theory (QFT/QED) and its universal quantum wave function  $\Psi$ .

MWI was developed by Hugh Everett in a 1957 PhD dissertation under the supervision of great gravitational physicist Archibald Wheeler, and popularized by physicist Bryce DeWitt in the 1960s. (*Appendix D*) MWI rejects (3) above—the 'one world' stipulation of classical physics.

MWI begins with the ontological/metaphysical assumption or presupposition that the forms of emerging spacetime existence is "entirely physical", or reducible to purely physical brain. "Many Worlds quantum mechanics is a quintessentially mechanistic theory." (Carroll 2019) It is fundamentally an observer-independent 'reductive physicalist' ontology. Arising spacetime stuff objectively exists as a purely material 'real world out there' (RWOT), whether or not it is observed by a conscious observer. Thus is MWI immersed and encaged in the classical dogmas of Scientific Local Realism, and Scientific Metaphysical Materialism/Physicalism. Clearly, this 'web of belief' is an exemplar of the classical ontology that is Metaphysical Local Realism. We shall see that if this be Realism, what remains of Realism? Well then, what is Realism?

'Scientific Local Realism' includes both 'Direct Realism' aka 'common sense Realism' or 'naïve Realism', and the subtler 'Indirect Realism' or 'Representative

Realism' or 'Representationalism' where we perceive reality not directly but via perceptual representations called 'sense data'. Realist ontologies generally oppose the ontological views of Antirealism and of philosophical Idealism where the substantial physical world is not a physical process as 'scientific' reductionist physicalists believe, but ultimately a monism of the mental, or 'mind only', an illusion (*vidya maya*) created by mental process.

Please understand that all of these ontologies that arise in the noble trade of Philosophy of Mind and its more recent cognizant issue known as Philosophy of Consciousness are entirely trans-empirical metaphysical speculative theoretical systems of concept and belief. There exists not a whit of either logical or empirical 'proof' for any of them; not even our 'naïve common sense Realism' certainty in the belief of a solid permanent RWOT. Professional philosophers are quite aware of this. Perennial metaphysical realist philosopher and logician Bertrand Russell (*Principia Mathematica*) referred to this bit of common reality conjuring as "The metaphysics of the Stone Age". Or, more correctly, since the Realism and Physicalism metaphysic arose in the Near East with the 'proto-Semitic' tribes circa 15th century BC or earlier we might choose to call it "The metaphysics of the Bronze Age".

That Scientific Local Realism admits of no compelling empirical grip may explain how it is that physicalist physicists fear philosophy, and the especially scary 'philosophy of consciousness'. Is it not now clear that Science, and especially quantum physics and quantum cosmology must at long last address the ontological elephant in the room, namely, a settled ontology of the universal quantum wave function? The many 'interpretations of quantum mechanics' are philosophical attempts to do just that. Strangely, MWI is a leading contender for that honor.

In any case, realist/physicalist MWI asserts that Irwin Schrödinger's inherently subjective universal quantum wave function ( $\Psi$ ) is objectively real and so there is no 'wave function collapse' into an objectively 'real world out there' (RWOT) at the instant of an observer's quantum measurement. The wave function of the entire universe is already objective and purely physical. The vexing 'quantum measurement problem'—how, or if, wave function collapse occurs—is resolved! For MWI the orthodox quantum 'wave function postulate' is altogether denied. All possible 'superposed' observations/measurements are actualized in one of many possible worlds or parallel universes. Suppose I measure an electron as spin-up rather than spin-down.

All other measurement outcomes still exist and are perfectly real, just as separate worlds...Both parts of the final wave function are actually there. They simply describe separate, never-to-interact-again worlds...The wave function of an electron can put it in a superposition of various possible locations, as well as in a superposition of spin-up and spin-

down...each part of the superposition (is) a separate world.  
—Carroll 2019 p. 114

In one world Schrödinger's poor little cat is dead; in another world the lucky cat is alive. Two cats, two separate non-interacting worlds. No problem. Beyond belief? Yes. Logically consistent? Yes. What's going on here?

For MWI there exists a real world in which I choose a 2004 Romanée Conti with my dinner; and an equally real world in which I choose a 1978 Chateau Mouton Rothschild for the same dinner. At the instant of choice all other equally real universes are closed to me. I am now a wave function participating in the evolution of the perfectly objective universal quantum wave function  $\Psi$ . I exercise no spooky free will consciousness because all of my choices may actually happen in some alternative universe. There are now many copies of me; one in each of all possible real parallel universes. For every quantum event a separate real world 'branches' or splits off that is precisely the same world, but in that world the quantum event did not actually happen. I am, by theoretical formal fiat, precluded from experiencing any of these other many worlds.

Therefore, sadly, I cannot enjoy both wines in two worlds simultaneously. Just as well. Such a reality would surely qualify as wretched excess in any world.

This mega-pluralistic ontology of the MWI view of QFT with its many parallel 'alternate universes' constitutes a wholesale multiplication of reality-slice entities that desperately needs an 'Occam's Razor' antidote, to wit, "Entities must not be multiplied without necessity." When considering competing hypotheses about the same result the best solution is usually the one with the fewest assumptions. It's a pragmatic, extra-evidential heuristic guide rather than a final arbiter among competing theories. This old bromide, known to the wise as the 'Principle of Parsimony' has rescued many a theoretical explanation from scientific and philosophical oblivion. As Einstein told not so long ago, "Everything should be made as simple as possible, but not simpler."

Confused and perplexed by MWI? If so, rightly so. There are many questions for the Many Worlds Interpretation.

For MWI is there a single spacetime or even formless ontic universal ground in which all these separate branching non-existing many worlds exist? If so, how? Do any of these many worlds possess any shred of existence other than a hypothetical posit of their nonexistence? Why Physicalism? Is everything purely physical by mere ideological stipulation? What if anything saves the theory from the nihilist ontic extreme of utter nonexistence of any worlds at all? What constitutes an observation that splits one world from all others? What is a choice? MWI "is purely physical and mechanistic", so what is the physical mechanism that causes the branching/splitting? Mereologically, parts are perforce included and subsumed by a greater, more inclusive Whole. What is the relation of an infinity of many 'non-existent' worlds to the boundless primordial

awareness-consciousness whole in which this all arises? Is such an all-subsuming perfectly subjective ground conceptually, theoretically reduced to the purely objective wave function itself? What is the ground in whom this all arises?

Ontic and epistemic problems abound. Does MWI create more ontic, epistemic, and phenomenological problems than it solves? There's plenty of separability in MWI. But no unified ontology. Mere logical consistency of an otherwise dubious and wholly ad hoc, unbelievable metaphysical belief system should not presume to be an adequate quantum foundational ontology. Ostensibly MWI salvages physicalist Local Realism. But at what cognitive cost? The doctrine stipulates an adventitious infinity of duplicates of a real local quantum observer. Can such a belief really qualify as Scientific Local Realism? If so what remains of the credible non-entangled Local Realism of Plato, James, Russell, and Einstein? MWI does more epistemic harm than good.

MWI replaces observer-dependence in the quantum measurement and observation of observer-dependent wave function collapse with observer-independent local 'quantum decoherence and branching' (of the wave function); that is, the loss of quantum coherence as observer and measuring apparatus interact and couple in the process of a measurement in real time. Sean Carroll again (2019 p. 119):

That simple process—macroscopic objects become entangled with the (measurement) environment which we cannot keep track of—is decoherence...Decoherence causes the wave function to split, or branch into multiple worlds. Any observer branches into multiple copies along with the rest of the universe... In one of those worlds the experimenter will have seen spin-up and in the other they will have seen spin-down. But both worlds are indisputably there...The price we pay for such powerful and simple unification of quantum dynamics is a large number of separate worlds.

And that's a big price. So, quantum decoherence is crucial for MWI. It is the cause, not of a collapse, but of a branching of the quantum wave function into many separate worlds. The coherent information in an entangled quantum system 'decouples' or 'leaks' into the instruments and measuring environment as quantum coherence decoheres. So, it is argued, there need be no 'problem of observer consciousness'. With no wave function collapse by a sentient consciousness there is no need to posit such a consciousness. The spooky subjectivity of consciousness is altogether 'explained away' by a highly speculative 'separate worlds' denial of human consciousness altogether. Wow! If this be quantum ontology, God deliver us from quantum impudence.

MWI grounds its physicalist denial of 'something deeply hidden' in consciousness in the purely local realist and materialist presumption that, as Professor Sean Carroll has told in his excellent best seller *Something Deeply Hidden* (2019):

Consciousness arises from brains...or 'nervous systems' or 'organisms'. These are assumed to be 'coherent physical systems'...conscious observers branch (into parallel universes) along with the rest of the wave function.

So, for MWI the receding 'classical paradigm' metaphysical physicalist assumption of physics and neurobiology that "Consciousness arises from brains" is an essential pillar of the theory. But does it?

Philosophical Idealism—perhaps the primary ontology of our great Primordial Wisdom Tradition (Eastern Hinduism, Buddhism, Taoism; and the Western mystical voices of Judaism, Christianity, Islam)—asserts that the *ultimate* nature of arising appearing reality is not merely the conspicuous and indisputable appearance of *relative* physical spacetime stuff, including the structure and function of physical brains. Rather, the nondual ultimate nature of mind and its experience is fundamentally 'Big Mind', the all-pervading ground, primordial awareness-consciousness itself in which, or in whom 'Small Mind' human consciousness with its big physical brains, along with the all the rest of physically real quantum stuff arises, participates and is instantiated.

There are non-idealist, realist, and dualist ontologies in each of the above wisdom traditions. Mahayana Buddhism has found a 'Middle Way' Two Truths view that affirms both a *relatively* real and existent spacetime that is *ultimately* nonexistent.

Has Sean Carroll failed to understand the ontological depth of Metaphysical Idealism in his consideration of it (p. 223-224)? Has he failed to fathom the depth of primordial awareness-consciousness itself—that very "something deeply hidden"—whence emerges these many "quantum worlds" of spacetime by limiting it to mere human brain consciousness (pp. 219-225)? Unfortunately, such is the standard orthodox 'scientific' understanding, encaged as it is in a waning classical old knowledge paradigm that is the foundational dogma of Scientific Local Realism, and mechanistic Metaphysical Scientific Materialism/Physicalism.

If present quantum mechanics—QFT/QED—is to evolve into its next more inclusive knowledge paradigm it must openly and assiduously engage the ontological questions of 'consciousness' in all of its depth. This means that interpretations of the universal quantum wave function—all of them inchoate ultimate ontologies—that ideologically adhere to a purely mechanistic Physicalism must, as David Hume told, "be committed to the flames for it is nothing but sophistry".

Fear of a physics' post-empirical, post-Core Theory nondual ultimate ontology, with its reflexive dualist denial mechanisms, constitutes an intellectual failure to courageously engage such a providential ontology by way of *both* objective conceptual/mathematical theory and praxis, and super-spooky subjective direct contemplative practice and experience (*yogi pratyaksa*). Yes, we must engage both voices of our innate human noetic cognitive doublet—both faces of gnosis, both Science and Spirit. The ideological exclusion of either of these reality dimensions is a recipe for human ignorance (*avidya, ajnana, hamartia/sin*). Our knowledge, wisdom, and human happiness is at stake. As Plato told so long ago, "For no small matter is at stake here; the question concerns the very way that human life is to be lived." (*The Republic*, Book I)

Perhaps the buddhas, *mahasiddhas*, saints, and sages of our great wisdom traditions have wisdom to share that will illumine our quantum ontic grail quest for the ultimate nature of nondual reality itself. Perhaps we might view the monumental universal quantum wave function as an inchoate conceptual ontology for that nondual ultimate nature of mind/consciousness—bright indwelling Presence of That—that is always already present within every human being, even the Many Worlds acolytes.

Let us then expand our view of 'consciousness' from the ontic and epistemic limit of a 'purely physicalist mechanistic' MWI, that we may better understand this ultimate 'Nature of Mind' that we are in its greater, all-embracing, all-inclusive context.

In the primordial wisdom (*jnana, gnosis*) view it is the "deeply hidden" *ultimate*, formless all-inclusive awareness-consciousness ground itself, by whatever grand name, in which or in whom human consciousness, and indeed all *relative* conventional spacetime physical and mental form arises and participates. Embodied physical brain is ultimately enfolded in that timeless formless ground while continuously unfolding and 'emerging' in relative space and time. This remarkable process is experienced by way of the brain's physical neuronal processing and operations.

To be sure, human consciousness has its 'neural correlates' in physical brain. Yet clearly, from that physical fact we cannot conclude that human "Consciousness arises from brains". Perhaps it is the other way round. In a larger more inclusive view the awareness of physical brain, and everything else arises from its all-subsuming awareness-consciousness ground.

Hence, we shall conclude that human consciousness does not *ultimately* arise from, nor is it caused by relative physical brain nor a central nervous system. Brain, human consciousness, and the whole world of spacetime form, including the universal quantum wave function arise from timeless, formless primordial awareness-consciousness ground itself, by whatever name. Again, Schrödinger's prodigious quantum wave function is an inchoate conceptual/mathematical approach pointing to basal nondual ultimate ground. Quantum mechanics can no longer dodge an ultimate ontology that engages both its voices—objective relative, and subjective ultimate.

In Mayayana Buddhist philosophy this ultimate ontic and relative epistemic mereological (part-whole relations) relation is known by way of our aboriginal Two Truths trope—the relative truth of form (*dharmata*), physical and mental human experience—'emerging' within, and never departing, its formless basal ultimate primordial base (*gzhi rigpa*) or ground (*dharmakaya*). Perhaps it is this nondual 'supreme source' that is that very "something deeply hidden" of Einstein, Bohm, Carroll, and Quantum Field Theory. I believe that it is. (Boaz 2020 Ch. V)

*The Quantum Wave Function and the Primordial Wisdom Ground.* Thus it is, the prodigious universal quantum wave function  $\Psi$  of our emerging spacetime reality dimension is a dualistic, relative, conceptual/mathematical description of Einstein's "something deeply hidden", that infinite nondual ultimate truth dimension (*paramartha satya*) that is the formless, selfless primordial awareness-consciousness ground in whom all the worlds arise. That vast all-pervading boundless cognizant consciousness whole abides utterly beyond the conceptual and mathematical grasp of our human consciousness arising and participating therein. All the love-wisdom masters have told it. The nondual Ultimate Truth that is the very Nature of Mind, 'Big Mind', cannot be grasped by Relative Truth, the dualistic conceptual cognition of 'Small Mind'. Try as we may. That it can is an exemplar of a philosophical 'category mistake', as we have seen.

Yet, "wonder of wonders", this noetic nondual ultimate wisdom may be recognized, then realized by way of our indwelling contemplative Christ-Buddha mind (*christos, buddhajnana*). Bright always already present nondual primordial Presence of That (*tat, sat*).

Yes. Primordial awareness wisdom (*jnana, gnosis*) is already innately present to trans-conceptual direct contemplative human cognition, the *yogi pratyaksa* of the well-trained mind. That that is 'deeply hidden' to human conceptual cognition is revealed, breath by mindful breath, to our direct contemplative cognition. That love-wisdom mind "energy is eternal delight". (William Blake).

Fraught 'scientific' denial of this subtle voice of our human noetic cognitive doublet—objective conceptual and subjective contemplative—is no longer possible for an authentic inquiring mind. Now we know better. Indeed, all of the antinomies of both classical and quantum consciousness have pointed to this great syncretic truth, yet we have chosen to remain encaged in our prior 'scientific' "global web of belief".

Therefore, let scientists of all stripes who would know the truth of that that lives as/in the very ultimate 'Nature of Mind' venture here. Human cognitive evolutionary development is perforce woefully incomplete without this adventure of relative conceptual mind awakening to its ultimate 'supreme source'. As the great Neoplatonist Plotinus told, "Development is envelopment" at ever deeper levels of Spirit embrace.

Indeed, the mindful process of that awakening to the prior ontic and ever present phenomenal unity of the original nondual unity of our perennial Two Truths—relative and ultimate, Science and Spirit—is the purpose of this book. (Ch. 6; *Appendix A*)

Be all that as it may, abstruse quantum formalism brings to mind an infamous pith of Richard Feynman, polisher of Dirac's QED: "I think I may safely say that nobody understands quantum mechanics." And nobody does. How so? QFT/QED with its logic-defying 'measurement problem', the measurement chain, requires—in most quantum interpretations—the 'consciousness' of an observer to collapse the subjective quantum wave function to reveal or even 'create' an objectively 'real world out there' (RWOT). And consciousness—human awareness and its vast awareness ground—transcends yet includes the universal quantum wave function  $\Psi$  and the logical laws of physics. Classical two-valued logic and the logical syntax of language is not adequate to an understanding of the trans-conceptual nature of consciousness—conscious human awareness—let alone its all-subsuming primordial awareness-consciousness ground. This providential fact opens into a liberating new post-empirical, post-quantum human knowledge paradigm.

*MWI Again.* However, we have seen that with MWI's objectification of Schrödinger's subjective universal quantum wave function postulate the thorny subjective paradoxes of consciousness and the present spooky 'lucid mysticism' (Pauli) of observer-dependent quantum interpretations—Schrödinger's Cat, Einstein's EPR Paradox, and von Neumann's Boundary Problem—are resolved in a classically comfortable—if *fantasque*—objective, entirely physical, super-deterministic, observer-independent, local realist RWOT. Physics' uncomfortable comfort zones that are the 'scientific' dogmas of Metaphysical Materialism/Physicalism and Scientific Local Realism is saved. But at what cost? MWI epistemology exceeds in absurdity even the inherently random nonlocal quantum wave function itself that it purports to clarify.

Hence, MWI now faces the disquieting conclusion that to make logical sense (in a limiting two-valued logic) of Quantum Field Theory (QFT) with its causality busting nonlocality, we need an even more contrived theoretical absurdity. What could be more contrived than a subjective quantum wave function collapse magically revealing an objective spacetime reality? How about infinitely many 'branching' *alternate universes* wherein each empirically possible choice of a quantum micro-measurement outcome, or of a macro-observation outcome by the 'consciousness of an observer' is somewhere, somehow physically, objectively realized! Yes, this means an infinite number of such objectively physically real quantum universes. 'Many worlds' indeed. But the epistemological problem runs far deeper than that. How shall we understand this?

MWI is a logically consistent but rather torturous way to 'save the appearances' of the Local Realism and Metaphysical Materialism/Physicalism of Modern Science



bound as it is, and should be, by the core 'principle of causality'—cause and effect logical reasoning. And what is Science if not that? By objectifying and reifying Schrödinger's inherently subjective quantum wave function  $\Psi$  superpositions through a denial of the orthodox  $\Psi$  collapse at the instant of a quantum measurement—thereby imputing  $\Psi$  to be an objective entity—the price paid is the super-spooky infinitely 'many worlds' inanity. While such a metaphysic is logically possible, it utterly exceeds the reach of empirical possibility.

Therefore, the MWI hypothesis, along with its  $\Psi$  theoretical rivals, is beyond the reach of empirical verification. And physics is an empirical science. You can see the problem. Recent Quantum Field Theory (QFT/QED) just gets "curiouser and curiouser". (Lewis Carroll) But maybe that's not so bad. After all, ontology is, almost by definition, post-empirical.

But it gets worse. Hyper-objectivist and super-deterministic MWI is fast becoming the prevailing quantum ontology among quantum physicists and quantum cosmologists—not because it makes good sense, or is believable, or is empirically sound, or verifiable—but because it is 'logically consistent' and cannot be proved logically contradictory. But neither can the absurd hypothesis that the notorious 'quantum measurement problem' can be resolved by application of quantum zero point vacuum energy (ZPE) fairy dust sprinkled upon a Geiger counter at precisely the instant of  $\Psi$  collapse while invoking the great mantra *OM AH HUM* be proved logically contradictory. Empirically absurd yet logically sound.

Nor should QFT in any of its metaphysical interpretations be construed as violating the axioms of formal Aristotelian logic. It does not. QFT is counterintuitive and bizarre but not logically contradictory. It works perfectly in making predictions that give us computer technology and our cell phones, and laser intercontinental communications.

But formal logic is as Kant would say 'analytic'. It gives us no new 'synthetic' information, or understanding. Logic is two-valued and truth functional. Either true or false. Either A or not-A. It only tells us if a conclusion logically follows from its premises. It yields no information as to the truth of a syllogism's premises. Human knowledge requires a deeper understanding. Just so, MWI needs more than formal logical soundness. It requires veridical empirical possibility, and non-absurdity as well.

That the quantum wave function of QFT is monumentally counterintuitive is not the problem. Copernican heliocentrism breeched common sense in 1543 when it replaced geocentrism. As did Einstein's counterintuitive relativity in 1905. The London Times called relativity "An assault on common sense." And fortunately it still is.

Perhaps we are overly troubled by the merely conceptual acausal aberrations of QFT. Perhaps there are more things in heaven and earth than are dreamt of in our dualistic conceptual philosophies. Going beyond our ideologically comfy observer-independent Scientific Local Realism to an antirealist, even idealist observer-dependent

metaphysic requires, in the 21st century, an all too unfamiliar human intelligence, and real courage. The classical ideologies and cognitive biases of the past are no longer adequate to our emerging post-quantum present.

Quantum mechanics has opened the door to the nondual infinite, that we may enter in a dimension where primordial wisdom outshines the beliefs of the past.

*Post-Quantum Logic and the Wisdom of Uncertainty.* Clearly, we require a three-valued quantum deductive logic (3VL), or a multi-valued quantum logic (MVL) which replaces the 'law of excluded middle' of classical logic. For example, the Hindu Nyala system—A, not-A and a third indeterminant value—permits *both* A and not-A; both relative existence and ultimate nonexistence to manage the cognition of both quantum and Buddhist acausal reasoning. Lama Professor Anne C. Klein has referred to such post-formal cognition as "the logic of the non-conceptual". Yes, human cognition must include both faces of our noetic cognitive doublet—both objective and subjective.

Thus do we require such a contemplative logic of the non-conceptual as it has arisen in Hindu and Buddhist philosophy that altogether transcends deductive and inductive logic. (Ch. 4) Now that's not only spooky, but wonky to boot!

We have seen that until we move beyond the obsessive classical scientific bias for extremist absolute objective certainty—*either A or not-A*, either absolute existence or absolute nonexistence—to interpret the non-objective quantum theory's view of a random observer-dependent *kosmos*, no propitious Quantum Gravity Theory (QGT) shall arise to unify the presently mathematically incommensurate two pillars of physics, namely, Einstein's classical General Relativity Theory (GRT), and Bohr's and then Dirac's post-classical Quantum Field Theory (QFT)/Quantum Electrodynamics (QED). The very real 'quantum measurement problem' with its quantum measurement problem of consciousness requires a cognitive breakthrough that is QGT, if it is mathematically possible at all. The scary 'logic of the non-conceptual' that is the 'wisdom of uncertainty' shall here be required. Niels Bohr, revealer of the quantum Principle of Uncertainty/Indeterminacy and student of Taoism and Buddhism understood this well.

Once again, we must somehow unify our noetic cognitive doublet that includes both the exoteric objective and the esoteric subjective dimensions of our human experience. Might the centrist Mahayana Buddhist Two Truths ontic trope—the unity of Relative Truth and Ultimate Truth—offer a providential Middle Way? Indeed it does.

Let us then approach this intimidating 'wisdom of uncertainty' and explore a centrist middle way philosophy between the ontological extremes of absolute existence and absolute non-existence; to wit, objective Scientific Materialism/Physicalism, and the antirealist, often subjective nihilism that is both Eastern and Western Absolute Idealism in our grail quest for the 'post-empirical' prior unity of relative objective Science and perfectly subjective ultimate Spirit in whom it arises.

We've seen that Bell's Proofs (1964), and many other more recent analogous proofs have all shown that the classical causal Newtonian view of Scientific Local Realism—an *observer-independent* purely objective local absolutely existing separate spacetime real world out there (RWOT)—is in point of fact, *observer-dependent*, that is to say, not *ultimately* existent in the absence of the presence of a *relative* observing sentient consciousness; sometimes with quantum measuring instruments.

We have seen that in the quantum orthodoxy a conscious observer is required to 'collapse' Schrödinger's universal quantum wave function revealing an objectively real entity/eigenstate that somehow—QFT can't explain how—pops into spacetime from a hitherto infinite 'superposed state' of quantum emptiness in which all possible states exist simultaneously. (Matter is borrowed gravitational energy.) 'Spooky' scientific metaphysics indeed. Einstein hated it.

For relativistic QFT/QED, the proto-physical light energy ( $E = mc^2$ ) that fills the worlds with matter-form clearly exists relatively, conventionally, yet it is entirely random, acausal, nonlocal and non-objective. It requires an observer's consciousness to reify and objectify it—make it really real. Thus does this quantum view parallel the Buddhist Two Truths centrist Middle Way *Prasangika* Madhyamaka ontology. (Boaz 2020)

The philosophically antirealist quantum 'entangled nonlocal behavior' of light—Einstein's "spooky action at a distance"—violated Einstein's inner local realist sensibilities as expressed in the 2nd postulate of his 1905 Special Relativity Theory (SRT), namely that the speed of light is relative, not infinite. For relativistic physics it is the relative finite velocity of an electromagnetic signal that bestows our really real *local* spacetime reality. (Boaz 2021b)

Yet, quantum nonlocality/entanglement allows for superluminal, faster than light transmission of an electromagnetic signal. Yes, Einstein hated it—although he was, along with Planck, Dirac, Pauli, Bohr and Heisenberg, one of the founding fathers of the original 1927 quantum theory, now known as the Copenhagen Interpretation.

The seismic paradigm shift from Newton's and Einstein's classical mechanics to quantum mechanics occurred with the advent of the two complementary foundational theories of the Copenhagen Interpretation. These were Werner Heisenberg's Principle of Quantum Uncertainty (quantum indeterminism), and Niels Bohr's Principle of Complementarity with its wave-particle duality. These two great scientific minds forever changed our classical view of physical reality.

Indeed, Paul Dirac's Relativistic Quantum Electrodynamics (QED) enhancement of Quantum Field Theory (QFT) is the theoretical basis of the prodigious physics Standard Model of Particles and Forces ( $\Lambda$ -CDM); arguably the greatest intellectual achievement of humankind. It remains to be unified with Einstein's classical GRT. And yes, we need a Quantum Gravity Theory (QGT) for that.

Be that as it may, 2021 discoveries in the physics Muon Sector seem to have demonstrated that our beloved Standard Model cannot be correct. It is, as most theoretical physicists have suspected, a provisional theory. Indeed, are not all theories incomplete, often apprehensively awaiting that next more inclusive theory? The cognitive gestalt shifts that resulted in the scientific revolutions of Copernicus, Kepler, Galileo, Descartes, Newton, Einstein, quantum mechanics, Gödel, and Freud are all cases in point.

Many theoretical physicists and most philosophers of physics understand that our propitious Standard Model of Particles and Forces now abides upon the cusp of a new paradigmatic physics revolution. That QFT has failed to quantize the gravity of Einstein's GRT is a root cause of this new evolutionary 'Scientific Revolution' (Thomas Kuhn 1962, 1970, *The Structure of Scientific Revolutions*) in science and culture that is now upon us. And Middle Way Madhyamaka Buddhist philosophy seems destined to play an ontological role in this arising revolution in matter, mind and Spirit. (Boaz 2021b)

It should come as no surprise that both Bohr and Heisenberg were inspired students of our Eastern wisdom traditions—Hindu Vedanta, Buddhism, and Taoism.

Bohr even included the Taoist black and white *tai chi/yin yang* symbol in his coat of arms placing it prominently upon the front gate of his Copenhagen estate. This ancient icon represents the interdependence, complementarity, balance, and prior unity of dualistic opposites arising from the vast whole itself (Tao, *Qi*). To wit: light and dark, positive and negative charges/forces, true/false, active (*yang*)/receptive (*yin*), unity/duality (the Two Truths), existence/nonexistence, nonlocal wave/local particle. The dualities perforce appearing in relative conditional space and time are inherently complementary, like light and dark. You can't have one without the other. (Ch. 6)

Einstein engaged his intellectual equal and philosophical nemesis Niels Bohr in the justly famous decades long 1935 Einstein-Bohr (EPR) debate over the fundamental nature of reality—Einstein's observer-independent objective causal Local Realism against Bohr's observer-dependent subjective acausal nonlocal Antirealism.

Does the random-acausal, nonlocal, quantum uncertainty and complementarity of Heisenberg and Bohr trump Einstein's and Newton's classical GRT causal, objectively certain local RWOT? It seems *prima facie* that these two rough hewn ontologies—Realism/existence and Antirealism/nonexistence—are mutually exclusive metaphysical views. But are they? Might they be complementary views of a greater, more inclusive post-quantum ontological ultimate reality awareness-consciousness ground?

Clearly, there 'exists' such a ground. Mereologically (part-whole relations) relative spacetime parts are necessarily embraced in a more inclusive primordial ultimate whole, or 'basic space', by whatever grand name, in which or in whom this all arises. Indeed, that trans-conceptual nondual primordial awareness-consciousness ground is the basis of human awareness-consciousness arising and instantiated therein. The perennial wisdom tradition of humankind is an expression of our quest to realize

our already present connection to That. Let Science consider this great truth in their inchoate ontological interpretations of the universal quantum wave function.

As we deepen our understanding of Buddhist Two Truths philosophy/practice we begin to see how it is that the primordial boundless whole of nondual reality itself both exists, and does not exist. That is to say, all this arising spacetime located local and nonlocal stuff exists relatively, yet not ultimately or absolutely, as we have already seen.

We've also seen that to accomplish such an understanding we shall need to enhance Aristotle's Greek dualistic two-valued logic—either true or false, either A or not-A—with an Eastern or Western three-valued logic (3VL) that logically permits both A and not-A, both existence and nonexistence. Why? Because this is the way that the things of our dualistically experienced reality actually exist. The Two Truths—relative form and its ultimate emptiness—are a prior ontic unity. Such a view is a nondual post-empirical wisdom view. It may suffice as an antidote to the false dichotomies of our all too common sense concepts, beliefs, and cognitive biases—particularly those beliefs that we are certain are 'true'. As American truth expert Mark Twain told:

It's not what you don't know  
that gets you in trouble.  
It's what you know that  
just ain't so.

In the meantime please consider that Metaphysical Realism/Materialism—that physical stuff is a correspondence to an external, objective, observer-independent reality—is a view as to the way that the dimension of spacetime Relative Truth exists. In Antirealism this relative external objective 'real world out there' (RWOT) is hypothetical and not assumed necessarily to ultimately exist. Thus is Antirealism, and Philosophical Idealism a conceptual condition of the Path to perfectly subjective dimension of all-embracing Ultimate Truth, primordial ground in whom this all arises and participates.

The great Einstein could not overcome his cognitive bias for an objective Realism metaphysic, a non-random, cause and effect proto-theistic local spacetime cosmos. Quantum randomness meant for Herr Professor Einstein that his theistic Creator God had no choice. He famously told Bohr in one of their heated exchanges, "God does not play dice with the world!" Bohr is reported to have retorted, "Oh Einstein, stop telling God what to do with his dice!" The completeness of the new 'always correct' quantum theory, and therefore the very future of 20th century physics was at stake.

The 1935 EPR debate continues today. The core issue—quantum entanglement/nonlocality/universal interconnectedness—remains still in the century long grail quest for a viable objective interpretation or foundation of an inherently subjective quantum theory. We require a centrist view that mediates between Scientific Local Realism and quantum entangled nonlocality.

Let us then further explore the ontological unity of the Buddhist Two Truths, relative and ultimate—a relative objectively really real world out there (RWOT), arising in a perfectly subjective primordial awareness ultimate ground.

*Toward a Quantum Middle Way Ontology.* Middle Way Buddhist philosophy points out that appearing spacetime form is relatively, objectively real; but subjectively, ultimately it is formless emptiness. So, form is relatively conventionally objectively real. And the absence of form's ultimate existence is still an absence of *something*. This absence exists. The absence of an elephant in the room logically implies the existence of at least one elephant somewhere. So, emptiness exists! Therefore, this Buddhist view of the Two Truths that are ultimate emptiness and its relatively arising form is not a philosophically idealist nihilistic denial of objective spacetime form altogether. If human beings in embodied form did not objectively exist who is it that enters and practices the Buddha's Eightfold Path to liberation from suffering? Who is it that practices compassion toward living beings? Who is it that ponders quantum emptiness?

Emptiness/*shunyata* represents a profound aspirational mean between the relative existence (Local Realism) and ultimate nonexistence (Absolute Idealism) of spacetime form. Objective *relative* quantum form arises, appears, and participates within its perfectly subjective all-pervading *ultimate* emptiness ground. An inchoate fundamental quantum ontology!

These Two Truths, relative and ultimate, of the Buddhist centrist 'middle path' must be viewed as an ontologically prior yet phenomenologically present unity. The Two Truths—Ultimate Truth, perfectly subjective, all-inclusive primordial awareness emptiness ground of everything (*paramartha satya*)—and Relative Truth, objective physical and mental quantum spacetime matter/energy form (*samvriti satya*) continuously arising and emerging in/as this ultimate 'groundless ground'. These two reality dimensions are always already a nondual primordial unified one truth, utterly indivisible and interdependent. A fundamental quantum ontology requires such a holistic unified view; does it not?

This Buddhist centrist path ontology is not at all dissimilar to some of the 'quantum interpretation' paths. A viable quantum ontology must balance the inherent ontological subjectivity of the nonlocal nondual interconnectedness of the primordial 'universal quantum wave function'—quantum emptiness—with the objective reality of the seemingly separate infinitely abundant wave functions of local spacetime form.

A robust quantum epistemology must build upon such an ontological base. It must then transcend yet include its own inherently dualistic mathematical formalisms in a theory that describes the interdependent relationship of the ontological identity of the nonlocal nondual ultimate primordial universal quantum wave function with its many objective physical and mental wave functional entities emerging in real relative spacetime existence. Ontology is prior to, and not separable from epistemology which is

its natural cognitive extension in real space and time. We can no longer split, ignore, or deny the natural interdependence of these two cognitive functions.

We've often seen that until a settled nonlocal quantum ontology emerges, there shall be no Quantum Gravity Theory (QGT)—the great mathematical consummation that quantizes gravity, finally unifying the hitherto incommensurable two great theoretical pillars of Modern physics, namely, Albert Einstein's General Relativity Theory (GRT) and Dirac's and Feynman's Quantum Electrodynamics (QFT  $\approx$  QED).

My reader may have noticed that there is at work here in the process of the arcane discipline of physics a rather humorous *kosmic* irony. The imperious laws of physics work perfectly in practice. Spacetime reality spontaneously appears. No problem whatsoever. Now if only we could make them work in theory!

Well, is the *ultimate* nature of appearing reality local, observer-independent, objective and physical; or is it nonlocal, observer-dependent, subjective and immaterial? Such a false dichotomy has now become cringe-worthy. So how about a nice centrist middle way? Mahayana Madhyamaka Buddhists have done a good job with it. (Ch. 6)

Beginning with John Stewart Bell's 1964 Bell's Theorem, and 50 years of numerous nonlocality physics experiments, quantum nonlocality/entanglement is now considered by the protagonists of this 100 year scientific drama to be 'scientifically' proven. Einstein's and Bohm's last gasp conjecture for a 'hidden variable parameter' to save Scientific Local Realism stands refuted for nearly all theoretical physicists, and philosophers of physics.

Or does it? What is the relative seed of common sense empirical truth in Scientific Local Realism that cannot be credibly denied? Whether spacetime stuff is *ultimately* real—Middle Way Buddhists deny that it is—appearing objective reality is at least *relatively* really real! After all, here we are, along with real trees and stars. Buddhists agree. Whether or not we reify quantum abstractions into existence, spacetime stuff and beings are everywhere! What is the existential reality status of an embodied mind that denies its own existence? The yoke of the burden of rejoinder for antirealist and idealist skeptics is heavy indeed.

Yes. We must avoid the false epistemic dichotomy that insists that the nature of appearing reality be *either* ultimately real (Metaphysical Scientific Realism/Materialism), *or* ultimately illusory (antirealist Metaphysical Idealism)? Recall that from the metaphysical ontology you choose arises the karmic phenomenal reality you deserve.

The history of religion and philosophy, both West and East, is a dispirited history of such a false absolutist distinction between objective, realist, monistic Metaphysical Materialism/Physicalism; and subjective, antirealist monistic Metaphysical Idealism.

Clearly, we need a centrist middle way between these ontological metaphysical extremes that present to the mind as *either* existence *or* nonexistence. We shall see below

that Mahayana Madhyamaka Buddhist philosophy and practice has profoundly accomplished such a pragmatic Middle Way.

We have seen that Quantum Field Theory has unwittingly pointed to such a middle way through its distinction between the spooky subjective nonlocality of the universal quantum wave function  $\Psi$  prior to its collapse—'consciousness causes collapse' (Wigner)—into a safe and sane local objective reality, our really 'real world out there' (RWOT) that we have all come to know and love. Here our objective observer-independent realities are neatly objectified/reified via an inherently subjective process of an observer-dependent consciousness. Two Truths indeed.

Our East-West human wisdom project has—for at least 10,000 years—been to conceptually and contemplatively understand the prior, already present unity of these two all too human cognitive modalities, objective and subjective. Without beings to consciously ponder such questions there can be no problems of consciousness.

To be sure, objective Science—physics, cosmology, neurobiology—and subjective Spirit/spirituality require a propitious Two Truths ontology, objective relative and nondual ultimate that is the 'grounding relation' of such an objectively fluent epistemology. (Boaz 2021a)

Thus is Heisenberg's *schnitt* or explanatory gap between objective local phenomenal experience and subjective nonlocal, nondual contemplative experience bridged, at least conceptually. And it is unified non-conceptually through direct contemplative experience (*yogi pratyaksa*).

Perhaps in this monumental grail quest for human absolute objective certainty we shall discover a unifying, if ever incomplete, theory that unites the objective classical relativity of Einstein's local GRT with the inherent subjectivity of nonlocal QFT/QED. I have here suggested the cognitive architecture for such an ontic/epistemic project. No doubt that this consummation shall add greatly to the relative human happiness of theoretical physicists; and as well add confidence to the quest of contemplatives for ultimate, trans-conceptual, nondual certainty.

The Two Truths—relative and ultimate—begets two corresponding and interdependent quests for certainty; until that is, the seeking subject ends the eternal goal for an object of its quest. Now, in the ultimate realization and peace of *buddic* 'no more learning' dawns the wisdom of non-seeking. "It is already accomplished from the very beginning." (Buddhist *Dzogchen* founder Garab Dorje) Told Jesus the Christ, "That which you seek...the Kingdom of God is already present within you...and it is spread upon the face of the world, but you do not see it." (Luke 17)

As to this deeply hidden interdependent centrist relationship between relative Science and ultimate Spirit—this prior and present unity of our perennial Two Truths—John Stewart Bell, the most profound quantum physicist since Irwin Schrödinger has pointed to the trans-rational truth of the primordial universal quantum wave function that abides at the nondual heart of the quantum enigma. He shall have the last word:



Suppose that quantum mechanics were found to resist precise formulation. Suppose that when formulation beyond FAPP (for all practical purposes) is attempted, we find an unmovable finger obstinately pointing outside the subject, to the mind of the observer, to the Hindu scriptures, to God, or even only Gravitation? Would that not be very, very interesting?

(Excerpted from David Paul Boaz 2021, *The Noetic Revolution: Toward an Integral Science of Matter, Mind, and Spirit*)

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