

The Quantum Revolution

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The progress of science has now reached a turning point. The stable foundations of physics have broken up... Time, space, matter...all require reinterpretation.

—Albert North Whitehead (1965)

Prelude: It's only physical. Prior to the 16th and 17th century discoveries of Copernicus, Kepler, Galileo, and Newton, humanity's worldview was essentially subjective. The early Greek, Hebrew, Hindu and Chinese traditions as well as indigenous shamanism, were all based upon speculative subjective metaphysical systems with no organized objective methodology—no science. The Taoists, the early Buddhists, the Hindus, Roman Cynics and Stoics, and Plato all metaphysically speculated. Aristotle, Ptolemy, Plotinus and Nagarjuna speculated, classified and qualified. But the Copernican Revolution quantified. The history of Western science and philosophy may be viewed from an integral, noetic perspective as an objectivist/rationalist epistemological quest for the grail of absolute objective certainty, an Aristotelian strategy to “save the appearances” from the spectre of Platonist and Neoplatonist transcendence, unity and spirituality. The Platonist Whitehead famously quipped, “The history of Western philosophy is a footnote to Plato.” Since Descartes, the great contemplative knowledge paradigm that included the Greek Hermetic, Hebrew Kabbalistic, and Eastern wisdom traditions has been sacked in a zealous Apollonian objectivist quest to measure and quantify everything. The primordial unity of the knowing subjective observer-perceiver and the apparently separate perceived object was thereby formally split into the duality of objective observer and that “other” object observed.

From about 1600, Western science and philosophy have assumed—without empirical proof—the metaphysical dogma that all appearing reality is only physical (monistic Physicalism or Materialism), and that it is somehow separate from the mental and spiritual dimensions of our nature. This question begging dogma is derived from the 17th century Cartesian presumption of an inherent eternal dualism between mental ideas and physical objects; the notion that a representational medium or veil, a “mirror of nature” (Rorty) forever separates the subject/self from an external, objective physical world. Epistemologists and philosophers of science refer to this dogma of the “myth of the given” as foundational epistemological Realism—of which massmind naïve realism and mechanistic Scientific Realism (Scientism) are species—which represents an absolute epistemological dualism of separate independent subject and observed object, observer and data, appearance and reality, matter and spirit, all the way into subatomic particles (plus charges and minus charges), the presumed ultimate constituents of phenomenal reality. By 1900 it was assumed in the West, in both common and high culture that the whole of appearing reality could be neatly reduced to little purely physical subatomic billiard balls whose behavior could be perfectly described and deterministically predicted by the sovereign classical mechanics of Sir Isaac Newton.

The Ultraviolet Catastrophe

Only the whole is completely objective.

—William Earle

Then, suddenly and without warning, the “ultraviolet catastrophe” struck the great theoretical estate that was the Modernist objectivist scientific worldview. In 1900, German theoretical physicist Max Planck made a world shattering discovery. Transcending his “scientific” objectivist predilections, Planck correctly formulated the mathematical description of ultraviolet radiation emitted from a perfect “black body” absorber proving that energy was absorbed and emitted, not in a continuous wave of electromagnetic energy as Thomas Young’s wave theory (1801) required, nor in a *continuous* stream of individual atoms as the classical, billiard ball theory of Aristotelian and Modernist atomic *continuity* required, but in a *discontinuous* emission of photons as discrete particle-like energy “packets,” which he named “quanta.” All sub-microscopic phenomena—including not only photons, but electrons—exhibit such quantization. Indeed, in 1924 Prince Louis de Broglie proved that such quantization obtains not only at the subatomic level, but at the atomic level as well. This fundamental “graininess” of all physical reality has profound implications for the development of microphysics, cosmology, epistemology, and metaphysical ontology.¹

Yet particles in motion also need Young’s related wave motion to fully describe their subatomic behavior. Thus energy or light was proven to be both particle-like and wave-like, a paradox that collapsed the old classical physics of Aristotle, Galileo, Descartes and Newton. Planck’s great discovery became the foundation of the new, post-classical, postmodern, non-determinist and non-objectivist Quantum Field Theory, and won him the Nobel Prize in 1918.

In the first decade of the 20th century, Niels Bohr replaced the Rutherford atomic model with his own, which explained the other two nails in the coffin of Newtonian mechanics, namely the hitherto dubious physical existence of the atom, and the problem of discreet atomic spectral emissions. But by 1925 it was clear that the strict determinism of classical Newtonian mechanics was inadequate to explain the apparent dual wave/particle nature of light. In 1905—the prolific year he developed and published the Special Theory of Relativity—Einstein firmly established the particle-photon nature of light using it to explain the photoelectric effect, for which he was awarded the Nobel Prize in 1921. Newton’s theory of light was also a particle theory. As noted above, Thomas Young had previously established the wave-like nature of light with his ingenious, double-slit experiment in 1801. Thus, by 1925 the dual wave-particle nature of light was firmly established in modern and contemporary physics. However, recent particle physics is trending toward a wave theory of light.

Well, which is it, wave or particle? The western logical canon states as its Law of

¹ Planck demonstrated that both the “ultraviolet catastrophe,” and another nail in the coffin of Newtonian physics, the photo-electric effect, could both be explained by his new “quantum of action,” that the atomic vibrational energy of a photon is quantized arising in multiples of discrete “wave packets.” This discovery is nothing less than a new constant of nature, namely Planck’s Constant (h). The equation is $E=hf$ where E is atomic vibrational energy, f is frequency, and h is the new fundamental constant of nature (6.6×10^{-34} joule seconds) a minuscule quantity of measure of the microphysical graininess of the physical cosmos. If this tiny constant were zero the universe would be not granular, but smooth and continuous, the continuity of Aristotle, Galileo and Newton.

Excluded Middle that “Either A or not-A” (contradictories cannot both be false). So which is it? Bohr’s Principle of Complementarity of the Quantum Theory replies that it is both. But how can a point-like particle be a wave spread out in space? Before a measurement, light is wavelike and demonstrates wave interference. Upon measurement, light behaves like a point-like particle. Again, to fully understand the behavior of light we need both wave and particle descriptions and equations. Thus the behavior of light is not contradictory, it’s complementary. Richard Feynman, great liberator of quantum electrodynamics (QED) on the quantum theory: “Anyone who thinks they understand quantum mechanics should have their head examined.” Physics just gets weirder and weirder.

Being and Time: Newton, Einstein, Heisenberg and Dōgen

Things don’t happen in time; time exists because things happen.
—Jay Garfield

Continuing our very brief history of time, in 1905 Einstein published his *Special Theory of Relativity*, and in 1915 his *General Theory of Relativity*. In 1924 de Broglie discovered that matter has a wavelike character. These great discoveries led in 1926 to Max Born and Erwin Schrödinger’s 1926 ingenious wave equation and the development of *Wave Mechanics* where the electron becomes a probability wave. Werner Heisenberg’s 1927 formulation of *Matrix Mechanics* (a particle mechanics) with its catastrophic (to classical dualistic subject-object determinist objectivism) *Uncertainty Principle* (the Principle of Indeterminacy) led to Niels Bohr’s *Principle of Complementarity*. Together these two quantum mechanical principles comprise the “Copenhagen Interpretation” of the Quantum Field Theory which demonstrates an inherent duality and atemporal subjectivity at the very heart of physical reality. This duality is the behavior of matter (the position and momentum of its ultimate particles), and its physical constitution (light wave or particle?) Thus ended 400 years of classical and modernist, material realist, objectivist physics with its objective linear—directional and durational—arrow of time, and 2500 years of deterministic epistemological and ontological materialist and realist dualistic separation of relative appearances from ultimate reality, of spacetime matter from the immediate now of its conceptually but not contemplatively ineffable, perfectly subjective timeless sourceground.

All of this made Albert Einstein very unhappy. He expressed his, and our consternation to his friend and colleague physicist Max Born in 1948: “If one abandons the assumption that what exists in different parts of space has its own, independent, real existence, then I simply cannot see what it is that physics is meant to describe.” Einstein was an inveterate defender of Scientific Realism.

The Quantum Revolution with its antinomies has now firmly established the need for a new global nondual Noetic Revolution that began with the great Second Century sages Nagarjuna in the East, and Plotinus in the West.

The end of time. *These two great principles of the Quantum Theory—uncertainty and complementarity—have effectively demolished foundationalist epistemological and Scientific Realism: namely absolute time, absolute space, and the purely objectivist linear Principle of Causality of the classical, Newtonian Modernist Enlightenment worldview, and with that the perennial ontic dualism of*

appearance and reality, of perceiving/knowing subject and its separate perceived object, of spirit and matter, mind and body. Particles are no longer separate. Observer and observed are no longer separate. Devotee and nondual godhead are no longer separate.

Einstein's classical Special and General Relativity assume that Aristotle's uncoupled absolutes of time and space are the spacetime continuum, the theoretical unity of time and space. Heisenberg's post-classical Post-Newtonian Quantum Theory expresses the left-brain exoteric philosophical truth that the observing subject and the object observed arise not *independently*, separately in time, but as a timeless atemporal relationship of *interdependence* (Buddhist *pratitya samutpada* or Interbeing) through acts or processes of consciousness, that is to say, acts of empirical observation and cognition (Dōgen Zenji would agree). "Subject and object are only one" (Schrödinger). "It is the theory which decides what we can observe" (Einstein). All of this is compatible with Buddhist *Madhyamaka Prasangika* and *Dzogchen*. This exoteric truth of the timeless (not eternal) subjectivity of consciousness is the analog (but not reducible to) the right brain esoteric truth of our nondual primordial Great Wisdom Tradition: *Tat tvam asi* (*That thou art*) that is our "supreme identity." That is who we actually are. Our being in time—which is what time is—is not separate from this great, vast expanse of the atemporal unbroken whole—by whatever name—our "supreme source" (*cittadhātu*) in which we all arise and participate.

Now is the time. According to our perennial Great Wisdom Tradition—including Quantum Field Theory and its scientific and philosophical descendants—the subjective observer is not separate from the object observed, but lives in a relation of interdependence with it. (This is the Buddhist *Madhyamaka* view.) We perceive such objects in what appears to be an external *objective* linear time. We've seen that this conventional flow of time, the "arrow of time" moves in a causal chain of quantum event moments (*vasana*) from past, to present to future (as codified in the second law of thermodynamics—entropy increases). *Yet, the past and the future necessarily occur now, in the present moment of our internal memory and imagination.* Time, as this "eternal present," is then internal first person subjective.

Thus our ontology of interdependence has an objective cause and effect relative-conventional level, and a subtler, direct atemporal subjective level (the Two Truths). So our *objective* experience of time is not definitive. Why? Events in time are perceptually and conceptually constituted or constructed only in relation to the process of change—relative motion—experienced *subjectively* by a sentient bodymind located in an objective relative-conventional spacetime reference frame ($t = \frac{vt}{c} = \frac{v}{c} \times \frac{L}{c} = \frac{Lv}{c^2}$). Change is the moment-to-moment causal arising, dwelling and decay of phenomenal appearance to a sentient nervous system. Time—our linear sense of time—is then, a sensory-conceptual imputation, superimposition or projection (*vikshepa*) upon this vast transrational perfectly subjective timeless *process* of change, of changeless Being Itself always in process of being becoming. Parmenides and Heraclitus together at last!

Einstein's Special Relativity and our Great Wisdom Tradition agree: contrary to Galileo's and Newton's classical mechanics, there can be no objective, universal or absolute time independent of, or unrelated to relative, conventionally arising phenomenal particulars. I have termed this situation or process Ontological Interdependence. Thus, the non-relativized absolute objective time of classical mechanics—from Aristotle to Newton—is a logocentric

“false absolute.” Or at least an absolute that has been relativized. So time is no longer “out there.” Time is “in here,” in the mind of the beholder. Time is subjective and relative conventional.

“Being is time” (Dōgen Zenji). For *Soto* Zen Patriarch Dōgen (1200-1253), who represents the Middle Way *Madhyamaka* Buddhist view, time is change. Time is merely the relative conventional change or movement of energy of dependently arising particulars. Time is not a universal absolute. All objects, events and beings arising in time abide in their singular “being-times” without ever departing the vast Being-Time (*Uji*) that is the emptiness sourceground of the primordial unbroken whole of infinite timeless Being Itself. In Being-Time phenomenal existence is selfless (*anatman*), impermanent (*anitya*), and empty of inherent existence (*shunyata*). Yet its particulars—interdependent being-times—are relative and conventional, abiding in the “eternal now” of the present moment, have a past and a future, and are capable of interacting. Being-Time is arrayed as the “three times,” past, present and future. The present has meaning only relative to a past and a future. This “eternal now” of the present moment abides in a past/future context that bestows meaning. Each moment is meaningful only in relation to what came before, and what happens next. There is no transcendent anything beyond this tripart Being-Time. There is nothing to seek and nothing to realize beyond this always present presence that is our Being-Time. Thus we fully engage this here/now world “just as it is.” And it is this perfection of the world, exactly as it is, that is the Ultimate Truth, nondual absolute reality itself. Being awake is simply to see this, right now, each direct perception of interdependently arising phenomena, prior to our conceptual superimposition upon it. Thus is self-grasping and self-cherishing with its subject/object dualism and the suffering that follows therefrom liberated. And this, it is told, is the secret of happiness.

So, being *is* time (motion/change). But time is not a logocentric absolute existing in an independent objective reality. The relative particulars that are Being-Time participate in a relation of identity and are not separate from their nondual supreme source. All such individual being-times are located in space and are conceptually imputed relative “flashings into existence.” Time abides in the mind of the perceiver. Just so, space. It is not absolute, it is empty of any intrinsic existence, and it is conceptually designated and fabricated by a cognizing mind. This is the nondual wisdom of the great Zen master Dōgen (1986).

According to Buddhist Middle Way wisdom, the interval/*bardo* of this subjective *now*, the Being-Time of the present moment abides in the all-embracing infinite Primordial Awareness Wisdom (*gnosis, jñana/yeshe*) as the “fourth time” (*turiya*), a potential, usually cognitively unrealized state of being (*turiyatita*) that is the already present immediate, timeless witness presence (*christos, atman, vidya/rigpa*) of this infinite expanse of nondual Ultimate Spirit that we “always already” actually are, here and now and nowhere else. *This fourth time, the moment now, unconceived, is an emptiness of perceiver and perceived.*

“All phenomena are merely metaphorical” (Goethe). Remembering the paradigmatic “Two Truths” of the one truth that is transconceptual nondual ultimate Reality Itself we’ve seen that the present experience of spacetime reality particulars in our mindstream, although objectively “real” by our conventional conceptual designations (*namarupa*, naming of forms, etc.), is heuristic and “merely metaphorical” —it has no *independent, separate, objective*

existence. All relative conventional spacetime relationships among events and beings are fundamentally, mutually *interdependent* and interactive, coemergent, coextensive and interconnected, situated together in *Relationship (hetu, tendril)*, a context or ultimate causal matrix sourceground of radical, timeless, perfectly subjective primordial openness/emptiness (not nihilistic, atheistic nothingness).

Implications of this astonishing result for the realist-idealist duality, the freedom-determinism duality, the “hard problem of consciousness,” and for an integral *noetic* epistemology and science are profound: appearance and reality, form and emptiness, + and - values, subject and object, self and other, God and humanity, *all the apparent binary dualities of contingent existence in spacetime are already a timeless perfectly subjective prior unity!* The two complementary streams of any binary—of all conventional dualistic reality—meet and merge in nondual radically open emptiness (*shunyata*), Tao, *Nirguna* (empty of attributes) *Brahman*, the Gnostic Depth (*Bathos*) of the still unbroken whole. This vast fullness/depth is Bohm’s “Zero Womb,” the womb-source of our Great Goddess Mother (*jnananirvakalpa*), infinite Feminine Principle, clarity of the “sky-like” basal nondual Primordial Awareness Wisdom.

Thus the Quantum Revolution ended the Modernist, rationalist Enlightenment Project and began the Postmodern age that is now yielding to post-metaphysical integral holism, ontological relativity, and methodological pluralism, transcending yet embracing the foundationalist Scientific Materialism (Scientism) of the Western tradition. Thus emerges the 21st century new reformation in religion, science and culture—the brave new world of our emerging integral noetic revolution. Let us then briefly explore the formal logic of this new ontology of interdependence.

Post-Quantum Logic: West Meets East

Open mouth, already a mistake.

—Zen Pith

Neils Bohr's Fundamental Principle of Complementarity that yields the wave-particle duality of the Copenhagen Interpretation of the Quantum Theory appears to violate two of Aristotle's three "Laws of Thought," the foundational laws of Western logic and mathematics, namely, the Law of Contradiction and the Law of the Excluded Middle. (Aristotle's first law is the "Law of Identity, "A is A," and not something other.) The Law of Contradiction—"Not both A and Not-A (A cannot be not-A) or contradictories cannot both be true—is violated because light cannot be both a point-like particle, and a wave spread out in space. Waves and particles are distinct objective entities. If an object is A, it cannot also be B. The Law of Excluded Middle—"either A or not-A" (contradictories cannot both be false)—is also violated because light must be either a particle or a wave, but not both. Moreover, in quantum mechanics, a particle—an electron—may exist in an ineffable "super position," that is, prior to a measurement that "collapses the wave function" the electron is in two places at once! In other words the electron is both A and not-A. This proposition represents an essential ambiguity of quantum mechanical logic and ostensibly violates the law of Excluded Middle.

Whether it is the Law of Excluded Middle or the Distributive Law that is violated, and whether or not Bohr's Principle of Complementarity saves the Excluded Middle, this untidy "quantum measurement problem" is only a problem if one insists on the primacy of the Western Logical Canon. *The problem is this: determinate quantities of mass, charge and spin are imputed to an indeterminate particle with no definite location or momentum. Classical descriptions are used to describe objectively real postclassical subjectively varied quantum phenomena.* Quantum mechanics is girded by and logically linked to the classical mechanics it disproves. Can we have it both ways?

The urgent question is this: is Aristotle's syllogistic, bivalent logic the last word? In this purely deductive logic, the Law of Contradiction and the Law of Excluded Middle are not *a priori* true assumptions, but are logically deduced from the definition of contradictories as stated in the Law of Contradiction itself. But in the Eastern logical canon the truth of a statement is not logically equivalent to the falsity of its contradictory, as we shall see.

Is the human mind then, entirely bound by the logical syntax of this binary deductive, merely two valued truth-functional logic? Are we forever yoked to a bivalent, bipolar view of reality that logically excludes the holism of "both A and not A"? This dichotomous, separative mode of thinking has become the pernicious, unconscious intersubjective *mythos* of dualism that has infected the history of ideas in the West—religion, science and culture—and we're not even aware of it! Let us monitor—moment to moment in our mindstream— this logical pretense to knowledge. Let us relax this habitual bivalent, bipolar cast of mind and open to the nondual whole that constantly pervades the mind, and in whose vast Consciousness Being the mind arises and plays.

How do we move then, from this fearful, habitual Cartesian quest for the totemic, logocentric grail of absolute objective certainty—the limit of the logical syntax of language—to

an atavistic, perspicuous, semiotic semantics, even a meditative contemplative integral understanding where the “modal mismatch” of mathematical logical *necessity* and the radical *contingency* of the Quantum Theory and Buddhist *Dzogchen* are all subsumed in their interdependent ontic prior unity?

Both Hindu and Buddhist logicians in the East, and the European Intuitionists (Brouwer, von Pauler) in the West deny Aristotle’s Law of Excluded Middle. This law is replaced with the unifying Law of Connection, “Both A and not-A,” (“Everything is connected with all other things”), and its complementary, “Neither A nor not-A.” These two together permit the ontological interdependence, the non-separateness of all arising phenomena—the “Interbeing” of Buddhist “dependent arising” (*pratitya samutpada*) of forms arising in spacetime—and do not assume or presuppose the existence of A, that is, the existence of anything at all. This then, permits a unified, East/West logic that allows, without contradiction, our fundamental Principle of Ontological Interdependence—that all arising phenomena are interconnected by prior causes and conditions and nothing exists independently—upon which turns the new post-materialist, post-metaphysical theories of ontological and universal relativity explored below. Gödel, Hilbert, Russell, Whitehead, Quine and Duhem have shown that even the hitherto *a priori* axioms of mathematics and deductive logic are merely conventional and cannot be a path to objective certainty. So, this logical Law of Connection defies the Western logical orthodoxy—the great legacy of Aristotle, Frege, Russell and his prodigy the young Wittgenstein—thereby revealing the ontologically prior, always present unity of the perennial Two Truths that is the all-embracing transconceptual one truth that must be included in any theory of ontological or universal relativity, and in any “theory of everything.”

The wave-particle duality and the quantum measurement problem of the Quantum Theory then, are in principle compatible with the Law of Connection—both A and not-A. Thus, with this urgent logical enrichment, primordial light-energy-mass is, or may be, without contradiction, both a point-like particle (after a measurement), and a wave spread out in space (before a measurement). Aristotle’s logocentric Law of Excluded Middle is refuted, relativized and transcended.

Wu-wei. Neils Bohr’s coat of arms was the *tai chi*—the *yin-yang* symbol that outpictures the primordial emptiness ground (*Wu/Mu*) of Ultimate Reality Itself (Tao) in whom or in which arises these two primordial energies, *yin* and *yang* (plus and minus charges) that is the very light that creates the five elements (*wu-hsing*) from which evolve the ten thousand things (*wan-wu*) that is all of material relative spacetime reality. This dialectic of the Tao of emptiness includes both “is and is not,” “both/and,” “both A and not A,” both being and non-being. Tao/emptiness is the interdependent arising (*pratitya samutpada*) of all physical and mental spacetime phenomena, all things spontaneously and effortlessly (*te*) which then generates the conduct that is liberation, *wu-wei*, wayless non-seeking conceptual surrender from whence flows the spontaneous, effortless action that is our salvation from “Karmageddon” through selfless compassionate activity. “The *wu-wei* that does not aim at *wu-wei* is truly *wu-wei*.” Such effortless effort realizes the Tao that is both relative and ultimate happiness for human beings. From this surrender follows flowing return (*fu*) of all things again to the light of Tao, supreme source that is “the stillness in motion that pervades heaven and earth.” “The Tao that can be told is not the true Tao... The Tao does nothing, yet nothing is left undone” (Lao Tzu).

The Great Quantum Debate: Einstein, Bohr, and a New Ontology

It is difficult to locate a black cat in a dark room, especially if there is no cat.

—Confucius

Prelude: physics in trouble. There have been two great revolutions in Science, the Copernican Revolution of the 17th century, and the 20th century Quantum Revolution. Now, on the cusp of the 21st century we enter a new scientific and cultural revolution, the Noetic Revolution in science, religion and culture. Here we establish an integral, noetic science of consciousness—the long neglected study of the mind beyond or prior to mere electrophysical brain—that will further the project of unifying the hitherto incommensurable paradigms of Science and Spirit/spirituality.

Perhaps the greatest problem facing theoretical physics today is the incompleteness of the “Standard Model” and its Quantum Theory. The problem is intimately linked to the lack of a unifying Quantum Gravity that quantizes General Relativity unifying it with the Quantum Theory. Such a synthesis will relativize the logocentric idols of General Relativity, namely absolute spacetime, and absolute locality. Unfortunately, the Standard Model and its theoretical quantum gravity candidates, Superstring Theory and Super Gravity, (and indeed all of the G.U.T. candidates) cling to epistemological Realism and thus to absolute spacetime and absolute locality. *What is needed is a cognitively courageous theoretical leap from the fundamentalism of foundationalist Scientific Realism toward a non-realist, non-materialist, nonlocal new middle way physics paradigm. The emerging integral noetic science of matter, mind, and spirit is an auspicious beginning of this urgent inter-dimensional, inter-paradigm project.* Here, the absolute dynamics of classical pre-quantum physics is yielding to the interactive dynamics of the interdependent epistemology and ontological relativity of the emerging Noetic Revolution.

There is presently a glaring inadequacy of the Standard Model of Modern physics to explain 1) its free constants, the values of which define the properties of particles (their masses and the strengths of the forces), 2) the non-zero mass of the neutrino (CPT symmetry violation), 3) the Higgs boson, dubbed the “God Particle” because it explains mass in subatomic particles and 4) the Standard Model’s inability to explain, or explain away the mystical Dark Matter and Dark Energy (the Cosmological Constant Problem) that together constitute about 96 percent of the matter of the known physical universe. Clearly, the Standard Model with its quantum mechanical description of nature is in dire need of that next more inclusive theory, a theory that will transcend its limits, yet include its marvelous successes.

By 1980 theoretical physics had established the quantitatively robust Standard Model, a supreme collective intellectual achievement. It has now become the “old paradigm” scientific orthodoxy. Particle physicists and philosophers of physics generally agree that there have been no real breakthroughs since. The incomplete Standard Model is now in the Kuhnian “scientific crisis” that precedes a “scientific revolution” and a “paradigm shift”. It is unable to explain the Quantum Uncertainty Principle and quantum nonlocality (entanglement). String Theory mathematics is in yes, chaos, and the nonzero mass of the neutrino,² along with Dark Matter

² Experimental results from Fermilab’s MINOS experiment, and others, indicate an asymmetry between neutrinos and antineutrinos. They appear to have different masses, which violates the Standard Model’s CPT symmetry of

and Dark Energy, and the “Problem of Consciousness” (the problem of subjectivity) are the new clouds on the horizon that portend at least a radical revision of the Standard Model, the model that explains nearly nothing about 96 percent of the physical cosmos, and absolutely nothing about consciousness, the non-physical or metaphysical subjectivity that is *Kosmos* Itself! That “next more inclusive theory” will transcend yet include the many truths of the Standard Model with its Quantum Theory, just as Relativity Theory included Newtonian Mechanics, which included Galilean Mechanics, which corrected yet included the celestial mechanics of Kepler, Copernicus and Aristotle.

“Why,” asks physicist Lee Smolin, “is physics in trouble?” I will here, again argue that theoretical physics has at last “hit the wall” fabricated by its petrified, ideological attachment to a foundationalist realist materialist orthodoxy, grounded in the metaphysical assumption that the whole of appearing reality is an objective purely physical reality (Physicalism/Materialism). This logocentric metaphysical false idol augurs the sinister “myth of the given” (Naïve and Scientific Realism) with its denial of consciousness, intersubjectively fixed for the Western mind by Apollonian measure, the logic of Aristotle, and Galilean radical objectivity, that is to say, the dogmatic presumption of monistic Physicalism (Materialism) with its effective denial of subjective, even “vertical spiritually empirical” contemplative phenomena. Why must reality be only and ultimately physical? Modern and contemporary physics has begged the question of Physicalism for 400 years and now resolutely ignores the clues given by the profound stochastic subjectivity of the Quantum Field Theory and Quantum Cosmology, the “Problem of Consciousness,” and Buddhist *advaitic* (nondual) epistemology.

The metaphysical presumptions of Scientific Realism. Alan Wallace has pointed out that in order to adopt Scientific Realism as a metaphysical ontology one must make conscious a number of unconscious assumptions: 1) Reality is only physical, and exists independently of an observer; 2) this reality can be known conceptually; 3) of all the theories of reality, only one can be true; 4) the view of Scientific Realism is that one true theory. Thus is the presumptive metaphysical view of Scientific Realism problematic, to say the least.

The great quantum debate: EPR and Bell’s Theorem. The epistemological Scientific Realism of the Hidden Variables interpretation of the Quantum Theory—Einstein, de Broglie, Schrödinger, Bohm—in perennial debate with the nominalist, instrumentalist, anti-realist Copenhagen Interpretation of the Quantum Theory—Bohr, Heisenberg, Born—deny that the Quantum Theory is complete, that is, the Standard Model of physics is incomplete. Einstein and the realists claim that it fails to offer a non-statistical, non-instrumental, realist description of the *real* objective independent existence of the furniture of relative spacetime physical reality. The Quantum Theory must therefore, be understood as an incomplete description of physical reality. Einstein insisted on an epistemologically realist interpretation; there’s an objective observer-independent “real world out there” (RWOT) existing independently from we separate observing subjects with our instruments. On this essentialist, realist account, the objects appearing to the senses exist as objective, independently existent, essentially real entities just as they appear and are given to us by the medium of our sense perception (the “myth of the given”). *The “completeness of physics” here assumes without proof—that is, it begs the question—of*

Relativistic Quantum Field Theory, which violates Einstein’s Special Relativity. This Neutrino Sector revelation, if true, demonstrates another limit of the Standard Model and the need of a fundamentally new paradigm in physics.

Materialism/Physicalism. If the physicalist explanation of physics is a complete explanation of reality, then of course, reality must necessarily be only physical. On the other hand, both Heisenberg and Bohr rejected the foundationalist defenses of the realist, mechanistic determinism of both Einstein's and Newton's classical physicalist worldview.

Complicating the issue, Nick Herbert (1985) identifies eight incompatible versions of the Quantum Theory, all of them internally consistent. Alan Wallace (1996) points out that if quantum mechanics is pragmatically true—true because it works (and it most certainly does work, every time)—then we must ask which of these several versions is the correct one? Moreover, if the Quantum Field Theory proves certain truths of popular mysticism, then we must ask which of these confirms mysticism, and which mystical experiences are confirmed by it? There is a plurality of explanatory theories that contain pragmatic truth. Perhaps we need not cling to a theory of Realism (Absolutism) or of Antirealism (nihilism) after all. This is certainly the view of the Neopragmatists.

Einstein's "inner realist" required that properties of material objects (1) have an independently "real existence" and (2) all physical effects are local (electromagnetic signals cannot exceed the speed of light). The Copenhagen Interpretation allegedly violates this common sense Scientific Realism of locality in that an individual quantum system—say, a pair of particles—can separate into two apparently "spacelike" (separated by a light signal) entities moving apart from each other while their quantities (position and momentum) remain a single "entangled" entity. When a measurement is made of one particle of the two particle system, the value of the other may be known instantaneously because it will always be of the opposite charge. In other words, the particle pair seem to interact non-locally, superluminally, via a signal that travels at faster than the speed of light. Moreover, the two particles seem to be communicating. Now that's spooky! Such "quantum entanglement" is a violation of the "locality" required by Einstein's neorealist Special Theory of Relativity. Indeed, without an experiment to determine a measurement of the particle quantities—position and momentum—the stochastic, non-determinist, non-objectivist Copenhagen Interpretation holds that the particles are non-existent—not real—a result that the Einstein vigorously resisted. Thus, it would seem that scientific Realism and the antirealist Quantum Theory are utterly incommensurable paradigms. Let us not yet foreclose debate.

In the infamous EPR thought experiment (Einstein, Podolsky, Rosen), published in 1935 (*Physical Review* Vol. 4), Einstein's realist attempt to "save the appearances"—to salvage the realist "myth of the given"—takes the form of a thought experiment challenge to the antirealist Copenhagen Interpretation of Bohr and Heisenberg. If a particle measurement can be made in an experiment that the quantum theory cannot predict, then the theory is, *ipso facto*, incomplete, and the "attempt to save the appearances" is furthered.

The EPR argument assumes the "locality assumption"—no particle interaction can be nonlocal (travel at superluminal speed)—and argues that a measurement can be made that proves that a particle in a correlated two-particle quantum system at one location in space cannot be influenced by a measurement of a particle at the other side of the galaxy, thus saving the locality assumption. Rather, the first particle alone will have precise simultaneous values as to both the particle's quantities—both position and momentum—a violation of the Heisenberg uncertainty relations. This conclusion, according to EPR, proves, not that

antirealist quantum mechanics is false, but that it is incomplete, that is to say, its description of the particle behavior in the correlated quantum system is not a complete description of the behavior of the system. Thus the cause of determinist scientific Realism is furthered. Note that EPR assumes, *a priori*, that objectivity and causality obtain in an objective real world out there (RWOT), as well as in the subjectivity of the quantum world. Reality and observer are always separate. But for Bohr and Heisenberg there is no violation of the causal principle, for causality does not obtain in the indeterminist subjectivity of the quantum realm. Quantum particle coherence is nonlocal and acausal. In the holism of the quantum theory, subjective observer and objective reality are an ontologically prior interdependent whole. The parts and particles are not separate at all. They are complementary. Sounds like Buddhist *Madhyamaka Prasangika*.

Further proof argued by Einstein: "God does not play dice with the universe." Bohr responded to this determinist-realist speculation of Einstein thusly: "Oh Einstein, stop telling God what to do."

Einstein further argued that if the Quantum Theory is complete it must apply not only to micro-particles, but as well to macroscopic phenomena, namely, cats, trees and stars. Is it not after all, absurd to conclude that the location of a cat—Schrödinger's cat, any cat—cannot be precisely determined, just because its electrons have no precise location?

Bohr's nominalist, instrumentalist antirealist reply to EPR—that this two-particle quantum system does not exist in reality, but only in an ideal experimental context—was not at all satisfying to Einstein and the naïve atomistic Realism of the hidden variables neorealists. And rightfully so. If the postmodernists Kuhn, Quine, the Introspectionists and the neuroscientists are correct—that all of our perceptions and conceptions are, at least in part, intersubjectively "theory laden," that is, they do not correspond to an objective, independently existent reality—then the Instrumentalism of the Copenhagen School of Quantum Physics offers only solipsism, we can know nothing of reality beyond our own sensory experience, and this is nothing more than Nihilism. So our ontic options seem to be either a naïve presumptuous dogmatic and absolutist Scientific Realism, or a bleak, useless, equally naïve Nihilism. Is there a middle way between Absolutism and Nihilism? Do we have a choice? *What is needed is a conceptually courageous, relative "centrist view" that declines to reify our percepts and concepts into an absolute independent physical existence, yet that offers a non-idealist explanation of appearing spacetime reality. We need to either relativize or dump Realism as an ontic explanation of what there is.* Let Realism be relegated to the epistemology of spacetime Relative-Conventional Truth.

For the next thirty years the EPR debate chilled. Then, in 1964 John Bell published a seminal, paradigm shattering paper introducing "Bell's Theorem," a mathematical proof that refutes *any* model of reality that requires the locality assumption; that is, reality must necessarily be nonlocal. Bell is questioning the EPR assumption of local causality. Bell's Theorem would demonstrate the logical inconsistency between Realism's spacetime causal local interactions among subatomic particles and the nominalist antirealist predictions of the quantum theory. Bell's Theorem established laboratory experiments—based on the mathematical formalism of "Bell's inequalities"—wherein the nonlocality of Bohr's quantum mechanics could be tested and Einstein's realist interpretation with its locality assumption could be decisively proved or disproved. Upon Bell's untimely death, these experiments were

conducted in 1982 at the University of Paris by Alain Aspect, and later by several others, that proved that Einstein's hidden variables are indeed necessarily nonlocal, and therefore 2,500 years of Premodern and Modern epistemological Realism—the Realism of both classical and relativistic physics—is refuted. “Non-local connections are ubiquitous because reality itself is non-local” (Nick Herbert). The nature of reality and the mind that perceives it are then, an undivided, unbroken whole. And if this is so, the transfer of information need not involve the propagation of light energy signals. Quantum information bits (qubits) are always already inherently present in everything. The superluminal transfer of signals of Einstein's Special Relativity is not violated after all in such an ontologically relative view. Yet, the primordial, ultimate nature of mind transcends and includes the merely spacetime coordinates of Special Relativity. Thus Einstein's nonlocal “spooky action at a distance” is an intrinsic feature of ontology, of what there is. And what is, isn't really real. Objectivity and causality are kaput! What hath God wrought?

So, Einstein and the neorealist atomists are wrong and the holistic antirealist, nominalist Copenhagen School with its spooky quantum weirdness is vindicated. That is the current academic and popular “high culture” view.

Thickening the plot. Well, that's not quite the end of the story. Lee Smolin argues (New York Review of Books, June 14, 2008) that Bell's experimental result—“Bell's inequalities”—requires that only one of Einstein's realist assumptions listed above is incorrect. Remember, these are (1) matter has a “real existence” prior to the “wave collapse” resulting from an observation or measurement, and (2) matter's particle interactions are local, that is, they obey the classical Principle of Special Relativity, that all particle interactions are mediated by light signals, thus no particle can exceed the speed of light, and therefore Einstein's “spooky action at a distance,” the bizarre nonlocality of quantum connectedness (entanglement) is false. Smolin speculates that it is assumption #2, particle interactions are local—the “locality assumption”—that is incorrect, as per Bell's inequalities. “This assumption can be denied while holding fully to Einstein's notion of realism.” Thus Smolin's neorealist “attempt to save the appearances” enlists the special pleading of the intrepid “hidden variables” argument whose *ad hoc* variations we may trace back in epistemic time through positivist, mechanist, empiricist, materialist/physicalist strategies all the way back to Leucippus and Democritus and the Greek pre-Socratic atomists, and the realist Buddhist atomists of the *Abidharma*.

Smolin argues, “There are theories that make the same predictions as quantum mechanics and are fully consistent with Einstein's notion of realism, but give up the assumption of locality.” These are of course, the “hidden variables,” theories of David Bohm, de Broglie, and recently, Ghirardi, Rimini and Weber. These theories give a realist-materialist explanation of quantum events, and criticize the stochastic, epistemologically antirealist results of the Copenhagen School as incomplete, as we have seen. For Smolin, Alain Aspect's experimental results on Bell's Theorem ruled out only hidden variables theories that are local, but not the nonlocal theories above. Moreover, Smolin reminds us that recent experiments in the on-going effort to quantize General Relativity and unify it with the Quantum Field Theory through a more complete and inclusive theory of Quantum Gravity suggest that locality—physical interactions are local, not superluminal—is a primitive theory that describes quantum behavior arising from a primordial “fundamental reality prior to the spacetime locality of

merely physical phenomena.” (Sounds like Buddhist/Vedanta metaphysics.) This incompatibility of General Relativity with the present state of the Quantum Field Theory it is assumed, will produce that next more inclusive, unifying realist theory, *i.e.* a Super-Duper String Theory that will correct the “problem of infinities” inherent in both theories, without appealing to a quite problematic *ad hoc* “renormalization” theorem.

Hope for a miracle. Alas, it cannot. Material Realist theories operate in the epistemic, relative conventionally real spacetime world. Our conceptual understanding is necessarily limited by this dimension or modality and cannot penetrate any conceptually ineffable ontic Reality that may lie prior to the Planck limit (Planck time, Planck length) and the quantum uncertainty relations. Thus Scientific Realism (Scientism) necessarily refers us to that ontologically subtler strata of formation—ontologically prior to the discursive and purely physical—which lies within or prior to this essential cognitive limit of merely conceptual understanding. The alternative is a naïve skepticism. The epistemology of objectivist foundational Material Realism—the conceptual realm of Relative Truth—cannot function as an ontological theory of ultimate reality in the subtler subjectivity of the non-conceptual realm of Ultimate Truth pointed to by the Antirealism of the Unified Quantum Vacuum, and more completely described by the Buddhist Idealism of *Yogachara*, and the centrist Middle Way ontological relativity of *Advaita Vedanta* and Buddhist *Madhyamaka Prasangika*. *We have waited 2,400 years for a hidden variable to save Material Realism! The entire edifice of the current world view of Scientific Materialism begs this question of Physicalism, the metaphysical assumption that reality is purely material or physical.* Again, the “completeness of physics” and its Quantum Theory begs this question of Physicalism (Materialism). How much longer must we wait? Would it be unfair to assert that this preconscious intersubjective realist materialist IOU has sold out the Western Tradition from the very beginning? And we’ve all bought it! In any case, the metaphysical, special pleading of the “hope for a miracle” hidden variable strategy of Reductive Materialism, Eliminative Materialism, Scientific Materialism (Scientism) and Scientific Realism requires a healthy watchful skepticism.

Alas, the appalling academic suppression of new work on hidden variables—and on consciousness and contemplative studies of the Buddhist cognitive, supramundane, “supernormal” — that dissent from the eristic ethos of the Copenhagen “orthodox ontology” has, as Smolin points out in his excellent *The Trouble With Physics* (2006), greatly inhibited further research. Perhaps such lettered hubris may best be understood as a preconscious intersubjective, deep cultural background ontic reticence to rocking the epistemic boat of the status quo, lest we be cast rudely from our *verecundiam* comfort zone of instrumentalist, nihilist quantum orthodoxy into that naked, “spooky” transrational void of ultimately subjective nondual Reality Itself. And this, while the antirealist, nascent proto-centric ontological relativism of the Copenhagen school points steadily beyond its nominalist, instrumentalist formalism, into this great open expanse of the “metaphysical,” even “mystical” primordial emptiness of the emerging Noetic Revolution. H. H. The Dalai Lama and Alan Wallace would think so.

A New Ontology? In any case, it is clear that with the failure of epistemological Scientific Realism and Physicalism/Materialism to provide ontological solace, these two great physical theories of the 20th century—General Relativity Theory and the Quantum Theory—

require a “final theory,” or at least a more inclusive, post-realist, nonlocal new ontology to explain Smolin’s “unified nature” of arising, spacetime phenomenal reality, and to unify General Relativity and the Quantum Field Theory. Smolin and other neorealists grasp at this next more inclusive theory, apparently unaware that epistemological Materialism/Realism alone is necessarily precluded as an ultimate ontological theory of everything by the conceptual—logical and epistemological—ambiguity barrier of the Planck time (10^{-33}) and the Planck length (10^{-43}). *Our weighty Problem of Knowledge—how we know what there is—requires a new noetic approach that transcends algorithmic computational (biomorphic or silicon) decidability and conceptual elaboration, yet that includes the non-discursive consciousness of the contemplatively trained human subject.* Science and its functionalist material realists must become aware of this growing body of scientific literature. In any case, Roger Penrose and others have shown that human conceptual cognition is not computational, much less noetic contemplative cognition. The human brain does not operate like a computer. (H. H. Dalai Lama 2005; Begley 2007; Wallace 2007, 2008, Penrose 1994.)

Nature is in an obvious sense “united.” The universe we find ourselves in is interconnected, in that everything interacts with everything else. There is no way we can have two theories of nature covering different phenomena, as if one had nothing to do with the other. Any claim for a final theory must be a complete theory of nature. It must encompass all we know.

—Lee Smolin, 2006

Yes indeed. It must encompass not only all we know up to Realism’s Plank ambiguity limit of conceptual understanding, but beyond. To penetrate that Upanishadic “Forest of Wisdom” we must find “the light within.” Here again, we must transcend (but include) representational Scientific Realism and Physicalism/Materialism—pragmatically useful strategies in the nominal realm of relative spacetime conventional reality—but untenable as the ontic ground of a final theory. Human beings possess an unmistakable innate imprint, a primordial urge toward transpersonal transphysical (metaphysical) knowledge, spiritual knowledge, knowledge of unobservable subjective phenomena and experience. We’ve seen that a purely objectivist, realist or physicalist epistemology is necessarily precluded as a method of reaching and explaining such subtle, non-objective phenomena. For this deeper, subtler wisdom we must—via contemplative “vertical spiritually empirical” study and practice—leap into the fearful arcanum of the perfectly subjective, metaphysical, contemplative unknown.

Let us be clear about this. The mind cannot think itself beyond itself any more than the eye can see itself. “The eye of mind sees everything, but cannot see itself” (H. H. The 16th Karmapa). A knife cannot cut itself. While it is true that we utilize the conventional knowledge of the realm of spacetime Relative Truth (*samvriti*, objective and subjective reality), in order to gradually accomplish Ultimate Truth (*paramartha*), enlightenment, *moksha*, Buddhahood—just as Nagarjuna and Plotinus told—still, there must be as it were, sudden, non-conceptual, non-discursive meditative contemplative leaps, in fear and trembling, into the vast expanse of naked, nondual Reality Itself. Our fearful skepticism that there is anything here, beyond or prior to physical reality instantiates the psychological truth that we limit our psycho-emotional-spiritual growth and happiness by our preconscious, conscious and even superconscious

attachment to the uncomfortable comfort zones of our current discursive conceptual and belief systems.

Such an injunction to venture inside is truly a radical empiricism in the mode of William James. More epistemological and methodological logocentric “idols of the tribe” are sure to fall as we enter our new Noetic Revolution. Western foundational Realism, Scientific Realism—the Realism that insists on an observer *independent* reality (RWOT) and denies the *interdependent* nonlocal and ontologically relative nature of quantum reality while clinging to the logocentric absolutes of locality and spacetime—may be the first to go.

Let us then once again, at great risk of being cast, without tenure, into the metaphysical outer darkness, consult the “intellectually lightweight,” “mysterion” Premodern primordial wisdom of the ages, the great nondual wisdom tradition of the Vedic/Buddhist tradition that culminates in relative-conventional spacetime transcendent, utterly nondual *Advaita Vedanta*, and *Ati Dzogchen*, the Great Perfection.³ Here, once again, we enter in the perennial Two Truths, the ontological interdependence of the truth of the epistemological Realism of Science (Relative Truth), with Ultimate Truth, nondual Spirit in which or in whom everything arises. Once again, we remember the paradigmatic incommensurability—the duality—of these two conceptual modalities are a prior unity in the utterly transconceptual, unfabricated one truth that is the unbroken whole of luminous nondual Reality Itself. Mind and body, spirit and matter are a transrational, noetic prior unity. So it is told by the masters of our Great Wisdom Tradition. Thus ends the Quantum Revolution, and the beginning of an inchoate noetic ontolgy, the new Noetic Revolution.

³ The nondual teaching of the great philosophical and religious traditions is no more “mysterion” or mystical or metaphysical than are the quantum uncertainty relations, or the Quantum Vacuum, or Dark Energy, or String Theory. The ultimate nature of reality is an utter mystery to the limited, even brilliant conceptual mind, but not necessarily to the highly contemplatively trained compassionate mind of the meditation master (Begley, 2007, Wallace 2007). Let us remember that the exoteric meaning of philosophy (*philo*/love and *sophia*/wisdom) is “love of wisdom.” The esoteric meaning is the recognition, then realization of the prior unity of love and wisdom. Realization and actualization of this unity of love and wisdom that is philosophy is the full *bodhi* of the buddhas and *mahasiddhas*.