

# Space and Time From Pythagoras to Einstein

David Paul Boaz

Space and time are not conditions in which we live, but modes  
in which we think.

- Albert Einstein

## Light Before Einstein

Let us now consider certain recent theoretical developments in Relativity Theory and the Quantum Theory with its Unified Quantum Vacuum which offer a bridge of understanding from the materialist realist paradigm or world view of Aristotle, the Stoics, and Descartes, to the “spooky” anti-Realism of the nonlocal Quantum Theory and the related primordial emptiness of the Buddhist view of the Great Perfection. As we have seen, the realist materialist/physicalist worldview of Modernity has been visited upon current religion, science and culture as the fundamentalist protoreligion that is Scientific Materialism (Scientism). It was the Postmodern reaction to this tyranny of objectivity of the old Modernist paradigm that begat the emerging integral Noetic Revolution that is nothing less than an incipient reunion of the hitherto incommensurable paradigms of physics and metaphysics; of the personal and the transpersonal; of Realism and Idealism; of Science and Spirituality. First then, a very brief history of spacetime.

From Pythagoras, Plato and Aristotle, to Galileo, Newton and Einstein, both exoteric and esoteric physics, philosophy and religion have been concerned with the four fundamental aspects of appearing reality: space, time, matter, and energy. Subjectivist, esoteric (right brain) attempts to unify these realities have been offered by the contemplative yogic, metaphysical and even mystical religious formulas of our primordial Great Wisdom Tradition. Objectivist, exoteric (left brain), attempts to understand and unify these apparently separate aspects of reality have focused on mathematics and physics (Boaz, 1971).

Energy is light and arises from the still luminous emptiness of its primordial source or base as motion. Motion is change, the continuous change of position of an object (with its waves and particles) relative to some frame of reference with respect to the consciousness of an observer. Consciousness is the key. The classical mechanics of Galileo, Descartes, Leibniz, and Newton clarified this idea of relative motion.

Galileo, who first proscribed value and the subjective “qualitative” from science, permitting only the quantifiable objective, postulated a relativity theory—the Principle of Galilean Relativity—adopted later by Newton and Einstein in which in an absolute “inertial” reference frame the laws of mechanics (the laws of motion) are always valid; in which theory is perfectly and always validated by experiment, a romantic perfect-world theory hungering after the grail of absolute deductive certainty. As this Modernist Cast of Mind infected the European Enlightenment the scientific study of the inherently subjective human mind was marginalized under the ensuing procrustean “taboo of subjectivity.” Contemporary Modernist mechanistic, determinist science and philosophy and the cultural worldview that follows therefrom continues to labor under this logocentric false idol of the attainability of a perfect objective certainty, in spite of the subjectivist Quantum Field Theory, utterly ignoring the inherent

subjectivity of mind—consciousness—and its perfectly subjective basal sourceground, primordial all inclusive ultimate Reality Itself, Suzuki Roshi's "Big Mind."

So, according to the classical view of Galileo and Newton, if the laws of mechanics are valid in reference frame "A," they are valid in all other reference frames moving in uniform motion (constant velocity) relative to "A." Newton's laws of motion are identical for all reference frames *moving in uniform, not accelerated motion*. No reference frame, not even the earth is privileged. All reference frames are equally valid. The bad news for this classical Newtonian mechanics is that the laws of mechanics are not valid for *non-uniform* inertial reference frames (co-ordinate systems) attached to the earth. According to recent relativity theory, the earth cannot be an inertial reference system. The laws of classical mechanics were derived therefore, from a co-ordinate system which has never been observed. Classical mechanics had no foundation! What was needed theoretically was something which was absolutely still to provide an inertial co-ordinate system or frame of reference in which the laws of mechanics are valid, and through which light propagates. The ancient theory of the ether provided such and *ad hoc* solution.

This "luminiferous ether" is a absolutely still, unmoving, invisible, undetectable "sea" that permeates everything and through which all particles, fields and objects in the universe move. Then, more bad news. Unfortunately for classical mechanics, in 1887 the "null result" of the Michelson-Morley experiment "disproved" the ether theory (although Einstein thought that it was salvageable). The ether concept has now reincarnated as cosmology's Quantum Vacuum. The death of the idea of an absolutely non-moving privileged reference frame gave birth to Einstein's Special Relativity. The incompleteness of Galilean-Newtonian relativity and Maxwell's and then Einstein's new relativistic principle of the absolute velocity of light left a gaping theoretical hole in classical modernist physics which, along with Planck's and Einstein's discovery of the quantum nature of light, would doom the Newtonian view,<sup>6</sup> and give rise to Special and General Relativity and later, the Principles of Quantum Uncertainty and Complementarity of the Quantum Field Theory, and of Quantum Cosmology.

Moreover, recent advances in the cosmology of the oscillating metaverse, neurobiology, consciousness studies, Buddhist epistemology, and philosophy of mind, and the new physics of the zero-point energy field (the quantum vacuum) have set the epistemic stage for a 21st century integral Noetic Revolution in religion, science and culture that is an incipient rapprochement of the ostensibly incommensurable paradigms of Science and Spirituality.

Thus, the objectivist quest of classical mechanics for absolute non-motion as a basis for coordinate reference systems has yet to emerge. Arising light-energy is continuous motion, constant change. Only the great depth of our ultimately subjective source (the emptiness of Tao) is changeless and still. And this perfectly subjective base or source (Brahman/*shunyata*/emptiness) is forever veiled to limited human conceptual objective understanding by the inherent subjectivity of the quantum uncertainty relations, complementarity, the Bohm-Bell-Aspect nonlocality, and the inherent objective limits of a

---

<sup>6</sup> Newtonian mechanics works perfectly well in the mesoworld. It got us to the moon and back. It does not however, accurately describe interactions in the realm of the very small that is the microworld of particle physics, in the macro realm of the very large that is intergalactic gravitational effects, and in the realm of the very dense that is quasars and black holes.

binary, two valued logic to describe a nondual ultimately subjective reality. Do the cognitive conceptual limits of the quantum theory and the bivalent logical syntax of language preclude the arising of an atavistic, semiotic (intersubjective), semantic and even contemplative understanding of emptiness? We have seen that it does not. The ultimately subjective emptiness base of reality may be penetrated by the contemplative, “spiritual empirical” yogic technologies of our Great Wisdom Tradition.

According to quantum physicist Henry Stapp, the discovery of quantum non-locality—quantum entanglement—is the ultimate unifying theory in the history of science. It is present at both the microphysical and cosmological dimensions of the unbounded whole of Reality Itself. *The uncertainty relations of the Quantum Theory is the veil of maya to our merely discursive conceptual knowing of the ultimate nature of Reality.* Yet, there is a luminous emptiness, stillness, a vast openness inherent in this movement of energy as it arises from its infinite “supreme source” as finite spacetime phenomena. This nondual transconceptual, noetic cognition (*noetos*) is present to human contemplative understanding (Begley, 2007/Wallace, 2007). And it is this nondual knowing—primordial wisdom/*gnosis/jnana*—that is the primary truth of our perennial Great Wisdom Tradition, and the key to the emerging *rapprochement* of the seeming incommensurability of the two paradigms Science and Spirituality.

The Tao that can be named is not the true Tao.

—*Tao te Ching*

The stillness in the Tao is not the true stillness. It is stillness in motion that is the Tao that pervades heaven and earth.

—*Ts'ai-ken t'an*

### **Special Relativity: Light Energy is the Wisdom of Emptiness**

Something lives within you that lives longer than the suns.  
It abides at the place in the heart.

—Chandogya Upanishad

**Special Relativity, the dreams that stuff is made of.** Einstein, Minkowski and Lorentz developed what was published by Einstein in 1905 as “On the Electrodynamics of Moving Bodies” and became known as the Special Theory of Relativity whose postulates unified our four fundamental realities—space, time, matter, energy—in a left-brain, exoteric scientific-philosophical model. This radical Principle of Relativity—this “affront to common sense” (London Times)—established a new paradigm in science and philosophy that transcended, yet included the previous Newtonian scientific paradigm.

Einstein accepted Minkowski’s four dimensional spacetime continuum, the three dimensions or co-ordinates of space, plus the temporal dimension of time. Einstein preferred the name “Theory of Invariants” for the new principle because *the second of the two basic postulates of Special Relativity* asserts that the spacetime separation of two “spacelike” events (events connected by a light signal) is the same, *i.e.* is invariant (absolute) in all inertial

reference systems. The motion or speed of light ( $c$ ) is constant, invariant, always the same when measured in relative motion. There is no reference frame or system in which light is at rest. *Light-energy is motion* (constant change). The speed of light cannot be relative; it is absolute in all sensory-perceptual frames of reference. And this postulate is derived from *Einstein's first postulate, the fundamental principle of relativity, that the laws of physics—the laws of mechanics and the laws of electromagnetism—must be the same for any observer in any reference frame anywhere in the physical cosmos*. The laws of physics—the laws of nature—are the same in all inertial reference systems. No observer's reference frame is privileged or "special," not even ours on the earth. We can do the same mathematics and physics anywhere in the physical cosmos. This postulate generalizes the Galilean/Newtonian relativity principle to include Maxwell's laws of electromagnetism (but not gravity), not just Newton's laws of mechanics. And this resulted in the constancy of the velocity of light ( $c$ ). Later, in 1915 Einstein's General Theory of Relativity would generalize his Special Relativity to include not just inertial systems but accelerated reference systems, and thereby define a new gravity (p.53).

According to our Great Wisdom Tradition, the fundamental nature of *kosmos* (ultimate reality) and *cosmos* (physical and mental reality arising therefrom) is empty, changeless and absolute. But the mental and physical phenomenal particulars arising and filling the world with light arise in and are relative to that great unbroken whole. We have absolute mind (Suzuki Roshi's "Big Mind"), our quantum primordial sourceground by whatever name, and relative mind ("Small Mind") arising therein. These two aspects of ultimately subjective Reality Itself are the conceptual "Two Truths"—relative phenomena and its ultimate ground—that are unified in the prior transconceptual one truth. Thus, *Special Relativity* has demonstrated (not proven) in a left-brain verbal-analytic modality (relative truth) the Primordial Wisdom truth and the Buddhist *Madhyamaka* view that the inherent nature of all arising relative phenomena is numinous luminous light energy. Let us then further explore this radical *kosmic* relationship.

Human reference systems or frames of reference are perceptually and conceptually fabricated relative spacetime constructions of the consciousness—the cognition—of the perceiving subject, a thinking-conceptual mind, and do not exist *a priori* in nature, apart from the relative operations of the mind. Kant understood this a hundred years before Einstein. Therefore, it is through the operations of mind that we reify, designate and construct our local, relative spacetime reality. *Of the great unbounded whole of appearing reality, there exist sentient beings whose perception or consciousness of systems of reference regarding the energy-motion of objects arising in the spacetime of that reality, are relative to the motion or velocity of light ( $c$ ), which is absolute or invariant, the same for all observers, the light source, and of direction, position, and time*. Indeed, light disregards the (Lorentz) transformation laws of classical mechanics altogether. Paradoxically, the reference system of "the observer" (believer) is not privileged. That is, all reference frames are equally privileged. The privileged reference frame of Maxwell's "luminiferous ether" is denied. Temporal relations are not absolute. Time is relative. Newton's absolute, one directional time is refuted. Linear causality is *kaput!*

**The end of time (59ff).** In Special Relativity, the forward flow of time—the thermodynamic "arrow of time"—is illusory. Thus Boltzmann's temporal asymmetry: the laws of mechanics do not preclude the arrow of time from moving in either direction! The Second

Law of Thermodynamics is not deterministic, but probabilistic. There is nothing that causes entropy to increase. Nominally, entropy may increase or decrease. *Time is dependent upon a particular reference frame, it has no independent existence. Time has no essential independent or absolute reality, but is merely a creative conventionally reified dependent array of causes and conditions, arising from an infinitely vast nondual “causal nexus.”* Just so, time exists only relatively, by intersubjective convention and conceptual designation. Past, present and future are absent any absolute or intrinsic reality. Events that occur simultaneously at separate locations in one frame of reference, will not be simultaneous in all frames of reference. Simultaneity is relative. Two observers in relative motion to one another see the others’ clock “run slow” with no contradiction. And all of this is relative to the subjective Absolute in which arises objective light-energy-motion whose velocity in the Quantum Vacuum is absolute, a universal constant. As we have seen, this ultimately subjective source of objective light-energy-mass of the  $E=mc^2$  equation, by whatever name is, *ipso facto* beyond physics—metaphysics—and is therefore not objectively knowable to conceptual mind. Yet this matrix source may be recognized, then subjectively realized by a trained yogic contemplative consciousness (*pratyaksa, samadhi, moksha*: Wallace 2007, Begley 2007).

*Therefore, some of the relations which deterministic Galilean-Newtonian mechanics had held to be invariant or absolute—spatial distance, time, mass—have been relativized. But two critical Newtonian relations, the velocity of light and the universality of the laws of physics have been “absolutized.” Therefore it is a mistake to assert that Special Relativity claims everything to be relative. What is relative is the spacetime arising appearances to a perceiving consciousness. What may appear to an observer relative to the reference frame of the earth as twenty-five years, may appear to an observer moving at near the speed of light as one year (the “twins paradox”). Appearing phenomena are dependent on the state of motion of the observer, and are relative to that reference frame. No conscious observer, no phenomena. No consciousness, no arising appearing reality. (More on this in the Quantum Theory below.)*

**General Relativity, the zen of spacetime.** *Special Relativity* (1905) is “special” because it applies only for inertial systems in which gravitational forces (acceleration) are not present, that is, systems that move in uniform, not accelerated motion relative to one another. The force of gravity was included by Einstein in the *General Theory of Relativity* (1915) and applies to all observers whether in uniform inertial motion or accelerated motion. The General Theory—arguably the greatest individual intellectual accomplishment in human history—is a speculative theory of gravity, a geometric generalization of Special Relativity that includes Galileo’s and Newton’s classical theory as a limiting case. Einstein’s Principle of Equivalence, the essence of General Relativity, subsumed accelerated motion under gravitation making gravity not a force acting at a distance as Newton would have it, but a local result of gravity in curved spacetime. Spacetime is curved by local matter and energy; gravity is nothing more than the curvature of spacetime. *Both of Einstein’s relativity theories are classical theories in that they are incompatible with the post-classical Uncertainty Principle of the Quantum Theory. Both relativity theories assert classical realist “locality,” that no signal can propagate faster than the velocity of light. Neither relativity theory addresses the problem of non-locality, Einstein’s “spooky action at a distance,” the instantaneous, superluminal (faster than light) propagation of light, and of gravity. Indeed, no classical theory can, by definition, explain the mysterious nonlocal, superluminal*

connectedness (quantum entanglement) of quantum reality. (Classical Galilean, Newtonian and Einsteinian relativity limit particle interactions to the speed of light). Definitive theorems and experiments by John Bell, Alain Aspect and many others have confirmed this paradoxical non-local, non-causal nature of hitherto “objective” appearing reality (p.68ff).

**A most amazing paradox.** So, the velocity of an object in motion can be determined only relative to the consciousness of an observer. A person running down the aisle of a train appears to be moving at the speed of the train, plus 10 mph. This is known as a classical (Lorentz) transformation. Again, Einstein assumed that the speed of light ( $c$ ) moving between the two reference frames was constant, *i.e.* the same for observers in both frames. Therefore, an observer in each reference frame will perceive the motion differently. Both observers are correct! There can be no privileged reference frame which is *really* correct. A most amazing paradox.

Again, time is not absolute, but relative (p.59ff). Again, simultaneity is relative. Time interval between two events is relative to the motion of an observer. This notion leads to the paradoxical result of *time dilation*. We have seen in the “twins paradox” that a space traveller moving at near the velocity of light ( $c$ ) would be away for many earth years, yet only a few months will have passed in the reference frame of the space traveller. Synchronized clocks of any two observers in different reference frames will read differently. “Moving clocks run slow.” Clocks moving at the speed of light stop. A moving clock does not run slower or stop compared to the clock of an observer at rest. A third clock must be used. Actually moving clocks do not really run slow. Remember, we cannot ask, “which reference frame is *really* correct. No reference frame is privileged; not even yours or mine.

**$E=mc^2$ .** *Another result of Special Relativity is that the mass of a body in motion increases with its velocity until, at the velocity of light, its mass becomes infinite, a fabulous result, to be sure. Einstein later developed this hypothesis into his famous  $E=mc^2$ , that the mass of a body is a measure of its energy content.* Just so, as space and time are not separate but constitute the continuum of spacetime, mass and energy are not separate but constitute mass-energy. This paradigm shift creates an entirely different conception of mass than that produced by the “web of belief” of Newton. Thus, this famous equation— $E=mc^2$ —was actually a footnote to Special Relativity, developed by Einstein between 1905 and 1907 when he published it.

The first of what Einstein termed the two “balance principles” of classical, Galilean/Leibnizian/Newtonian relativity is the *principle of the conservation of energy*, which states that arising primordial energy (*jnana prana*) cannot be created or destroyed, only changed in form. For example, combustion converts stored chemical energy into thermal energy which may in turn be converted to kinetic energy to run a generator which produces the electrical energy that lights our homes. Throughout the conversions, energy is conserved, that is, neither created nor destroyed. The second “balance principle” is the *principle of the conservation of mass*. Classical physicists extended the first of these principles to include not only mechanical energy, but also to thermal, chemical and electromagnetic energy, that is, to all physical fields. Energy is conserved through all possible changes. But what precisely *is* energy? What is the ontological status of this unity that is mass-energy? Nobody seems to know. Heisenberg, Bohr, Dirac, Stapp and Feynman suggest a nominalist view—that energy is not a local physical spacetime existing objective reality, but is merely a reified, stochastic

mathematical-conceptual abstraction empty of an independently real inherent existence. This is of course, the ontological relativity of the Buddhist *Madhyamaka Prasangika* view. Mass-energy arises within the context matrix of our conceptual “web of belief” (Quine) which determines our lifeworld reality. Mere theory can posit no reality. Ontology — what there is — is relative to the assumptions of our deep cultural background conceptual and belief systems. And this is ontological relativity.

Regarding the second principle, mass appeared to classical theorists to be the essential, invariant or absolute quality of matter. *The classical mind reifies absolute entities and does not discern quantum event moments (vasana, qubits) arising from the process of reciprocal cognitive coupling of observer and that observed.* But this view did not hold up to Special Relativity and was therefore, transcended and included in the principle of the conservation of energy which had, as Einstein put it, “previously swallowed up” the other energy fields. Primordial light energy arising from its utterly ineffable source is always conserved. So now mass/matter are equivalent as mass-energy. Mass is solidified energy; energy is liberated matter.

**Newtonian sidebar.** The great classical mind of Sir Isaac Newton (1642–1727) anticipated this truth of the equivalency of mass and energy in his *Optiks* when he asked, “Are not gross bodies and light convertible into one another.” The young Scots prodigy and later prodigious genius, David Hume referred to Newton, this greatest of all intellects as “the greatest and rarest that ever arose for the ornament and instruction of the species.” Even the poets loved Newton. Alexander Pope’s memorable epitaph for Newton: “Knowledge and nature’s laws lay hid in night. Then God said, ‘Let Newton Be,’ and all was light.” The great contemplative omniscient minds of the Buddhas and *Mahasiddhas* notwithstanding, only the astonishing syncretic genius of Aristotle or of Al-biruni compares.

By 1666, Newton, at the tender age of 24 had accomplished 1) his explanation of the theory of gravity, 2) his three laws of motion, 3) his infinitesimal calculus, and 4) his theory of optics, which explained the nature of light.

Without Newton’s calculus we would have to muddle through without jet planes, spaceflight, skyscrapers, Accuweather, MRI, nuclear bombs and financial derivatives.

In 1687 he published what is generally considered the greatest individual intellectual achievement in human history, his sublime *Principia Mathematica* which included these early discoveries, mapped the nature of the physical cosmos, silenced his Cartesian School critics, utterly transcended prevailing Aristotelian Scholasticism, and firmly established Francis Bacon’s *Novum Organon*, the new inductive scientific method. Meanwhile he was a student of gnostic and mystical wisdom. The aftermath of this astounding display of genius was nothing less than the European Enlightenment and its cultural revolution that became the Modernity of our Modern world.

Back to the genius of Einstein and  $E=mc^2$ , arguably the second greatest intellectual achievement of humankind.  $E=mc^2$  is the mathematical formulation of the Theory of Special Relativity to express the fundamental equivalence of matter and energy, where “E” is energy, “m” is mass (quantity of matter), and “ $c^2$ ” is the velocity of light squared (multiplied by itself), a huge number. Therefore, there is enormous energy contained in the smallest bit of matter. This equation represents the mathematical formula for the conversion of mass (matter) to energy that occurs in the nuclear reactions of stars, nuclear reactors and nuclear bombs. Einstein

explains simply (1952):

The mass of a body is the measure of its energy content; if the energy changes by  $L$ , the mass changes in the same sense by  $L/9 \times 10^{20}$ , the energy being measured in ergs, and the mass in grams.

The  $E=mc^2$  equation applies not just to nuclear reactions, but to all energy transformations, thermal, chemical and electromagnetic. The most profound example of the equivalence of energy and mass is “pair production,” the pair creation of particles of matter and antimatter arising from the Quantum Vacuum that is the pure primordial energy base of the physical cosmos (if not the entire *kosmos*). This occurs in particle accelerators, black holes and the Big Bangs that create the many universes of the oscillating “Metaverse” (Multiverse).

**The wisdom of emptiness.**  *$E=mc^2$  demonstrates that all matter, all of material reality is actually light-energy (prana, shakti, lung, pneuma, ch'i) arising from vast basal primordial emptiness/matrix/sourceground, just as the Hindu Vedas, Upanishads, Buddhist Tantras and other teachings of our Great Wisdom Tradition have told from the very beginning.* On the account of our Great Tradition then, the physical cosmos is not simply a linear, material chain of cause and effect from the “Big Bang” (“First Cause”) to the present, but an atemporal, continuous emanation, manifestation, objectification or solidification of light-energy from its great timeless, ultimately or perfectly subjective, utterly ineffable (to concept-mind but not yogic contemplative mind) base or source, the “supreme source” (*cittadhatu*), of all-inclusive *Kosmos* (gross, physical, subtle, causal, nondual aspects of the reality dimensions of Body, Mind, Spirit), the Primordial Emptiness, Tao, *Nirguna Brahman* of our Great Wisdom Tradition. According to Tibetan *Dzogchen* scholar and meditation master Chögyal Namkhai Norbu:

It is the inherent nature of the primordial state to manifest as light, which in turn manifests as the five colors, the essences of the elements ...to produce the elements themselves, which make up ...the whole material dimension ...the spontaneously arising play of this energy ...may be enjoyed as such by an individual who remains integrated with his or her essential inherent condition, in the self-liberating, self-perfected state, the state of Dzogchen.

—Chögyal Namkhai Norbu, 1999

$E=mc^2$ , with its light energy (motion/matter), along with the inherent emptiness of such matter in the Quantum Theory, has bridged the gap, analogically, between space and time, physics and metaphysics, between the vexing Modernist dualism of the Cartesian/Newtonian objective worldview, and the inherent subjectivity of the quantum and Buddhist worldviews.

From this urgent synthesis now arises the incipient integral world reformation of the 21st century that is the very foundation of the emerging Noetic Revolution. But first, the Quantum Revolution.