ON THE PHILOSOPHICAL INADEQUACY OF MODERN PHYSICS AND THE NEED FOR A THEORY OF SPACE

Henry H. Lindner

ABSTRACT: Relativity and Quantum Mechanics are not what physicists think they are. They are not physical theories; they are mathematical models of the observers' experiences and measurements—of the contents of consciousness. They relate physical phenomena to observers and arbitrary frames, not to Cosmic entities or frames. Since they do not model the Cosmos, they cannot be used to theorize about Cosmic entities or processes; attempting to do so produces paradoxes and confusion. These subjectivistic models and the Science of which they are archetypes are products of Berkeleyan subjective idealism and Machian positivism—archaic spiritualistic-idealistic theories of the nature of consciousness and its contents. In order to understand the Cosmos we must relate all physical phenomena to the causal substrate—to Cosmic space. When we do so, gravity immediately appears to be the flow of inertial-electromagnetic space into all matter. The flow's acceleration (GM/r^2) produces gravity's ballistic effects and its velocity ($\sqrt{2GM/r}$) produces gravity's electromagnetic ("relativistic") effects. This theory directly implies plausible mechanisms for black holes and for the galaxial rotation and recession anomalies (a.k.a. "dark matter" and "dark energy"). Its quantized space allows us to theorize about the microcosmic entities and processes that underlie the hierarchical evolution of complexity. Space theory restores the Cosmos and causality to both physics and philosophy.

KEYWORDS: Black Holes, Cosmos, Dark Matter, Dark Energy, Epistemology, Ether, Evolution, Gravity, Idealism, Language, Metaphysics, Newtonian Mechanics, Philosophy, Physics, Positivism, Quantum Mechanics, Relativity, Science, Space

It is the cause that we seek in all our inquiries…One who can give no account which includes the cause has no scientific knowledge.

Aristotle[1]

These [Ptolemy's eccentrics, deferents, equants and epicycles] are not retained by philosophical astronomers who…seek to investigate the true constitution of the universe.

Galileo Galilei[2]

In philosophical disquisitions we ought to abstract from our senses and consider things themselves, distinct from what are only sensible measures of them.

Isaac Newton[3]

It has recently been objected that this [theory of evolution] is an unsafe method of arguing; but it is a method used…by the greatest natural philosophers…the belief in the revolution of the earth on its own axis was until lately supported by hardly any direct evidence.

Charles Darwin[4]

1 INTRODUCTION

Many, if not most of us no longer see the Cosmos[5,6] and our species as having been created by a supernatural being a few thousand years ago. We believe that the Cosmos has existed for billions of years and that we are recent products of its evolution. As Carl Sagan put it, "We are star-stuff…a way for the Cosmos to know itself."[7,8] It is therefore imperative that we try to understand what the Cosmos is, how it produces level-upon-level of complexity including creatures like ourselves, and what this means for how we should think and live. This paper is an account of what I discovered when I looked to theoretical physics for answers.

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[1] Aristotle, *Posterior Analytics*, Bk II, ch. 2 and Bk. I, ch. 6.
[2] Galileo Galilei, First Letter to Mark Welser on Solar Spots, 1612.
[3] Isaac Newton, *Mathematical Principles of Natural Philosophy*, 1686, Definitions, Scholium, para. 8.
[4] Charles Darwin, *The Origin of Species*, 1872, 6th ed., p. 421.
[5] By "Cosmos" I refer to everything that exists, including space, galaxies, stars, planets, living creatures, ourselves, our consciousnesses, our cultures and our products.
[6] I believe that we should capitalize the proper names of celestial objects and ideologies.
[7] Carl Sagan, *Cosmos, A Personal Voyage*, PBS, 1980, see also:
[8] Anne Druyan and Steve Soter, *Cosmos: A Space-Time Odyssey*, with Neil deGrasse Tyson, Nat. Geo. Ch., 2014.

As a young man I discovered philosophy through the works of Ayn Rand. She asserted the primacy of existence (Cosmism) over the primacy of consciousness (spiritualism-idealism).[9] I embraced Cosmism and began deprogramming myself from the spiritualistic doctrines that I had been taught. I searched for, but failed to find a fully-developed alternative worldview in the literature, so I began reprogramming myself by writing an outline of the Cosmos' evolution of complexity.[10] I first assumed that all physical phenomena were products of mass-energy and space-time. However, while reading Albert Einstein's book on Relativity,[11] I realized that these were nothing but measurements, made by the observer, with his rods and clocks. I found that Quantum Mechanics (QM) was also an observer-based accounting-prediction model. I realized that our theoretical physics described the contents of human consciousness, not the Cosmos; that we had no theory of what exists and causes[12] physical phenomena. I assumed that such a theory must begin by relating the phenomena to Cosmic space instead of observers and arbitrary frames. When I did so, space immediately appeared to be a substance of some kind; that which resists the acceleration of matter, transmits light waves at velocity *c*, prevents matter from moving at *c*, and spontaneously organizes itself into subatomic particles, then atoms, then molecules, single-celled organisms, plants, animals, and animals with language.

With this alternative philosophical approach, I interpreted Einstein's principle of equivalence of inertial and gravitational acceleration as implying that gravity is the flow of space into all matter. This theory fits the facts, explains the successes of Newton and Einstein,[13] and promises to explain much more. I wondered why this theory had been ignored, and began to study both physics and philosophy in depth.[14] I discovered a prohibition against space theory (the ether taboo). By following it to its source I came to understand the philosophical inadequacy, not only of modern physics, but of Science itself. In this paper, I expose the origins and nature of modern physics and Science, explain what philosophy is and why we need it, and show how to replace Relativity and QM with a theory of Cosmic space and motion.

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[9] Ayn Rand, *Philosophy: Who Needs It*, 1982, p. 29.

[10] An old version can be seen at http://henrylindner.net/Writings/Hierarchical.html (Sept. 1, 2015). In it, I have already replaced the original mass-energy/space-time (MEST) with quantized space.

[11] Albert Einstein, *Relativity, The Special and General Theory*, Crown, 1961, orig. pub. 1920.

[12] The meaning of "space", "cause", etc., depends upon the theoretical context, which I will provide.

[13] Henry H. Lindner, "Beyond Newton and Einstein to Flowing Space", *Physics Essays*, vol. 25, 2012, p. 500.

[14] Henry H. Lindner, "Beyond Consciousness to Cosmos—Beyond Relativity and Quantum Theory to Cosmic Theory", *Physics Essays*, vol. 15, 2002, p. 15. It includes definitions of the alternative philosophical positions.

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2 SPACE AND MOTION FROM PTOLEMY TO STOKES AND LORENTZ

Ptolemy of Alexandria (*c.* 150) modeled Cosmic motion in Earth's frame; it did indeed seem that Earth was stationary and at the center of the Cosmos. The stars rotated around Earth every 24 hours, but the planets had wandering paths, moving backwards at times. To describe their motion required *ad hoc* mathematical devices: eccentrics, deferents, equants and epicycles. The Ptolemaic system fit the facts and gave correct predictions, but Copernicus refused to believe that it represented Cosmic reality. He thought that God would favor a more natural motion. He read about the heliocentric theory of Aristarchus and others, and using the latest data, was able to demonstrate that the planets' motions could be simple circles if they and Earth were in orbit about the Sun. His theory sent Earth flying through space at 30 km/s (67,000 miles/hr) while rotating on its axis every 24 hours (1037 miles/hr at the equator).[15] His opponents argued that such motions were not evident to their senses or instruments—they felt no spatial wind or rotation. Copernicus could neither answer these objections nor provide any explanation for Earth's motion. His model, though simpler, was not as accurate as Ptolemy's. Only in retrospect do we know that his cognitive leap from

[15] Nicolaus Copernicus, *On the Revolutions of the Heavenly Spheres*, 1543.

the observer's accidental frame to the causative Cosmic frame was necessary for all subsequent progress in physics and philosophy. Johannes Kepler improved Copernicus' theory by determining that the planets' orbits were not circles but ellipses. This allowed Isaac Newton to model astronomical motions as due to an inverse-square-law gravitational force acting within absolute space. Newton's single Cosmic inertial frame resisted the acceleration of matter ($F = ma$) but allowed it to move at any uniform velocity (in inertial motion) without resistance. He believed that all matter had some definite velocity in space, even if it could not be determined.[16]

Michael Faraday's experiments led him to believe that electric and magnetic fields were states of a medium that filled all space. This idea encouraged James Clerk Maxwell to postulate that Newton's space was also the electromagnetic medium (i.e., ether or aether). On this basis he formulated the equations of classical electrodynamics which predicted that waves in this medium would propagate at velocity *c*.[17] In 1887, Michelson and Morley performed a light wave-interferometer experiment (MMX) to detect the ether wind caused by Earth's ±30 km/s orbital velocity through Newton-Maxwell inertial-electromagnetic space.[18] Their null result (no detected wind) supported George Stokes' ether-entrainment theory[19]—that there was no ether wind because Earth entrained (dragged) its surrounding space with it into its free-fall orbital motion, but not into its rotation. The null MMX was inconsistent with the Newton-Maxwell space theory, but George Fitzgerald and Hendrik Lorentz tried to save it by arguing that the wind existed but was not detected because electrons moving through the ether were shortened in the direction of motion. Since matter's extension is electronic, this shortened the arm of the interferometer parallel to the flow so that its light travel time equaled the travel time in the perpendicular arm. Lorentz's transformation equations described this length contraction and transverse frequency reduction (time dilation). Lorentz ether theory,[20,21] further developed by Poincaré,[22] explained what are now called "relativistic" effects as physical effects of velocity in electromagnetic space.

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[16] Isaac Newton, *Mathematical Principles of Natural Philosophy*, Definitions, Scholium, para. 9.

[17] Said Maxwell: "It was perhaps to the advantage of Science that Faraday…was not a professed mathematician…He was thus left at leisure to do his proper work, to coordinate his ideas with his facts, and to express them in natural, untechnical language." *A Treatise on Electricity and Magnetism*, 1873, see Dover, 1954, vol. 2, p. 176.

[18] Albert Michelson and Edward Morley, "On the Relative Motion of the Earth and the Luminiferous Ether", *American Journal of Science*, 1887, vol. 34, p. 333. Modern experiments have yielded the same result.

[19] George Stokes, "On the Aberration of Light", *Philosophical Magazine*, vol. 27, 1845, p. 9. He said it was "startling" to think that the Earth in its motion would offer no resistance to the ether; i.e., that the inertial-electromagnetic medium could flow through the Earth as if it were not there.

[20] Hendrik A. Lorentz, *The Electromagnetic Theory of Maxwell and its Application to Moving Bodies*, 1892.

[21] Hendrik A. Lorentz, *Attempt of a Theory of Electrical and Optical Phenomena in Moving Bodies*, 1895.

[22] Henri Poincaré, "On the Dynamics of the Electron", *Rendiconti del Circolo matematico di Palermo*, vol. 21, 1906, p. 129.

In 1925 Michelson and Gale built a large rectangular closed-path interferometer in a field. They sent light around it in both directions and found that its velocity differed when it propagated with or against Earth's rotation. They detected the rotational ether wind[23] proving that light propagated at *c* in a medium that did not rotate with Earth. Georges Sagnac saw the same effect with a small rotating ring interferometer and also considered it proof of the existence of the luminiferous ether.[24] The MMX and rotating interferometer experiments were consistent with both Stokes' ether-entrainment theory and the Newton-Maxwell-Lorentz ether theory.[25] To understand what happened next requires a review of the history of philosophy, concentrating upon the ideas that influenced the young Albert Einstein and other physicists of his time.

3 THE ORIGIN AND NATURE OF MODERN PHYSICS

It is not surprising if the growth of natural philosophy is checked, when religion, the thing which has the most power over men's minds, has by the simpleness and incautious zeal of certain persons been drawn to take part against her.

Francis Bacon[26]

Philosophy was born in Ionia in the 6th century B.C when Thales of Miletus theorized that all physical entities and processes were the result of changes in and of water. This historic conjecture replaced myth and magic with Cosmic theory. His pupil, Anaximander, posited the existence of an invisible eternal substance, *apeiron*, that gave rise to everything that we perceive. Leucippus and Democritus theorized that all phenomena were caused by invisible atoms flying through a void (atomism). There was, however, another trend in Greek thought. Pythagoras asserted that the Cosmos was a manifestation of mathematics. The sophist Protagoras claimed that "man is the criterion of all objects". Of him it was said, "he posits only what appears to each individual, and thus he introduces relativity".[27] The problems that Socrates encountered in trying to explain the world made him doubt the efficacy of Cosmic theory and even of his own senses. He decided to "take recourse to the world of mind and seek there the truth of existence".[28] His pupil Aristippus founded the Cyrenaic

[23] Albert Michelson and Henry Gale, "The Effect of the Earth's Rotation on the Velocity of Light, Part II", *Astrophysical Journal*, vol. 61, 1925, p. 140.

[24] Georges Sagnac, "Sur la Preuve de la Réalité de l'Éther Lumineux par l'Expérience de l'Interférographe Tournant" [On the proof of the reality of the luminiferous aether by the experiment with a rotating interferometer], *Comptes Rendus*, vol. 157, 1913, p. 1410.

[25] A debate ensued about whether Stokes' ether-entrainment theory was compatible with stellar aberration. Stokes and Max Planck argued that it was. Lorentz conceded that Stokes' theory was consistent with aberration if the Earth-entrained ether had certain qualities. (See Lorentz, 1909, p. 170.).

[26] Francis Bacon, *Novum Organum*, 1620, Aphorisms, lxxxix.

[27] Sextus Empiricus, *Outlines of Pyrrhonism*, I. 216 sq.

[28] Plato, *Phaedo.*

school which rejected both physical theory and mathematics, claiming we can only know our sensations and experiences. Plato asserted that there was an underlying cause of our experiences—the world that we experience (becoming) is a projection from an unseen world of ideas (being).[29]

Aristotle opposed the skepticism, subjectivism, relativism and idealism of these thinkers. He demonstrated that subjectivism cannot account for illusions, and that different observers must often disagree on what they experience and measure:

> *But if not all things are relative, but some are self-existent, not everything that appears will be true; for that which appears is apparent to someone; so that he who says all things that appear are true, makes all things relative.*[30]

Aristotle argued that gravity was proof that motion was not merely relative, as objects gravitate Earthward regardless of the position of the observer or the choice of frame.[31] In the Dark Ages Aristotle's works on logic educated the nascent Western civilization. However, with the discovery of his works on natural philosophy the union was strained. Churchmen viewed his idea of a self-existing, self-evolving Cosmos as a threat to religion. Thomas Aquinas tried and failed to reconcile Aristotle and Christianity. In 1277 the Bishop of Paris issued a condemnation of many Aristotelian-Thomist theses. William of Ockham then tried to free theology from philosophy by stressing the omnipotence of God and the radical dependence of all things upon God. He asserted that we should only describe our experiences using the fewest propositions necessary, not posit God-independent causes or mechanisms.[32]

René Descartes similarly argued that we should confine our knowledge to what is given to us by God and about which we can be certain—the "clear and distinct ideas presented to the senses". His *Cogito*, "I think, therefore I am", tacitly assumed spiritualism: that consciousness exists prior to and independent of the human body. He argued that the Cosmos could be a hallucination produced in his mind by a demon,[33] and that theorizing about the unseen or final (Cosmic) causes of things could lead to "error and sin".[34] We should confine ourselves to what is indubitable: the mathematical description of our sensations and measurements—universal mathematics. He invented his three-dimensional coordinate system to convert Cosmic space and motion into mathematical information. John Locke also asserted that we could only know the ideas presented to us by our senses and could never pass beyond them to any knowledge of the nature or hidden causes of things.[35] Descartes and

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[29] Plato, *The Republic*, Bk. VII.
[30] Aristotle, *Metaphysics*, Bk. IV, ch. 6, 1011a.
[31] Aristotle, *Physics*, Bk. IV, ch. 1, 208b. An argument against Relativity that is no less cogent today.
[32] Ernest A. Moody, "William of Ockham", *The Encyclopedia of Philosophy*, 1rst ed., 1967. This is the origin of Ockham's Razor: the simplest theory is always "God does it".
[33] René Descartes, *Meditations on First Philosophy*, 1641, Med. I, para. 10.
[34] Descartes, Med. IV, paras. 5, 9.
[35] John Locke, *An Essay Concerning Human Understanding*, 1690, Bk. II, chap. XXIII. This is empiricism.

Locke were dualists—they believed in two metaphysical realities: spiritual and physical, consciousness and Cosmos. This left a problem: How do these two different realities coexist and interact?

This problem was addressed by George Berkeley (*c.* 1710), a bishop of the Church of Ireland. He saw the damage done to religious belief by the Copernican and Newtonian revolutions. He realized that dualism was unstable and feared that as philosophy continued to reveal the workings of the Cosmos, faith in Christianity would decline. Philosophy was a slippery slope leading to atheistic materialism. He realized that he could destroy philosophy by removing its object—the Cosmos. He asserted that since we are spirits, we can only know our spiritual experiences. Since we have no direct knowledge of any physical Cosmos, we must not assume that it exists—it is a superfluous hypothesis.[36] He argued that the Cosmos that we perceive is a spiritual simulation, created, coordinated and fed to our spirits by God. An analogue of Berkeley's subjective idealism can be seen in the science fiction film, *The Matrix*.[37] In it, humans believe that they are living in the real world, when in fact their bodies are lying in vats and their brains are hard-wired to a neural-active computer simulation. They interact with one another within this virtual reality. Berkeley argued that since God alone makes one experience follow another, philosophy should merely note these regularities and not pretend to explain things by corporeal causes.[38] Thus Berkeley studied optics in order to understand how God creates the illusion of distance in the spiritual Matrix, and coordinates it with the illusion of our own motion in virtual space.[39] Berkeley hoped that the heathen would stop worshipping the Sun when they realized it was just a God-provided apparition.[40]

Berkeley accused Newton of atheism because his absolute space, absolute time, and matter existed "without the mind" and thus without God.[41] He argued that gravity was not an essential quality inherent in bodies but was simply a motion entirely dependent on the will of the God—who causes some bodies to tend towards each other, others to stay at fixed distances, and others to fly asunder as He sees convenient.[42] Since God alone makes one experience follow another, we should not treat motion as absolute or Cosmic but as merely relative to ourselves and to other objects in our sensoria, and treat time as the succession of events in our consciousness. David Hume followed Berkeley in asserting that our belief that an effect will follow from a cause is merely a custom that we have acquired through repetitive

[36] George Berkeley, *Principles of Human Knowledge*, 1710, body, para. 18.
[37] Andy Wachowski and Lana Wachowski, *The Matrix*, Warner Bros., 1999.
[38] Ibid., para. 66.
[39] George Berkeley, *An Essay towards a New Theory of Vision*, 1709, (just as video game makers do today).
[40] *Principles of Human Knowledge*, para. 94.
[41] Ibid., paras. 92, 117
[42] Ibid., para. 106.

experience.[43] He denied that we could ever know the cause of a custom like gravity.[44] Immanuel Kant similarly argued that we could know only the *phenomena* presented to our senses and could never pass beyond them to knowledge of the *noumena*—of things in themselves.[45]

Ernst Mach was a highly influential philosopher-scientist in the late 19th and early 20th centuries. He admitted his debt to Berkeley, Hume and Kant[46] and thus proclaimed, "The world consists only of our sensations."[47] He did not speak of philosophy, but instead asserted that the aim of Science[48] was to describe our sensations, and that the laws of Science were just consistent relationships among our sensations. What is not directly perceived does not exist; any inapparent entities that we posit as causes of our sensations are just "metaphysical speculations"—convenient fictions. He redefined "theory" to mean "mathematical model".[49] Mach's Science is known as "positivism". True to his ideology, he denied the existence of atoms because they were not evident to our senses. Following Berkeley, he dismissed Newton's theory of absolute space and motion as "devoid of content", saying that "we have knowledge only of relative spaces and motions".[50] He called those who shared this view "relativists". Unlike Berkeley, Mach did not provide any theory to explain how we exist and have these shared experiences.

Albert Einstein rejected traditional religion and authority as a teenager and developed a keen interest in philosophy. He read Descartes, Berkeley, Kant and others. He credited Hume and Mach for his approach to physics.[51,52] So we can understand why he said:

> *The only justification for our concepts and system of concepts is that they serve to represent the complex of experiences; beyond this they have no legitimacy.*[53]

Following Mach, Einstein at first insisted that only observable facts be accepted as causes. He too rejected Newton's space because it could not be seen. However, his ideology changed with time: "in my younger years, however, Mach's epistemological position also influenced me very greatly, a position which today appears to me to be essentially untenable. For he did not place in correct light the essentially constructive

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[43] David Hume, *An Enquiry Concerning Human Understanding,* 1748, sec. V, pt. II, para.11.
[44] Ibid,.sect. IV, part I, para. 12.
[45] Immanuel Kant, *Prolegmena to Every Future Metaphysics that may be Presented as a Science,* 1783.
[46] Peter Alexander, "Mach, Ernst", *The Encyclopedia of Philosophy,* 1rst ed., 1967.
[47] Ernst Mach, *The Analysis of Sensations,* 1897, English translation, 1914, p. 12.
[48] I capitalize "Science" when referring to this subjectivistic-positivistic ideology; not when referring to the various sciences.
[49] Mach's definition is still used today; scientists therefore do not know what a real theory is.
[50] Ernst Mach, *The Science of Mechanics,* 1883, English translation, 1960, p. 283.
[51] Albert Einstein, *Michele Besso Correspondence 1903-1955,* Hermann, Paris, 1972, p. 464.
[52] Albert Einstein, *Relativity, The Special and General Theory,* appendix V.
[53] Albert Einstein, *The Meaning of Relativity,* 1922, p. 2.

and speculative nature of thought and more especially of scientific thought…".[54] Einstein realized that Mach's Science was incomplete; to escape solipsism we must posit the existence of something beyond our sensations—that produces our sensations. He thus posited an "external world independent of the perceiving subject", but he defined it inter-subjectivistically, as the sum total of all experienced events about which subjects agree.[55] He believed that we can grasp the organizing principles of this reality with our minds:

> *Physics is an attempt conceptually to grasp reality as it is thought, independently of its being observed. In this sense, one speaks of 'physical reality'.*[56]

Einstein thus began with subjectivism, with the contents of the observer's consciousness, and sought the simplest ideas that could explain our shared experiences. His "freely-created ideas" were not hypotheses in a theory of the Cosmos; for Einstein, atoms, photons, absolute *c*, frames and the laws of physics all existed only *as thought*—as ideas that helped to organize our experiences. His space-time interval was just something that observers could agree upon—a rule of the Matrix. Einstein admitted that the interval had no physical meaning or concrete interpretation.[57] Thus Einstein used his mind to reach beyond Mach's positivism, but only to Berkeley's subjective idealism.[58] Einstein was a subjective mathematical idealist. He believed that Nature was "the realization of the simplest conceivable mathematical ideas".[59] He was also a theist, believing with Berkeley that God was "a superior mind that reveals itself in the world of experience".[60] Einstein's physics does not attempt to model the Cosmos as it exists prior to and apart from the observer's consciousness; it contains no Cosmic hypotheses or causal theory. It thus leaves God and/or mathematical ideals as the cause of our experiences.

3.1 SPECIAL RELATIVITY

Following Berkeley, Hume and Mach, Einstein sought to eliminate space-as-cause from physics. He interpreted the null MMX as indicating that light moves at *c* in all frames (a hasty generalization). Starting with Galileo's ballistic principle of relativity, he tried to relate all phenomena and laws of physics, including the velocity of light, to all non-accelerating (relative to what?) observers and frames. He used Lorentz's

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[54] Paul Arthur Schilpp (ed.), *Albert Einstein: Philosopher-Scientist*, 1949, p. 21.
[55] Albert Einstein, *Ideas and Opinions*, 1954, p. 363
[56] Schlipp (ed.), *Albert Einstein, Philosopher-Scientist*, p. 81.
[57] Tullio Levi-Civita, "Sulla Nozione di Intervallo Fra due Avvenimenti: Primo Approccio alla Teoria della Relatività" [Italian], *Nuovo Cimento*, vol. 13, 1936 , p. 45.
[58] See Karl Popper's (incomplete) analysis of Berkeley's influence, "A Note on Berkeley as a Precursor of Mach and Einstein", *Conjectures and Refutations*, 1962.
[59] Einstein, *Ideas and Opinions*, p. 274.
[60] Einstein, *Ideas and Opinions*, p. 262.

transformations to describe mutually-observed differences between relatively-moving frames. He dismissed the Newton-Maxwell-Lorentz ether as a "superfluous hypothesis". His 1905 paper on Special Relativity (SR)[61] was, in fact, a restatement of Lorentz ether theory, without the ether.[62] SR is based upon these axioms:

The Restricted Principle of Relativity: "All laws of Nature are the same in all CSs [coordinate systems] moving uniformly relative to each other."[63]

The Law of Propagation of Light: The velocity of light *in vacuo* is a law of Nature, true for all CSs.

Lorentz Covariance: The differences observed between uniformly co-moving CSs are described by the Lorentz transformations.

Notice that there is no mention of the Cosmos or of any CS or frame that represents the space or matter of the Cosmos. There is no Cosmos in Relativity. Like Berkeley's spiritual Matrix, Relativity's reality consists only of observers and the laws that govern their experiences and measurements. Light does not propagate at *c* in any Cosmic frame; but in every observer's or arbitrary frame. It is called "Relativity" precisely because it asserts that all motion and effects of motion are merely relative; that there is "no such thing as an independently existing [i.e., Cosmic] trajectory, but only a trajectory relative to a particular body of reference".[64] Since all observers' frames are equally valid for the description of physical phenomena, all differences between relatively-moving frames must be symmetrical. Every observer should see all other moving frames' clocks running slower, rods shortened in the direction of motion, mass increased, etc.

The current consensus is that SR is a proven theory and beyond doubt; yet what is actually proven is that the Lorentz transformations work to describe certain high-velocity physical phenomena, when applied to the correct Cosmic frame. Relativity does not work at all. Neither its equality nor its symmetry among frames has ever been seen in real experiments—there is always inequality and asymmetry. To account for the facts, physicists must always break Relativity's symmetry by introducing the local Cosmic frame that is causative—in which velocity slows atomic clocks and in which light moves at *c*. They do so surreptitiously, even unconsciously in order to conceal their violation of the Principle of Relativity. They call the Cosmic frame "the inertial frame", "flat space", "the co-moving frame", "the gravitational field" or "the most convenient frame". They often specify the frame by placing an imaginary

[61] Albert Einstein, "Zur Elektrodynamik bewegter Körper", *Annalen der Physik*, vol. 17, 1905, p. 891. Trans. A. F. Kracklauer, *Einstein in English*, 2010, vol. 1.

[62] Said Lorentz of Einstein's Relativity: "His results concerning electromagnetic and optical phenomena…agree in the main with those which we have obtained…the chief difference being that Einstein simply postulates what we have deduced…from the fundamental equations of the electromagnetic field." (1909, p. 230).

[63] Albert Einstein and Leopold Infeld, *The Evolution of Physics*, 1938, p. 186.

[64] Albert Einstein, *Relativity, The Special and General Theory*, 1920, p. 10.

observer or "master clock" in it.[65] They call acceleration relative to this frame "changing frames" or just "absolute". They rationalize Relativity and its paradoxes in numerous and conflicting ways.[66]

For example, the twin paradox arises in Relativity because any relatively-moving twins' trajectories are mutually symmetrical—identical in each other's frames. If motion is merely relative, each twin should therefore see the other's clock running slower and should find the other to be younger when they meet.[67] This is contradictory, hence the paradox. In all real experiments, the atomic clock that runs slower is the one that moves at higher velocity relative to the near and distant distribution of matter (the Hafele-Keating[68] and similar experiments).

There is no Relativity in the functioning of the global positioning system (GPS). The rates of the satellites' clocks are determined by their height and orbital velocity in the Earth-centered frame (ECF) that is Sun-star irrotational (not rotating with Earth). (See Fig. 2.) Their rates are not affected by their velocities relative to one another, to any Earth-surface clock, or to the Sun.[69] The satellites' clocks are somewhat slowed by their orbital velocity in the ECF, but still run faster than Earth-surface clocks due to their greater distance from Earth (weaker gravity). (See p. 169.) They therefore "see" the Earth-surface clocks as running slower, and Earth clocks "see" the satellites' clocks as running faster, violating Relativity's symmetry.[70] The GPS requires light to propagate at *c* in the ECF, not in any satellites' or observers' frames. To attempt to use any other frame for the GPS would require many complex mathematical fixes.

The aberration of light is also inconsistent with Relativity. In Relativity, aberration should result from any relative motion of source and observer. It does not; here too the symmetry is broken. The change in a source's apparent position is always caused by the observer's motion in the light-medium, not by the source's motion or the relative motion of source and observer. No aberration is seen when sources move

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[65] For an example of Relativistic apologetics see Clifford M. Will, *Was Einstein Right?*, 1986. On p. 55 he accounts for the asymmetrical result of the Hafele-Keating experiment by introducing a "master clock" high above the Earth, at rest in the non-rotating, Earth-centered frame. He relates the slowing of clocks to their motion in this clock's frame.

[66] Many books have been dedicated to trying to make sense of Relativity's subjectivistic-objectivistic paradoxes and confusion. For an example see Lewis Carroll Epstein's *Relativity Visualized*. He concludes that Relativity means that everyone and everything is moving at the speed of light, all the time.

[67] We know that motion through space redshifts the spectra of atoms and thereby slows the rates of atomic clocks. We do not know how velocity in space will affect biological aging or any other "clocks".

[68] Joseph C. Hafele and Richard E. Keating, "Around-the-World Atomic Clocks: Predicted Relativistic Time Gains", *Science*, vol.177, 1972, p.166.

[69] Neil Ashby, "Relativity in the Global Positioning System", *Living Reviews of Relativity* vol. 6, 2003, p. 1. http://www.livingreviews.org/lrr-2003-1 (Sept. 1, 2015).

[70] Ronald Hatch, "Relativity and GPS-I", *Galilean Electrodynamics*, vol.6, 1995, p. 51.

at high velocity in a laboratory.[71] No aberration is seen when stars in binary orbiting systems move at varying velocities relative to Earth; if Relativity were true their apparent positions would deviate wildly from Keplerian motion.[72] To "resolve the paradox" physicists must specify the Sun-star frame as the space in which light propagates at *c* and in which the observer is moving.[73] The twin paradox, the GPS system and the aberration of light all require some version of Stokes' ether-entrainment theory: Celestial bodies determine the position and motion of their surrounding space out to a great distance. Light travels at *c* in this space and the Lorentz transformations must be applied to velocity in this space. (See sect. 7.5.)

The incompatibility of Relativity with any Cosmic model or theory can be demonstrated by considering a spaceship that is moving at 0.9*c*, almost the speed of light, between Earth and the nearest star system, Alpha Centauri (AC). (Fig. 1.)

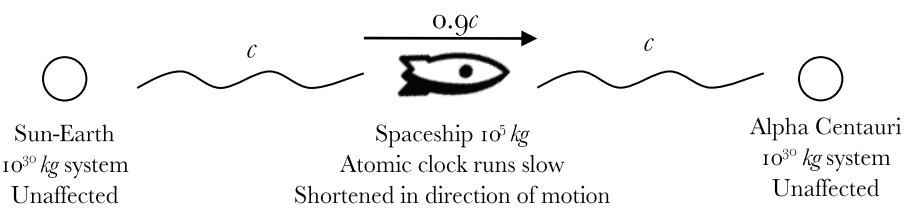

Figure 1. Cosmic Reality vs. Relativity

Relativity holds that the spaceship should see Earth's and AC's clocks running slow. In reality, Earth's and AC's clocks are unaffected by the tiny ship's motion; it is the ship's atomic clock that runs slow (<1/2 the rate of a clock at rest in space). The spaceship clock's motion through interstellar space somehow causes a redshift of its atoms' spectra. Relativity holds that light propagates at *c* relative to the moving ship. However, light travels from the Sun to AC in 4.4 years and the ship takes 4.9 years. In this Cosmos, between two of its large masses, the velocity of sunlight relative to the ship is 0.1*c*, and that of AC's light is 1.9*c*. If the ship's instruments measure the velocity of light as *c* relative to the ship, it can only be an illusion; the instruments must be altered by their velocity in space (as per Lorentz). Relativity also holds that the astronauts should "see" all the matter in the Cosmos that is moving at near-*c* in their frame as having much greater mass-energy and thus more gravity. They should see all solar systems and galaxies collapse—*reductio ad absurdum.*

[71] Johannes Stark, "Die Wellenfläche der Lichtemission der Kanalstrahlen", *Annalen der Physik.* vol. 4, 1925, p. 77. (In the laboratory, light appeared to come from the same location from both stationary and high-velocity atoms.)

[72] Stephen Gift, "Einstein's Principle of Relativity and Stellar Aberration", *Physics Essays.* vol. 18, 2005, p. 561.

[73] Edward Eisner, "Aberration of Light from Binary Stars—a Paradox?", *American Journal of Physics*, vol. 35, 1967, p. 817. To "resolve the paradox" he introduces a second observer—in the Sun-star frame.

SR includes descriptions of Cosmic phenomena: the redshift of moving spectra, the fixed velocity of light and the limiting velocity for matter. However it does not relate them to any observer-independent Cosmic frame; it does not attempt to identify the Cosmic entities and processes that cause these effects. To say that they are laws of Nature or products of geometry is to claim that the observers' descriptions of Cosmic phenomena are their causes. Lacking any possible Cosmic-physical cause, SR leaves God and/or mathematical ideals as the cause.

3.2 GENERAL RELATIVITY

The consensus view is that General Relativity (GR) resolves SR's paradoxes, that it somehow restores the Cosmos to physics by specifying the causative Cosmic frame. Does it? General Relativity is so named because it was Einstein's attempt to generalize SR—to complete his Relativity program of relating all phenomena and laws of Nature to *any* observer or arbitrary frame, in *any* state of motion. Einstein realized that Newton's space was still present in the background in SR, determining which frames were inertial—the ones not accelerating or rotating relative to absolute space. He wanted to eliminate this last vestige of Cosmic space from physics. In GR, no Cosmic CSs, including those of the celestial bodies of the Cosmos, should have priority over any observers' or arbitrary CSs. He wanted to "relativize" acceleration, rotation and gravity in order "to build a physics valid for all CSs".[74]

The General Principle of Relativity: All laws of Nature are the same in all CSs, whatever their state of relative motion.[75]

Did he succeed? Like the Special Principle, the General Principle of Relativity contains no mention of the Cosmos or of any frame representing the space or matter of the Cosmos. There is no Cosmos in GR. It attempts to treat all phenomena as merely relative to any arbitrary frame; any accelerating, rotating, writhing "reference-mollusc".[76] GR did not attempt to break the symmetry between relatively moving frames; it tried to extend it to relatively accelerating and rotating frames. This generalized Relativity is a non-starter—a more spectacular failure than SR. An observer may not be able to detect his uniform velocity in space with his instruments, but he always knows when he is accelerating or rotating within it. He feels it and his accelerometer and laser gyroscope measure it. Acceleration and rotation are "absolute"—physical, Cosmic; they cannot be relativized. They are relative in one sense only: they are motions relative to the surrounding Cosmic space.

[74] Einstein and Infeld, *The Evolution of Physics*, p. 226.
[75] Einstein, *Relativity, The Special and General Theory*, p. 61.
[76] Ibid., p. 99.

Einstein claimed that general covariance "takes away from space and time the last remnant of physical objectivity".[77] It does not. Covariance is a mathematical frame-game; what matters is what actually happens in this Cosmos. Choosing a frame that is accelerating or rotating with the object does not make the physical effects of acceleration or rotation disappear. Any attempt to describe Cosmic phenomena in the frame of an accelerating or rotating observer produces nonsense. Recall the unreality and complexity of the Ptolemaic system and the great effort required to remove the rotating Earth-observer from the center of physics. Einstein was not joking when he claimed that Relativity made the historic struggle between the views of Ptolemy and Copernicus "meaningless" since it was only a matter of one's choice of coordinate system.[78]

Like SR, GR is claimed to be proven beyond doubt. However, what physicists call "GR" today has nothing to do with the General Principle of Relativity or general covariance. It is an *ad hoc*, quasi-Cosmic construct that pays lip service to Relativity. As with SR, every application of GR's concepts and equations requires physicists to violate the Principle of Relativity by specifying the local Cosmic frame that is causative. Gravity's effects must be described in the frame of the mass, not in any arbitrary frame. GR's successes are due to its incorporation of the fact that gravitational fields have, in addition to their acceleration-like effect, a velocity-like effect (v^2/c^2). It is this velocity field that causes atomic clocks to slow and light to bend. Einstein somehow correctly predicted this velocity.[79] In sect. 7, I will show that GR is actually an ether-flow model of gravity, without the ether.

GR did not eliminate physical space from physics. Like SR, GR still requires the existence of a quasi-Newtonian inertial space to account for the "absolute" nature of inertia and rotation. Its inertial frames are inertial because they are moving at constant velocity relative to this inertial space. GR's space-time metric specifies what frames are inertial, and thereby surreptitiously incorporates this Cosmic space. It is claimed that GR explains gravity as the "curvature of space-time", but Minkowski's space-time is a subjectivistic construct—composed of the observers' measured distance and time intervals between events: $ds^2 = (dx^2 + dy^2 + dz^2) - c^2dt^2$. It models the observers' experiences and measurements, not the Cosmos. The curvature of space-time describes how the observers' measured intervals are altered in the presence of matter; it says nothing about the cause of gravity or inertia. To say that a

[77] Albert Einstein, "The Foundation of the General Theory of Relativity", in *The Principle of Relativity*, 1923.

[78] Albert Einstein and Leopold Infeld, *The Evolution of Physics*, p. 224.

[79] In *Relativity, The Special and General Theory*, Appendix III, he derives the velocity ("relativistic") effects of gravity using the work needed to transfer a clock from the edge of a rotating disk to its center. He likened this to the presence of a gravitational field of potential: $\varphi = GM/r = v^2/2$. This potential yields the correct velocity, but serendipitously. The accelerations and velocities caused by rotation do not have the same relationships as in gravity. His *gedanken* also drops the context: rotation has physical effects because it is rotation relative to physical space.

fired cannonball follows a geodesic or that light follows a straight line in curved space-time is to claim that our geometric descriptions of phenomena are their causes. Like SR, GR leaves God and/or mathematical ideals as the causes of everything.

3.3 COSMOLOGY

The consensus view of the Big Bang and Cosmic expansion is provided by astrophysicists Charles Lineweaver and Tamara Davis.[80,81] They seek to "understand the Universe" and to do so they have to treat Cosmic space as a substance that can expand and move and in which light moves at *c*. They say that the Big Bang was an "explosion of space itself". Space is still expanding and this "stretches light waves" but (strangely) does not affect the size of particles or objects. They say that SR applies only to "movement through space", not to relative motion between different regions of space. Distant galaxies can recede from us faster than light without contradicting SR because they are not moving at >*c* in our space or in any observer's inertial frame. Those galaxies and ours are at rest locally in their own spaces; they move apart because the space (not space-time) between them is expanding. Light can reach us from a superluminally-receding galaxy because it first travels at *c* in the galaxy's co-moving space, then at *c* in a space that is receding from us at subluminal velocity, then enters our space and travels at *c* to us.

Their theory may contain truth, but it has nothing to do with the Principle of Relativity—with SR or GR. They have gone beyond specifying the causative frame; they have restored ether-space to Cosmology with a combination of Lorentz ether theory and Stokes' ether-entrainment theory—and yet still call it "Relativity". Physicists note this contradiction, but cannot pursue it:

> *It is ironic that Einstein's most creative work, the general theory of relativity, should boil down to conceptualizing space as a medium when his original premise [in special relativity] was that no such medium existed.*[82]

Cosmologists and astrophysicists fail to realize that if space itself has any substantiality, if it plays any role in physical phenomena, then Relativity was a mistake. They simply do not understand what Relativity is; and this is why

[80] Tamara M. Davis and Charles H. Lineweaver, "Expanding Confusion: Common Misconceptions of Cosmological Horizons and the Superluminal Expansion of the Universe", *Publications of the Astronomical Society of Australia*, vol. 21, 2004, p. 97. astro-ph/0310808 (Sept.1, 2015)

[81] Charles H. Lineweaver and Tamara M. Davis, "Misconceptions about the Big Bang", *Scientific American*, vol. 292, 2005, p. 36.

[82] Robert B. Laughlin, *A Different Universe: Reinventing Physics from the Bottom Down*, 2005, Basic Books, New York, pp. 120-121.

generations of students have been confused and why so many experts have "misconceptions".[83]

3.4 QUANTUM MECHANICS

In 1905, the same year that Einstein published his paper on SR, he published a paper on the "lightquantum",[84] which became the photon. While admitting that it was unlikely that the wave theory of light would ever be replaced, he noted that certain light-matter interactions could be modeled as an exchange of light quanta, as if light were composed of particles flying through a void from source to receiver. In the microcosm too he tried to eliminate ether-space from physics by merely accounting for the observers' measurements. Einstein thus imposed his subjectivistic epistemology on QM. As in Relativity, there is no Cosmos in QM; there is only the observer's consciousness and its contents. This is why all of QM's concepts refer to the observer's information, not to the Cosmos (e.g. uncertainty, complementarity, entanglement, symmetry, etc.). Unlike Relativity, QM's subjectivism has been the subject of some debate among philosophers.[85] Unlike Relativity, the observer can never account for all the unseen waves and particles affecting his apparatus; so he can only produce probabilistic laws. What causes one possibility to become reality? Lacking any Cosmic model or theory, it must be the observer's decision to observe that "collapses the wavefunction" and determines what is real (e.g., Schrödinger's cat, observer-created reality). As one textbook put it:

> *Quantum mechanics…rejects as meaningless and useless the notion that behind the universe of our perception there lies a hidden objective world ruled by causality; instead, it confines itself to the description of the relations among perceptions.*[86]

QM does not teach us that reality is spooky; the spookiness is built into QM's foundations: subjectivism in, subjectivism out. As an observer-based accounting system, all of QM's concepts and mathematical devices, like those of the Ptolemaic system and Relativity, serve only to get the observers' predictions right. As with Relativity, all the knowledge that we have gained in the last 110 yrs. has been incorporated into QM *ad hoc*, but its epistemology is wrong.

The nature and implications of QM were frankly discussed by Richard Feynman in his book on Quantum Electrodynamics (QED), the branch of QM dealing with

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[83] In 'Expanding Confusion...' they give 25 examples of experts' false or misleading statements about Relativity and superluminal galaxial recession; including Feynman, Rindler and Weinberg.

[84] Albert Einstein, 'Über einen der Erzeugung und Verwandlung des Lichtes betreffenden heuristischen Gesichtspuntk', [A Heuristic Viewpoint on Generation and Modification of Light], *Annalen der Physik*, vol. 17, 1905, p. 132. Trans. A. F. Kracklauer, *Einstein in English*, vol. 1, 2010.

[85] Karl Popper, *Quantum Theory and the Schism in Physics*, 1956, rev. 1982. Popper accepted Relativity. He could not grasp the problem with modern physics due to his own positivism and admiration for Einstein.

[86] Robert Eisberg and Robert Resnick, *Quantum Physics*, 1974, p. 88.

light and electrons and their interactions. Feynman tells us that QED calculates the probabilities of three observations:[87]

Action #1: A photon goes from place to place
Action #2: An electron goes from place to place
Action #3: An electron emits or absorbs a photon

That is all; there is no physical or causal theory here, just a statistical model to predict observations. The observer does not actually "see" any photon or electron moving from place to place, he simply manipulates or measures something at point A and then measures something at point B. Indeed, Feynman echoes Mach, asserting that the only criterion of a good "theory" is that its predictions agree with experimental observations. He describes how QED was modified over many decades to fit the data (i.e., it is an *ad hoc* mathematical model, not a "proven theory").

In his path-integral version of QED, light sources produce neither physical particles nor physical waves, but "probability amplitudes". These "propagate" throughout space at *c* in all directions exactly as light waves do, by "shrinks and turns". Adding up (superposing) all the amplitude-arrows for all possible paths to a point renders a final amplitude arrow. Squaring this arrow yields the probability that the observer will detect a light-electron interaction at the given place and time. All of this is consistent with the wave theory of light. Feynman simply converted real light waves into probability-of-detection waves. He admits that the wave theory of light accounts for all known phenomena when the light is intense, but insists that "wave theory cannot explain how the detector makes equally loud clicks as the light gets dimmer."[88] He concludes that "light is made of particles".[89] However, he admits that the idea that particles of light travel from A to B makes no sense (e.g., produces the double-slit paradox and others). So he advises the reader to just do the math and not think about "which way the photon goes". Failing to resolve the contradiction between his particle theory of light and reality, he concludes that Nature is "absurd",[90] and this is why physics has given up trying to explain how things work. Yet he also claims that QED is a description of "what Nature is really doing underneath nearly all the phenomena we see in the world". I submit that it is Feynman's epistemology, not Nature, which is absurd. Like most physicists, he was trapped in the contradiction between his natural objectivism and the subjectivistic physics that he was taught.

Historically, the Compton effect convinced most physicists that light is made of particles, and more recent anti-correlation experiments are cited as further proof. These phenomena actually disprove only certain inadequate theories of light waves

[87] Richard Feynman, *QED, The Strange Theory of Light and Matter*, 1985, p. 90.
[88] Feynman, p. 36. A classic argument from ignorance: "Since I cannot explain it, it is not possible."
[89] Feynman, p. 15.
[90] Feynman, p. 10.

and electrons, and they certainly cannot be explained with flying photons. Physicists ignore Feynman's counsel when they presume to know that their source produces particles of light that bounce off mirrors, decide to go this or that way at a beam splitter, shed some energy in a filter, get tipped by a polarizer, and eventually arrive at their detector to produce photomultiplied clicks. All of this would require magic. It is absurd to think that a particle of light can pass through a glass beam splitter (10^{23} atoms/cm^3) and emerge intact with new instructions on which way to go. Indeed, to get the predictions right, QM's math treats both light and matter as waves at all times.[91] I submit that light appears to be particle-like only when light waves are being emitted and absorbed by particles (usually electrons). Quantization is a property of light-particle interactions, not of light itself.[92]

The idea that light consists of particles flying through a void is philosophically untenable; it is a non-starter. It is contradicted by the known wave-qualities of light: wavelength and frequency, superpositioning-interference, invariant velocity independent of source velocity, diffraction and refraction, and a continuous spectrum including radio waves that are hundreds of meters long. Because the photon theory is false it creates confusion and paradoxes (e.g. the double slit paradox, delayed-choice paradox, etc.). To even speak of photons, one has to invoke "wave-particle duality". This is illogical; one does not resolve a contradiction by giving it a name. Waves in a medium and particles flying through a void have mutually-exclusive properties. Waves and fields are states of a medium; they cannot exist without a medium.[93] The recognition that light is a wave in electromagnetic space, that Nature is not absurd, will bring about the long-overdue reconsideration of all of QM's particles, real and "virtual".

4 POSITIVISM, IDEALISM, ATOMISM AND CONFUSION

We have as yet no natural philosophy that is pure; all is tainted and corrupted: in Aristotle's school by logic; in Plato's by natural theology; and in [the Platonists' school] by mathematics, which ought only to give definiteness to natural philosophy, not to generate or give it birth.

Francis Bacon[94]

Albert Einstein was a brilliant mathematician and scientist, but as a philosopher he faltered. He believed that a scientist could be an "unscrupulous opportunist", resorting to realism, idealism, positivism, or Platonism as the situation seemed to require.[95] In philosophy, such inconsistency is error, and the predictable result has

[91] Hrvoje Nikolić, "Quantum Mechanics, Myths and Facts", *Foundations of Physics*, vol. 37, 2007, p. 1563.
[92] Henry H. Lindner, "A QED-compatible Wave Theory of Light, Electrons, and their Interactions", *The Nature of Light: What are Photons IV, Proceedings of SPIE*, vol. 8121, 2011, p. 81210X-1.
[93] To posit waves and fields without a medium is an example of "dropping the context", an informal fallacy.
[94] Francis Bacon, *Novum Organum*, 1620, Aphorisms, xcvi.
[95] Schlipp (ed.), *Albert Einstein: Philosopher-Scientist*, p. 684.

been contradiction and confusion. Physicists and philosophers have failed to understand his esoteric ideology and have mistaken his models for physical theories for over 100 years. In fact, subjectivism and idealism can never be understood; they are false and must be dismissed as such. (See sect. 5.)

Physicists learn SR, GR and QM from textbooks. They are taught that these "theories" are the applications of certain mathematical methods to certain situations. Most have never read Newton, Berkeley, Mach, Einstein, Heisenberg, Bohr, Feynman, etc. They are not acquainted with the ideas that produced modern physics; they do not understand their own models. While they want "not just to describe the world but to explain why it is the way it is",[96] they are saddled with subjectivistic and idealistic models that were not created for that purpose. They want to know the cause, but their models produce only observer-based magical laws. They are interested in what is real, but their models deal only with what is apparent. The result is unending confusion. Are time dilation and length contraction real or only apparent? Does light really travel at *c* relative to every observer, or only appear to do so? Do the atomic clocks in our GPS satellites actually run faster or only appear to do so? Does the act of observing cause everything to happen? Does math cause everything to happen? Is physics just geometry, or statistics? Each tries to resolve these conundrums in his/her own way. For instance, when many physicists speak of "relativistic" effects, they actually think of them as physical effects caused by high-velocity movement through Cosmic space—as if they are ether theorists. Einstein was also confused about the nature of space. He admitted that "the theory of special relativity does not compel us to deny ether" and that "according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether…". However, instead of admitting that Relativity was a mistake (understandably difficult to do), he simply forbade any theorizing about ether-space, saying "this ether may not be thought of…as having parts which may be tracked through time. The idea of motion may not be applied to it."[97] He thus tried to prevent physicists from pursuing the essential question: What is space and what is its role in physical phenomena?

Einstein also produced confusion in study of the microcosm. His lightquantum gave birth to the photon and QM, but he was never comfortable with either.[98] When no deterministic laws, no rules of the Matrix, could be found to account for the observer's experience of photonic or other microcosmic events, Einstein asserted that QM was incomplete and could not be the final form of physics. In this he was quite

[96] Stephen Weinberg, *Dreams of a Final Theory*, 1992, p. 219.

[97] Albert Einstein, "Ether and the Theory of Relativity", *Sidelights on Relativity*, 1983. In sect. 7, I will show that in order to understand space, we must give it both parts and motion.

[98] Albert Einstein, *Michele Besso Correspondence 1903-1955*, p. 265. "All these fifty years of conscious brooding have not brought me any closer to answering the question, 'What are light quanta?' Nowadays every scalawag thinks he knows what they are, but he deludes himself."

right. He famously objected, "God does not play dice with the world". Niels Bohr and Werner Heisenberg asserted that the wavefunction (Ψ) represented only the observer's knowledge (The Copenhagen Interpretation). Einstein objected, "The orthodox quantum theoreticians generally refuse to admit the existence of a real state (based on positivistic considerations). One thus ends up in a situation that resembles that of the good Bishop Berkeley."[99] Here Einstein was mistaken: his position was Berkeley's (subjective idealism); Bohr and Heisenberg's was Mach's (positivism). Einstein rightly argued that QM could not escape solipsism because it did not posit any observer-independent reality. To prove his point, he asked a colleague whether he really believed that the moon existed only when he is looking at it;[100] and a group of students, "When a mouse observes, does that change the state of the universe?"[101] He complained, "A new fashion has arisen in physics which declares that certain things cannot be observed and therefore should not be ascribed to reality". When colleagues reminded him that it was he who invented this approach to physics in 1905, he responded, "Possibly I did use this kind of reasoning, but it is nonsense all the same".[102] "I regarded these ideas as temporary; I never thought that others would take them so much more seriously than I did".[103] "A good joke should not be repeated too often".[104] Einstein did start this subjectivistic nonsense with Relativity and the lightquantum. He escaped solipsism with an idealism which few could embrace and which did not work to model or explain the Cosmos.

Few physicists can be shut-up-and-calculate Machian positivists. They want to understand the world. With space theory forbidden, they are forced to try to explain physical phenomena with idealism or atomism or both. Idealism is an intellectualized form of spiritualism—of belief in magic. It holds that the linguistic concepts that we invented (e.g., chair, horse, line, point, etc.) are actually real objects in some higher mind-like plane of existence. These ideals somehow produce the physical world that we experience. Mathematical idealism holds that the Cosmos is a manifestation of mathematical forms,[105] i.e. the Cosmos is the product of the mathematical concepts that we invented to describe it. The laws of physics and the physical constants are all mathematical ideals; they exist in some other plane of reality and magically cause and control everything. The idea of "laws of physics" is also theistic; it implies a law-giver. Mathematical idealism transforms energy from a measurement of motion into a magical substance that flows from place-to-place and makes everything happen.

[99] Albert Einstein, *Letter to Michael Besso*, Albert Einstein Archives, 1952, 7-412.00.
[100] Abraham Pais, "Einstein and the Quantum Theory", *Reviews of Modern Physics*, vol. 51, 1979, p. 863.
[101] Walter Isaacson, *Einstein: His Life and Universe*, 2007, Simon and Schuster, New York p. 515.
[102] Werner Heisenberg, *Physics and Beyond*, 1969, trans. A. J. Pomerans, 1971, Harper & Row, New York, p. 63.
[103] Ronald Clark, *Einstein: The Life and Times*, 1971, Avon Books, New York, p. 414.
[104] Isaacson, *Einstein: His Life and Universe*, p. 332.
[105] Max Tegmark, "The Mathematical Universe", *Foundations of Physics*, vol. 38, 2008, p. 101. Also available at: http://arxiv.org/pdf/0704.0646.pdf (Sept. 1, 2015)

Time, the reading on the observer's clock, becomes a mysterious entity that can have a beginning, slow down, speed up and even reverse. Particles can travel forwards and backwards "in time". The evolution of the Cosmos is said to be caused by "the arrow of time" and "laws of thermodynamics". All the mathematical constructs and fixes that these observer-based models require become laws and "causes": absolute *c*, symmetry, conservation principles, exclusion principles, variational principles (least action, maximal time), potentials, extra dimensions, strings, membranes, many universes, holograms, etc.

In Relativity, space-time is transformed from the observers' measured intervals between events into the cause of the events—the "fabric of the Cosmos".[106] Space-time is, however, utterly unreal, non-Cosmic. With time as an axis, nothing moves in space-time. It is a four-dimensional mathematical solid, a "frozen river" of past, present, and future.[107] Physicists constantly confuse space-time with Cosmic space, frames and fields, just as Einstein did.[108] They often say that light travels at *c* in space (ether theory) instead of relative to any frame (Relativity). They speak of expanding space (ether theory) instead of expanding space-time (impossible). Space-time prevents them from understanding both space and time.

Other physicists eschew idealism; they believe in matter and mechanism and want to discover the physical causes of things. With space theory (etherism) forbidden, they must turn to atomism—particles and the void. While space theory provides one causal substrate that produces all physical phenomena, atomism posits many different self-existing particles, many realities. It has no unifying causal substrate and does not work to explain the most basic phenomena. Modern atomists believe that they are physical theorists, that they have transcended QM's positivistic foundation.[109] However, like Relativists, they have failed to understand their own science. They forget that "the quantum state is simply a tool to calculate probabilities…whenever we talk about a particle…we should only mean that which a 'click in the detector' refers to".[110] They ignore Mach's counsel whenever they posit unseen particles as being real and causative, whenever they believe in their own "convenient fictions": photons, quarks, gluons, W and Z bosons, Higgs bosons, neutrinos, tachyons, WIMPs, supersymmetrical particles, inflatons, etc.

Modern atomism is codified in the Standard Model. It posits twelve matter particles (leptons and quarks) interacting via four forces (gravity, electromagnetism, strong and weak nuclear forces). Each force is supposedly due to the exchange of "virtual particles" between real particles. These virtual particles and their exchanges

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[106] Brian Greene, *The Fabric of the Cosmos*, 2003.
[107] Prompting Karl Popper to call Einstein "Parmenides" in *Unended Quest*, Routledge, [1976] 2002, p. 127.
[108] Einstein, *Relativity, the Special and General Theory*, Appendix V, "Relativity and the Problem of Space".
[109] Weinberg, *Dreams of a Final Theory*, p. 182.
[110] Anton Zeilinger et al., "Happy Centenary, Photon", *Nature*, vol. 433, 2005, p. 230.

have never been observed (hence "virtual"). They are mathematical devices that make no sense as physical explanations. Atomism doesn't even work as an accounting scheme. In order to model and predict the observers' experiences, physicists are forced to ascribe properties to empty space.[111] They do so surreptitiously by invoking "field-particle duality", believing that their point particles are also infinitely extended fields. It is no surprise that a recent poll found that "there is still no consensus in the scientific community regarding the interpretation of [QM's] foundational building blocks."[112]

Quantum Field Theory (QFT) resolves some of QM's conundrums by choosing the field side of field/particle duality: there are no particles, only fields.[113] QFT fills space with a multitude of fields—with many ethers. Frank Wilczek grasps the ethereal implications of QFT. He calls space "the grid", "the primary ingredient of physical reality, from which all else is formed, fills space and time."[114] He says that it is composed not only of fluctuating vacuum fields but also more "substantial stuff" such as the quark-antiquark ($Q\bar{Q}$) condensate, the Higgs condensate and the "metric field". The latter is GR's space-time, which he interprets as the "map" that tells light and matter how to move and rods and clocks how to behave. Again, logic requires us to try to explain everything as a manifestation of one substance—one ether. Wilczek is trying to understand space using disparate subjectivistic models that were invented to ignore space. He is pouring new wine into old bottles.

5 PHILOSOPHY OVER SCIENCE

Yet this very philosophy it is that ought to be esteemed the great mother of the sciences. For all arts and sciences, if torn from this root, though they may be polished and shaped and made fit for use, yet they will hardly grow...let no man look for much progress in the sciences…unless natural philosophy be carried on and applied to particular sciences, and particular sciences be carried back again to natural philosophy.

Francis Bacon[115]

The Ptolemaic system and creationist biology persisted for many centuries. Within these ideologies much research was done, with great care. They no longer dominate their sciences because Copernicus and Darwin refused to believe that they represented Cosmic reality. They grasped that there is much more to this Cosmos than is evident to our senses. They chose to replace the observer and magic with Cosmos and mechanism. Their opponents argued that it was inappropriate for them

[111] Feynman was disappointed when he realized that his program of "emptying space" had failed. (Wilczek, p. 89).

[112] Maximilian Schlosshauer, Johannes Kofler, Anton Zeilinger, "A Snapshot of Foundational Attitudes Toward Quantum Mechanics", arXiv:1301.1069 [quant-ph].

[113] Art Hobson, "There are No Particles, There are Only Fields", *American Journal of Physics*, vol. 81, 2013, p. 211.

[114] Frank Wilczek, *The Lightness of Being, Mass, Ether, and the Unification of Forces*, 2008, p. 74.

[115] Francis Bacon, *Novum Organum*, 1620, Aphorisms, lxxix and lxxx.

to posit entities, motions and processes that were not directly observed; and that their theories were incomplete and did not explain the cause. Indeed, Copernicus and Darwin did not and could not explain everything. They knew nothing about gravity or genetics. What they did was to put their sciences on the right paths, and we are still working out the details. Theoretical physics needs a similar revolution, and for the same reasons.

Thomas Kuhn described such revolutions.[116] He argued that sciences operate within paradigms based upon assumptions about the nature of the subject and how it should be studied. In these eras of "normal science" all research aims to support and improve the existing paradigm. Textbooks mislead students into thinking that all previous revolutions were stepping stones to the current state of enlightenment. Questioning the foundations of the science is prohibited. Academic philosophy simply adopts and rationalizes the current paradigm. Facts and ideas that do not fit into the paradigm are rationalized away or simply ignored ("paradigm paralysis"). As research uncovers more anomalies, change is resisted until a new paradigm is available and is accepted by enough younger scientists.

Kuhn's critique does not fault scientists' objectivity, carefulness or ethics, but instead their lack of intellectual curiosity—their failure to question their assumptions. He called these revolutions "scientific", but sciences operate within paradigms. He needed another name for such revolutions—a name for our ability to identify false and inadequate theories and replace them with better ones. The traditional and only name for this higher cognitive function is "philosophy". The Copernican and Darwinian revolutions were philosophical, not scientific. They demonstrated how knowledge can advance in great leaps when sciences operate within better theories. A better theory more accurately mirrors Cosmic entities and processes. A better theory makes sense of the world and reveals new connections among phenomena; everything fits. A better theory keeps on giving, continuing to incorporate new data and to steer research into productive paths. On the contrary, a false or inadequate theory causes knowledge to advance slowly and incoherently; observations, experiments and mathematical models increase our knowledge but not our understanding. Research can indicate problems with the theory, but cannot fix it. If not for Copernicus' better theory, we would still be trying to improve the accuracy of our epicycles, equants and deferents. If not for Darwin's better theory, we would still be merely describing the species and believing that they were all planned and produced by God-magic. Biology is a healthy science now because of Darwin's evolutionary theory. Modern physics, on the other hand, is moribund—confused and contradictory—a dead end.

Theoretic cognition is the most powerful use of language; it allows us to reach beyond the evidence of our senses and grasp the nature and causes of things. Theories

[116] Thomas Kuhn, *The Structure of Scientific Revolutions*, 1962.

are categorically different than mathematical models; they are fundamental to our understanding. We cannot avoid theories—all thought and practice are "theory-soaked". We must judge theories according to the criteria applicable to theories: correspondence to the facts of experience, consistency with other good theories, explanatory power, predictive power, etc. Contrary to the doctrines of Science, theories cannot be born perfect and complete; that would require God-like knowledge. Theories are often just first steps in the right direction. Unlike mathematical models, theories usually cannot be proved or disproved; they are linguistic approximations of Cosmic reality. They are supported or weakened by the data. When facts arise that are inconsistent with a theory, it can often be altered to accommodate them. When a theory can no longer be so modified it must be replaced. We can confidently consider a theory to be true when we can no longer consider it possible that it could be false—as stated, within its realm of application. However, we must remain willing to reconsider any theory if/when the facts require.

A good theory may or may not be falsifiable; it may or not be mathematically complete, it may or may not make predictions that can be tested; it may or may not be more accurate in all respects when first formulated. We must test theories whenever we can; but a theory that is necessary to explain the phenomena cannot, by definition, be falsified. For instance, the first theory in which we must believe in order to begin to understand the Cosmos is that the Cosmos exists and evolves independent of our consciousness of it. This theory is necessary to escape solipsism. Next, to escape spiritualism-idealism, we must postulate that the Cosmos produced our species and our linguistic consciousness by its own inherent propensities and processes.[117] Both theories are necessary to the advance of knowledge yet they make no predictions and cannot be tested or falsified. They are better explanations of our existence and experiences. Darwin's theory of the origin of the species by natural selection is similarly necessary. It cannot be falsified, and the alternative is the God-magic theory.

Theoretic cognition is an aspect of philosophy. Philosophy is the disciplined use of our neurological-intuitive and linguistic capabilities in order to understand the Cosmos and ourselves. Philosophy is the means by which we can identify false or inadequate ideas, arguments and theories and replace them with better ones. The most important theories are foundational: about what exists (metaphysics), how we can know it (epistemology) and how we should live (ethics). These determine the superstructure of ideas, and therefore our sciences, cultures, laws, political systems and institutions. Logic and mathematics are tools of philosophy—with which we assure that our qualitative and quantitative linguistic formulae correspond to Cosmic reality. For example, the first rule of logic is non-contradiction because the Cosmos is a coherent, interacting whole that contains nothing that corresponds to a

[117] Popper's positivism prevented him from grasping the necessity of these foundational, non-falsifiable conjectures. Without them, he too could only think of creating "theories" to account for our experiences.

contradiction. All sciences are, and must remain, branches of philosophy. Otherwise they can remain mired in false and inadequate ideas for centuries.

Philosophy is what most people believe and hope that Science is. However, Relativity and QM are the archetypes of modern Science, therefore Science is fundamentally Machian and/or Berkeleyan: subjectivistic, positivistic, and/or idealistic. Science is merely technical and mathematical because it restricts our inquiries to describing, modeling and predicting our observations—the contents of consciousness. Science trusts only numbers because it is incompetent to deal with theories; it lacks the necessary cognitive tools. Science restricts our sciences to "doing research" within the current paradigm. Our sciences' journals are full of quantitative information—measurements, experiments, observations and models—but lack any discussion of what is most important: foundational concepts and theories. Any such articles that are submitted are rejected out of hand because the editors and reviewers are not only incapable, but also afraid to deal with theories. Science even accepts contradictions among our word formulas, calling them "paradoxes" and thus further degrading our cognition. Science is anti-philosophy—a corruption of our intellectual capabilities. Science is preventing us from understanding the Cosmos and ourselves.

For over 100 years, physics has been torn from its philosophical roots and this schism has corrupted both physics and philosophy. With no theory of what the Cosmos is made of or how it works, we cannot understand what we are: philosophy is groundless. Academic philosophy has thus deteriorated into sterile debates about floating abstractions; it has become irrelevant. With every passing generation since the ascendance of modern physics and Science, philosophical curiosity and competence have been waning, producing increasingly confused and dysfunctional societies characterized by relativism, authoritarianism and apathy. Having neither a religious nor a philosophical worldview, individuals default to the pursuit of pleasure, money, and power. They are easily manipulated and prone to hysteria.

We can and must rebuild philosophy upon a solid foundation. Our knowledge of the Cosmos—of physics, biology, neurology, and linguistics—has advanced tremendously since the early 20th century. We can and must discard the intellectual detritus of our species' infancy. We are not spirits in a material world or a spiritual Matrix. The Cosmos was not produced by magic and does not run on magic. The outlines of the new Cosmic philosophy are clear. The current best theory to explain the evidence is that the Cosmos has existed in its current form for over 13 billion years. The Cosmos is unimaginably immense and appears to be still expanding from a much smaller, hotter state; from a "Big Bang".[118] As the Cosmos expanded and cooled it became more organized—into subatomic particles, then into atoms, then molecules. Here on Earth molecules combined to produce living cells and these combined to

[118] This was most likely not a creation *ex nihilo* or from a "singularity" but resulted from a "Big Crunch" of the preceding Cosmos. See below.

produce plants, animals, and a species with language. This evolutionary process is hierarchical: Under conducive environmental circumstances, simpler entities and processes combine and interact in new ways to produce new, more complex entities and processes. These then combine again in new ways to produce higher levels of complexity. Each higher level of complexity is built upon, and remains completely dependent upon all lower levels. The result is a hierarchically-organized, interacting whole. The primary levels of complexity that we have identified are:[119]

Astrophysicochemical – spatial, subatomic, atomic, chemical (stars, planets, etc.)
Biological – molecular, prokaryotic, eukaryotic, multicellular (DNA, bacteria, plants, etc.)
Neuropsychological – sensation, information-processing, consciousness (animals)
Linguo-Mythic – language, tool-making, cultures, religions, civilizations (*homo sapiens*)
Linguo-Philosophical – disciplined linguistic information processing (human potential)

Each of these levels has many sublevels. Indeed, a full elaboration of this outline will encompass all of Cosmic history and all phenomena, including all of human history and thought. It provides an organizational tool for our sciences; situating each in its proper place within a comprehensive evolutionary Cosmology. It completes Darwin's evolutionary theory by including pre- and post-biological evolution.[120]

We are the products of the Cosmos' inherent tendency to produce greater complexity including self-aware and self-directing species. Consciousness and language are, like atoms and life, just more emergent phenomena. We no longer need vitalism to explain life, and we no longer need spiritualism to explain consciousness. We now know that all aspects of consciousness are dependent upon specific regions of the brain.[121] With our recent advances in computer technology, we can understand animalian consciousness as a virtual reality simulation, created and maintained by the brain to aid the animal's response to the environment. Human consciousness differs qualitatively from that of other animals only by our acquisition of syntactic language. We are apes that can talk. Language, not greater intelligence, is the source of our unique information-processing power, tool-making ability, and self-awareness.[122,123,124,125,126] Because we have language, our intellects, our judgments and our actions are largely controlled by word-formulas. These linguistic ideas, or memes, are a new form of life. Their medium is the human brain and their environment is

[119] Lindner, "Hierarchical Cosmism", http://henrylindner.net/Writings/Hierarchical.html.
[120] Because Darwin's theory was incomplete, it had only a limited impact and mixed consequences.
[121] I lost my own spiritualist preconceptions while working as a physician on the neurology service of a Veterans Administration hospital. I saw a wide variety of brain diseases and disorders and their effects upon the mind. Non-physicians rarely see such evidence of the dependence of the mind upon the brain.
[122] Julian Jaynes, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, 1976.
[123] Derek Bickerton, *Language and Species*, 1990.
[124] Merlin Donald, *Origins of the Modern Mind*, 1991.
[125] Daniel Dennet, *Consciousness Explained*, 1991.
[126] John McCrone, *The Ape That Spoke*, 1991.

human society. Just as life can be viewed as a competition among genes, human cultures and civilizations can be viewed as a competition among memes.[127,128]

Language is a powerful tool, but it is also a trap. Memes (ideas) and memeplexes (ideologies) that produce behaviors that further their own existence and reproduction become more prevalent in the population, regardless of their truth-status. Memeplexes can persist by causing their hosts to ignore, ostracize or kill those who reject the memeplex, labeling them as "witches", "heretics", "crackpots", "insane", "conspiracy theorists", etc. Memeplexes can also persist and spread by inducing their hosts to convert, exploit, enslave or kill "outsiders"—those not infected with the memeplex (e.g. other tribes, barbarians, unbelievers, heathens, infidels, gentiles, terrorists, etc.). Memeplexes can even persist and spread by seeming to be more rational than competing memeplexes (e.g. monotheism vs. polytheism). Inasmuch as memes and memeplexes are false or inadequate concepts and theories, they are mental viruses—pathological. They cause the host to misinterpret reality and therefore to think and behave in ways that are ineffective and self-destructive and/or destructive of other human beings, human potential and the environment. Like viruses, memeplexes produce defenses. Like the human immunodeficiency virus, memeplexes can persist by disabling the host's immune system—its philosophical capacity to recognize and replace false ideas. Thus the spiritualism-idealism-theism memeplex produced Science in order to protect itself from philosophy.

With rare exceptions, human history up to now has been a competition among memes and memeplexes for dominance (the Linguo-Mythic era), resulting in ignorance, delusion, unnecessary suffering, exploitation and violence. It will remain so until humans collectively decide to take control of the ideas in their heads. We can choose: either to allow ourselves and our societies to continue to be controlled by false and inadequate word formulas, or to actively question all word formulas and replace them with better ones. We can either be the slaves of ideas or their masters. To become masters of ideas, we must become philosophers.

6 SPIRITUALISM AND THE ETHER TABOO

The modern concept of the vacuum of space, confirmed every day by experiment, is a relativistic ether. But we do not call it this because it is taboo.

Robert Laughlin[129,130]

All the efforts exerted, over the last 400 yrs., to suppress space theory constitute the "ether taboo". No matter how obvious it has been that space is a substance that has a causal role in all phenomena, physicists and philosophers have continued to deny this

[127] Daniel Dennet, *Consciousness Explained*, 1991.
[128] Susan Blackmore, *The Meme Machine*, 1999.
[129] Robert B. Laughlin, *A Different Universe: Reinventing Physics from the Bottom Down*, 2005, pp. 120-121.
[130] It appears that physicists must win a Nobel prize before they can speak of the physical reality of space.

fact. If physicists were to embrace space theory, they would have to admit that they have been wrong for a century. They would open Pandora's box; releasing a hoard of suppressed questions. They would have to become theorists. This would be tremendously liberating and stimulating for their profession; their inability to embrace space physics is partly due to their training, but it has a deeper, subconscious cause.

As I have shown, the conflict over space theory is part of the historic and ongoing conflict between philosophy and all varieties of spiritualism—including Platonic idealism, Eastern mysticism, and the Abrahamic religions. Judaism and its offshoots, Christianity and Islam, are based upon the idea that the ultimate reality is not Cosmos but spirit (spiritualism). A spirit-God created the Cosmos and our individual spirits by magic (omnipotence). These religions hold that consciousness is spiritual; it participates in a reality that is prior to and more fundamental than the Cosmos. Our spirits can survive the deaths of our brains. The Cosmos is therefore derivative, merely "physical", and possibly just an illusion. By filling the Cosmos with a substance that causes and sustains all things, space theory chases the "God of the gaps" out of its last refuge—the void-space of our modern theoretical physics. Evolutionary theory based upon space theory has been suppressed precisely because it is the ultimate threat to spiritualism; it is the rational alternative.

Table 1. Space Theory vs. Spirit-God Theory

Attribute	**Space**	**God**
Omnipresent	Yes	Yes
Created all things	Yes	Yes
Sustains all things	Yes	Yes
Infinite duration	Yes	Yes
Human-like personality	No	Yes
Cares about individual humans	No	Yes
Intervenes in human affairs	No	Yes
Individual immortality	No	Yes
Tells us what to believe (scriptures)	No	Yes

As shown in Table 1, space theory fills many of the functions of the spirit-God theory, but lacks its anthropocentric, wish-fulfilling qualities. It is no coincidence that the ether taboo was first and most clearly stated by Bishop Berkeley when he accused Newton of atheism.[131] A theory of space and its hierarchical evolution produces a completely different view of reality and of human existence than spiritualism; one can say that it provides a better theory of what "God" is—the Cosmos. When we embrace space-evolutionary theory we face the truth: that we are on our own; there is no spirit-

[131] Partly in response to Berkeley's charge, Newton added the General Scholium to his *Principia* in which he equated space with God and claimed that material or metaphysical hypotheses have no place in "experimental philosophy".

God to tell us how to think and live. We are responsible for our own and our species' ideas and actions.

Most physicists are not religious, but even if they did not receive religious indoctrination they grew up within societies that were founded upon spiritualistic doctrines. They imbibed spiritualist ideas from their environment. Like everyone else, their philosophical development was inhibited by schooling. In college, they had to either accept spiritualistic physics or choose another subject.[132] I know from personal experience that one cannot escape the influence of a metaphysical doctrine like spiritualism simply by ceasing to believe in some religion. One must form or find a better theory, one that satisfactorily explains human consciousness and language as natural products of Cosmic evolution. Until one understands and accepts such a theory, one remains a spiritualist. Even when one succeeds in replacing spiritualism with Cosmism, one still has to deprogram oneself from all the ideological and psychological remnants of spiritualism. Indeed, the modern dilemma is precisely this: most persons no longer believe in the religions that formed their societies and their own psychologies, but they have not found or embraced a philosophical alternative. They are spiritualists without a guidebook; and this produces uncertainty and chaos. To move forward we must replace Science with philosophy, spiritualism with Cosmism, and spiritualistic physics with space physics.

7 SPACE THEORY

It is wrong to remove the foundations of a science unless you can replace them with others more convincing.
Aristotle[133]

The stone which the builders rejected is become the head of the corner.
Psalms 118:22

To produce a working theory of space's role in all physical phenomena, we need not start from scratch; we can modify the theories of Stokes, Newton, Maxwell and Lorentz, using Einstein's insights and all the data that we have gathered about the Cosmos in the last 100 years.

7.1 NEWTON-LORENTZ INERTIAL-ELECTROMAGNETIC SPACE

The first semester of college physics is still Newtonian Mechanics. If Relativity and QM revealed the true nature of physical reality, wouldn't we teach them first?[134] Newton's space remains in physics and in physicists' minds because it provides what

[132] Many mathematicians and astrophysicists are defectors from physics; they sensed that something was amiss.
[133] Aristotle, *On The Heavens*, Bk. III, ch. 1.
[134] Quite the contrary, not until postgraduate study does a physicist learn much about Relativity and QM; even then he learns only those mathematical aspects that are needed for his subspecialty.

Relativity and QM lack: the Cosmos—objective reality. It is the space that resists acceleration and determines which frames are inertial: those that are not accelerating relative to it. Newton's spinning bucket argument still stands: rotation in the Sun-star frame is ballistically and luminally absolute. It is rotation in the inertial-electromagnetic medium in which light moves at *c*.

Lorentz-Poincaré ether theory (LET) assumes that Newton's inertial space is also the electromagnetic medium, and it is consistent with the evidence:

> *Summarizing these results we may say that the following statement is in perfect agreement with all experimental evidence: A preferred system of reference, the ether system, exists. Clocks are slow when moving with respect to the ether system and measuring rods shrink. As seen from a moving system clocks [at rest] in the ether system are fast and measuring rods elongated.*[135,136]

LET is philosophically superior to SR because it is objectivistic; it relates the phenomena to Cosmic-causative space. It produces no paradoxes and it allows us to theorize about the causes of "relativistic" effects.[137,138] The Lorentz transformations are simple and physically comprehensible. They are just an application of the Pythagorean theorem, describing the longer distance (hypotenuse) that any circulating or reciprocating impulse in the medium must travel when moving through the medium.[139] The Lorentz factor, by which moving clocks are slowed, rods shortened, and apparent mass increased, is $\gamma = 1/\sqrt{1 - v^2/c^2}$, where v is the velocity in ether-space. With LET, we can begin to theorize about the cause of atomic clock-slowing. When in motion, the atoms' electrons are forced to propagate through more space. The electrons' wave-number does not increase, but their wavelength does. This redshifts the light that they absorb and emit, by the Lorentz factor. A working theory of this redshift will relate the microcosm to the macrocosm as has never been done before. It is a crucial first step towards a unified physics.

7.2 GRAVITY IS SPATIAL SINK FLOW

What happens to Newton-Lorentz inertial-electromagnetic space in gravity? Einstein found the key to this mystery, but could not recognize it as such. Consider that matter moves freely at any uniform velocity through Newton's inertial space, but does not naturally accelerate with respect to it; to make it do so requires a force. If inertial

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[135] Reza Mansouri and Roman U. Sexl, "A Test Theory of Special Relativity: I. Simultaneity and Clock Synchronization", *General Relativity and Gravitation*, vol. 8, 1977, p. 497.

[136] While length-contraction is plausible for the reasons given by Fitzgerald and Lorentz, the null MMX is sufficiently explained by Stokes' ether-entrainment theory; so there is as yet no requirement for length-contraction to explain any phenomenon, nor any direct evidence of it.

[137] Herbert E. Ives, "Apparent Lengths and Times in Systems Experiencing the Fitzgerald-Larmor-Lorentz Contractions", *Journal of the Optical Society of America*, vol. 27, 1937, p. 310.

[138] Geoffrey Builder, "Ether and Relativity", *Australian Journal of Physics*, vol. 11, 1958, p. 279.

[139] A physical analogy of the Lorentz transformations is seen in the "bouncing light clock" illustration found in many Relativity textbooks.

space accelerates in some direction, matter must passively accelerate with it. Einstein recognized that the forces felt by an observer on Earth's surface and by an observer in a space ship accelerating at 1*g* are essentially identical. Thus he formulated his principle of equivalence of inertial and gravitational acceleration. In both cases a force is being applied—by the ship's rocket engines and Earth's surface, respectively. We should assume that similar effects have the same cause, until proven otherwise. We should assume that both observers are being forced into a state of acceleration with respect to their surrounding inertial space. For this to be true, in gravity inertial space must be accelerating towards the center of Earth. Earth's surface prevents us from accelerating Earthward with it, forcing us into a constant state of acceleration with respect to space. If we are free to accelerate Earthward with space, as in free fall, we are "weightless"; gravity seems to disappear.

Thus Einstein's principle of equivalence implies that the inertial-electromagnetic space posited by Newton, Maxwell and Lorentz is not a unitary Cosmic solid, but is a massless, frictionless fluid that is flowing radially into all matter as into a 3-dimensional sink. (Fig. 2)[140] The centripetal acceleration of this spatial flow at any point outside a mass is GM/r^2, the known gravitational acceleration.[141] All masses accelerate Earthward with space, explaining the ballistic aspects of gravity. A flow must also have a velocity. The spatial flow's velocity at any height r from Earth's center must be the cumulative result of its centripetal acceleration from rest at infinite distance to r. This velocity is necessarily identical to its inverse: the initial velocity required by any mass at r to overcome the total centripetal acceleration of space and reach a position of rest at infinite distance. This is easily calculated and is Newton's escape velocity: $v = \sqrt{2GM/r}$. This velocity explains gravity's electromagnetic ("relativistic") effects. To reproduce GR's predictions, we need only to apply the Lorentz Transformations to this gravitational velocity. For instance, the Lorentz Transformation for the reduction in frequency (i.e., transverse redshift or time dilation) caused by velocity in space is: $\Delta f/f = 1 - \sqrt{1 - v^2/c^2}$. In gravity we substitute the gravitational velocity, $\sqrt{2GM/r}$, for v as per the escape velocity equation. This yields the correct gravitational redshift: $\Delta f/f = 1 - \sqrt{1 - 2GM/rc^2}$. Again, similar effects should have the same cause: all spectral redshifts including the slowing of atomic clocks have one cause: velocity relative to space. This is a significant unification: it expands Einstein's principle of equivalence to include velocity. Acceleration and velocity with respect to the surrounding space, whatever the cause, produce the same physical effects.

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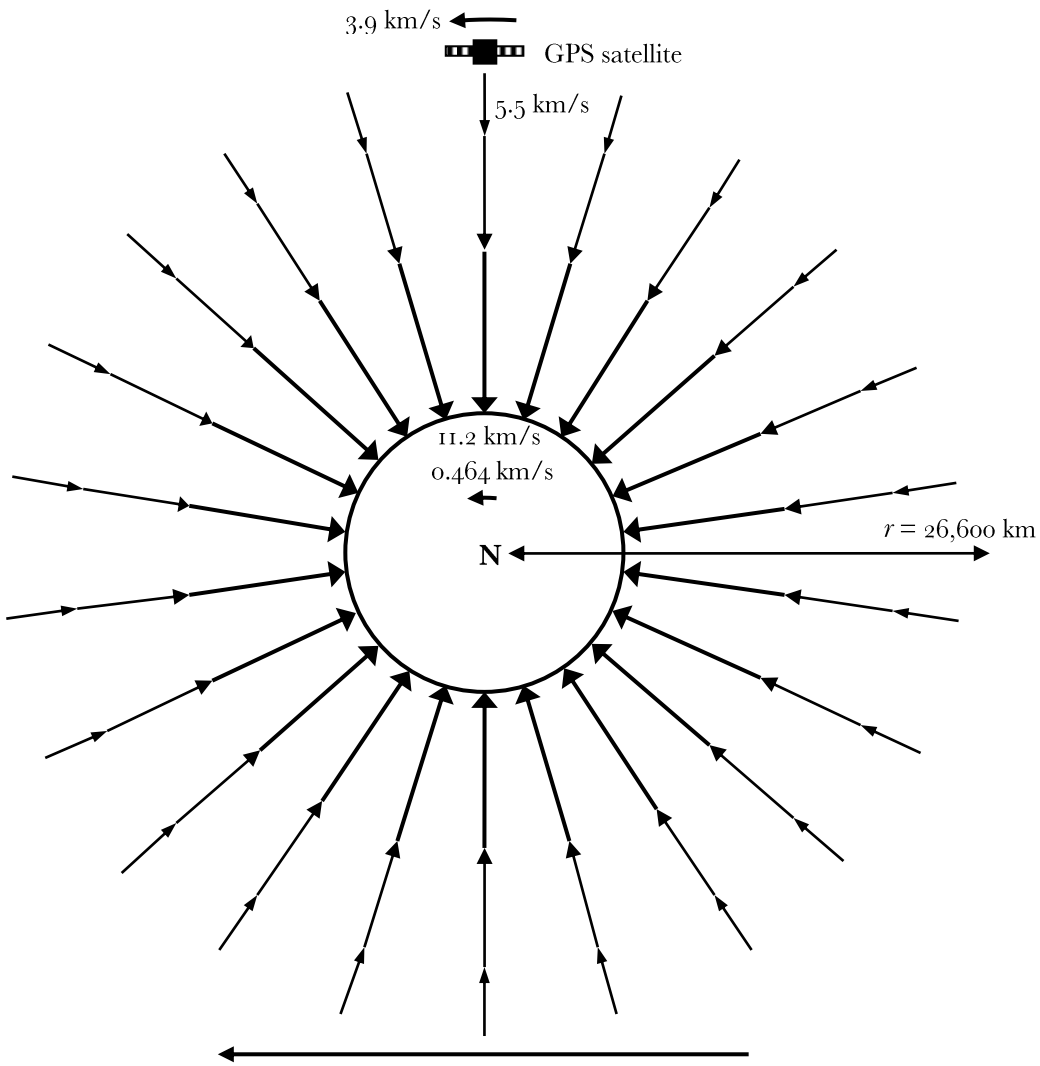
[140] Newton speculated that gravity was caused by the flow of space into celestial bodies, but did not pursue the idea in his *Principia*. Edwin A. Burtt, *The Metaphysical Foundations of Modern Physical Science*, 1924, pp. 270-276.

[141] *G* is Newton's gravitational constant, *M* is the mass of the object, and r is the distance from its center. Without cancellations, the acceleration is $4\pi GM/4\pi r^2$, emphasizing its spherical-area dependence.



Earth's 30 km/s orbital velocity through the Sun's flow- field

Figure 2. A two-dimensional representation of the gravitational flow of inertial-electromagnetic space into Earth's equator, as seen from the North pole. The acceleration at any height, r, is GM/r^2 and the velocity is $\sqrt{2GM/r}$. The flow is Sun-star irrotational. It shows the spatial flows affecting the GPS satellites' and Earth-surface clocks.

Here on Earth's surface, space is flowing downwards through us at a velocity of 11.2 km/s and an acceleration of 9.8 m/s² (1*g*). We cannot see this flow, but we feel its Earthward acceleration constantly as gravity. We also sense the flow when we accelerate or rotate relative to it. The only time we don't feel it is when we are in free-fall, accelerating Earthward with it. Atomic clocks on Earth's surface do indeed slow just as if they are moving at 11.2 km/s in space. If we place them at higher elevations where the flow is slower, they run faster.[142] The velocity of the flow at the 26,600 km height of a GPS satellite is only 5.5 km/s, so its atomic clock runs faster. Its rate is somewhat slowed, however, by its 3.9 km/s tangential orbital velocity in the ECF. (Fig. 2.) The satellite's resultant spatial velocity is obtained by the Pythagorean theorem: $\sqrt{5.5^2 + 3.9^2} = 6.7$ km/s. Since its velocity in space is lower than that of Earth surface clocks (11.2 km/s), its clock runs faster. A clock on Earth's equator is slowed slightly by its 0.464 km/s tangential velocity in space due to Earth's rotation within its own flow-field. This rotation is physically evidenced by the Michelson-Gale and Hafele-Keating experiments, the Coriolis effect and the rotation of a Foucault pendulum. The rotational state of Earth's inflow field is controlled by the position and motion of the surrounding large masses (the Sun and stars) and their flow-fields. The rotation of a sink like Earth cannot spin its inflowing space into rotation with it.

This theory of gravity is actually neither new nor controversial; it has simply been ignored for the reasons discussed above. Soon after Einstein published his gravitational field equations, Paul Painlevé[143] and Alvar Gullstrand[144] demonstrated that the Schwarzschild metric that described an isolated gravitational field could be represented by a flat (Newton-Lorentz) space flowing radially inward towards matter at the Newtonian escape velocity (the Painlevé-Gullstrand metric). Herbert Ives demonstrated that if objects in a gravitational field were affected *as if* they had the escape velocity at every r—if their frequency were redshifted, if they were shortened in the vertical direction, and if their effective mass were increased—the successful predictions of GR could be produced with greater simplicity, including gravitational lensing, the gravitational redshift, and the advance of Mercury's perihelion.[145,146] Robert Kirkwood demonstrated that an actual flow of Newtonian-Lorentzian space

[142] Some claim that the GPS satellites" clocks don't actually run faster, but instead the light from them "gains energy" as it falls to Earth, increasing in frequency. However, scientists have placed one clock above another and watched it run faster. See: Chin-Wen Chou et al., "Optical Clocks and Relativity", *Science*, vol. 329, 2010, p. 1630.

[143] Paul Painlevé, "La Méchanique Classique et la Théorie de la Relativité" (French) *Comptes Rendus de l"Académie des Sciences*, vol. 173, 1921, p. 677.

[144] Alvar Gullstrand, "Allgemeine Lösung des statischen Einkörperproblems in der Einsteinschen Gravitationstheorie" (Swedish) *Arkiv för Matematik, Astronomioch Fysik*, vol. 16, 1922, p.1.

[145] Herbert E. Ives, "Behavior of an Interferometer in a Gravitational field", *Journal of the Optical Society of America*, vol. 29, 1939, p. 183.

[146] Herbert E. Ives, "The Behavior of an Interferometer in a Gravitational Field. II. Application to Planetary Orbit", *Journal of the Optical Society of America*, vol. 38, 1947, p. 413.

into or out of all matter reproduces Einstein's gravitational field equations.[147,148] Tom Martin demonstrated that a Galilean frame with spatial inflow or outflow of speed $w = \sqrt{2GM/r}\,\hat{r}$ gives all of the correct effects associated with the static and curved space-time Schwarzschild solutions.[149]

We can therefore transition from Newtonian Mechanics and Relativity to space physics with these simple principles of discovery:

Spatial Acceleration: The acceleration (dv/dt) of a test mass in freefall at any location reveals the acceleration of space.

Spatial Velocity: The slowing of an atomic clock (the redshift of an atom's spectrum) at any location reveals its velocity in space.

With our test masses and atomic clocks we have always been detecting "absolute" motion within (relative to) space. Since this theory defines the motion of space relative to the celestial bodies, it can predict what "frame" is at rest in space at every location. It accounts for what we know and is rich in additional predictions. The direction of the gravitational flow will create anisotropies that are not predicted in GR's static space-time curvature model. For instance, atomic clocks falling with Earth's inflowing space will run faster than clocks rising against the flow. A clock falling at the escape velocity at every r is at rest in space and will run at the fastest rate. We may be able to perform such tests economically with our GPS satellites. Muons' half-lives will be greater (their internal frequency reduced) when they move against the 11.2 km/s spatial flow as compared to falling with the flow. Light signals will rise against and fall with Earth's spatial flow at $c \pm v_{flow}$. It may be possible to tweak "GR" to accommodate such findings, or even to claim that they are implied in GR, but GR did not predict and cannot explain them.

7.3 BLACK HOLES

The flowing space theory of gravity has resurfaced in the study of black holes. It is called the "waterfall" or "river" model where "space itself flows like a river…while objects move through the river according to the rules of special relativity…the river of space falls into the black hole at the Newtonian escape velocity…"[150] The idea is so intuitively attractive that physicists use it to describe black holes in popular video documentaries.[151,152] However, they view it only as an interesting analogy and fail to

[147] Robert Kirkwood, "The Physical Basis of Gravitation", *Physical Review*, vol. 92, 1953, p. 1557.
[148] Robert Kirkwood, "Gravitational field equations", *Physical Review*, vol. 95, 1954, p. 1051.
[149] Tom Martin, "General Relativity and Spatial Flows: I. Absolute Relativistic Dynamics", *arXiv.org, General Relativity and Quantum Cosmology*, gr-qc/0006029v1 , 2000.
[150] Andrew J. S. Hamilton and Jason P. Lisle, "The River Model of Black Holes", *American Journal of Physics*, vol. 76, 2008, p. 519, and arXiv.org, gr-qc/0411060v2 , 2006. See Hamilton"s discussion and animations of spatial flow into black holes at: http://jila.colorado.edu/~ajsh/insidebh/waterfall.html (Sept. 1, 2015)
[151] Max Tegmark, in *Seeing Black Holes*, dir. S. Cooter, BBC/Science Channel, 2010.

consider that it explains weak gravity as well. In flowing space, the "event horizon" or Schwarzschild radius, R_S, of a black hole is where the spatial inflow velocity reaches *c*. Since light propagates in the space at *c*, it cannot exit against the superluminal inflow. It is calculated by setting Newton's escape velocity equal to *c*: $R_S = 2GM/c^2$. Flowing space thus resolves a long-standing mystery: Why does Newton's escape velocity yield the luminal radius much more simply than Schwarzschild's solution of GR's field equations?[153]

Flowing space implies no singularities, wormholes or other universes. A black hole is simply a celestial body that is so massive and compact that the spatial inflow velocity at some point outside its surface is $\geq c$. Soon after the flow enters the mass it must decelerate and come to a stop at the center; there is an internal anti-gravitational effect. The black mass is some form of hadronic matter. It could be densely-packed neutrons. A neutron star of density 5×10^{17} kg/m^3 and mass 6 times that of our Sun ($6M_\odot$) would have an inflow velocity of *c* at its surface. Its physical radius of 18 km would also be its luminal (Schwarzschild) radius. At the other extreme, the apparent black hole at the center of the Milky Way,[154] Sagittarius A*, with a calculated mass of 4 million Suns ($4\times10^6 M_\odot$), has a luminal radius of 12×10^6 km. If composed of densely-packed neutrons its physical radius would be 1600 km, slightly smaller than our Moon. The spatial inflow velocity at its surface would be 86*c*. With this theory, we can begin to theorize about what happens inside of a black hole.

7.4 ON SPACE, WAVES, AND PARTICLES

How do we begin to characterize space, this hitherto unknown Cosmic substrate? We must simply ascribe to it whatever qualities are needed to explain the phenomena. In order for space to produce the observed uniformity of particles and processes it must be quantized; it must have smallest parts of some size—perhaps at the Planck scale (10^{-35} m). These "cells" must have the complexity needed to produce all the fundamental processes and particles. Their qualities determine the physical constants. In order for spatial sinks (matter) to move through space without resistance at subliminal velocities, the cells must be massless and able to move relative to one another without friction. They must flow around and into the moving sink's entrained flow-field. Space does not have mass or charge; these qualities are products of certain persistent motions and/or distortions in and of the spatial cells. True particles are various stable, localized patterns of motion in and of the spatial cells; some combine

[152] Brian Cox, in *Wonders of the Universe, The Known and the Unknown*, dir. C. Holt, BBC/Science Channel, 2011.

[153] Giovanni Preti, "Schwarzschild Radius Before General Relativity: Why Does Michell-Laplace Argument Provide the Correct Answer?", *Foundations of Physics*, vol. 39, 2009, p. 1046. Compare the complexity of Schwarzschild"s solution to that of flowing space at: https://en.wikipedia.org/wiki/Deriving_the_Schwarzschild_solution (Sept. 1, 2015).

[154] Rainer Schödel et al., "A Star in a 15.2-year Orbit Around the Supermassive Black hole at the Centre of the Milky Way", *Nature*, vol. 410, 2002, p. 694.

multiple spatial mechanisms. Particles are not infinitely-small points associated with fields; they are their fields—as large as their gravitational, electromagnetic and other effects in space. Space is the electromagnetic medium—it supports electromagnetic fields and waves. The charge-creating entities are the electron and positron. They appear to be electromagnetic wave-structures. In double-slit experiments, electrons can build up a wave-interference pattern, even one-at-a-time, because their wave-structure is larger than the separation of the slits. The electron's waves self-interfere at the slits, altering its trajectory so as to produce maxima and minima. This effect has been seen in double-slit experiments with standing waves in a fluid.[155]

Space theory will retain the data and working equations and concepts of classical and modern physics, but will reinterpret them and integrate them into a working physical theory. For instance, gravity is not a "force" and is unlikely to be caused by every form of "mass-energy". There is no evidence that a mass's gravity is increased if it is hotter or is moving faster in some frame. The energy of the vacuum as required by QM produces no gravity (the "vacuum catastrophe"). There is no evidence that light or even electrons create gravity. An electron's "mass" is purely electromagnetic. Gravity is most likely hadronic, caused by protons and neutrons. A quark may be a structural nidus of spatial consumption, explaining its strange qualities. The strong nuclear force may be a residuum of the quarks' spatial consumption. The close proximity of the protonic and neutronic sinks in a nucleus may hold positively charged protons together perpetually—a form of strong gravity. Nuclear stability probably depends upon spatial consumption.

The neutrinos produced in nuclear reactions are a mystery. They always move at velocity *c* in space. They have widely varying energies but no rest mass. They appear to change "flavor" in flight. These qualities suggest that they are not particles at all but are waves in space. They may be high-frequency fluid-compression waves caused by space-creating nuclear reactions, microscopic inflation events. (See below.) As with light, neutrinos may appear to be particles because our detectors are particulate. As with light, detections would be more likely to occur where all waves from all sources near and far superpose to produce the largest amplitudes.

7.5 THE GALAXIAL ROTATION ANOMALY: SPATIAL ENTRAINMENT

Newton did not know that we lived in one galaxy among many, or that our galaxy was rotating; neither did Einstein in 1916 when he published GR. As Darwin's voyage on the Beagle confronted him with living species and fossils that were not adequately explained by a single arbitrary creation event, likewise our more powerful Earth-based and space telescopes have revealed motions within and among galaxies that were not predicted and cannot be explained by Newtonian Mechanics, Relativity or QM. To save the current paradigm, physicists have had to posit the existence of "dark

[155] Yves Couder and Emmanuel Fort, "Single Particle Diffraction and Interference at a Macroscopic Scale", *Physical Review Letters*, vol. 97, 2006, p. 154101.

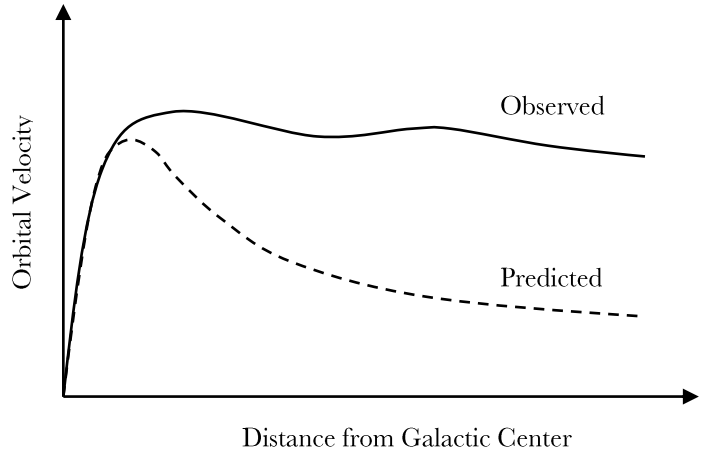


Figure 3. The deviation from the Newtonian prediction of the orbital velocities of stars in a spiral galaxy.

matter" and "dark energy"; for which no other evidence exists and which are not apparent in our solar system. The flowing space theory of gravity implies plausible explanations for both.

In recent decades astronomers have discovered that the stars and gas in the outer parts of spiral galaxies revolve around the galaxial center at much higher velocities than predicted by normal gravity acting within Newton's single Cosmic inertial frame—assumed fixed to the surrounding galaxies. The stars' velocities do not fall off with distance from the center as they should. (Fig. 3.) Their deviation from Newtonian Mechanics increases with distance from the center. A similar anomaly—an appearance of excess gravity, is also seen in globular star and galaxy clusters. To explain this effect, scientists have invented dark matter and distributed it where needed to save Newtonian Mechanics. Amazingly, they have had to posit 10 times more dark matter than visible matter in spiral galaxies like ours. Dark matter is supposed to have gravitational mass, therefore should have inertial mass, but it never collides with normal matter nor transfers momentum to it. Worse, observations of stars moving perpendicular to the plane of the Milky Way show no excess mass within the disc—no apparent dark matter within 13,000 light years of the plane of the disc.[156] So they must presume that the dark matter is distributed in a "halo" far above and below the galaxy. There are tremendous difficulties in explaining how dark matter got into this strange distribution and how it stays there.

The solution to this problem is actually old, Mach's Principle,[157] and it follows directly from the flowing space theory of gravity. Mach rightly sought to relate inertia

[156] Christian Moni Bidin et al., "No Evidence for a Dark Matter Disk within 4 kpc from the Galactic Plane", *The Astrophysical Journal*, vol. 724, 2010, L122–L126. arXiv:1011.1289.
[157] Described by Einstein in *The Meaning of Relativity*, 1922, p. 100 of the Princeton Science Library edition.

to the distribution and motion of matter, instead of Newton's single Cosmic frame. Indeed if we reject Newton's conjecture, we must accept some version of Mach's Principle; but it could not be pursued within positivism or Relativity because it requires a theory of space—Stokes' ether-entrainment theory. In the flowing space theory, all matter (mass) is an extended dynamic sink or source flow-field in space. Since space is a massless and frictionless fluid, every celestial body in free-fall motion must entrain its radial flow-field into its own motion out to a very great distance, limited only by the flow-fields of surrounding celestial bodies. This distance is probably represented by the Hill Sphere radius, $R_{HS} \approx r_{orb}\sqrt[3]{M_g/3M_S}$. In a sense, every celestial body is as big as its entrained flow field. Therefore, the motion of space at any location is determined by the position and motion of the near and distant planets, stars and galaxies—by the distribution of matter.

The stars orbiting the centers of galaxies and clusters must cause the space within these stellar communities to also rotate around the center. The disk of a spiral galaxy like ours has a thickness of 100 to 500 stars; all these stars moving together "spin up" intragalaxial space, creating a vortex. The intragalaxial inertial frame is rotating relative to the surrounding galaxies. Within the disc, space is everywhere accelerating centripetally, towards the galaxy's center, by various amounts at various distances. The stars, in free-fall, accelerate centripetally with space. This creates the appearance of excess gravity between the outer stars and the galaxial center. The stars move much faster than predicted by Newtonian Mechanics because Newton's space would be unaffected by their collective motion. This theory is consistent with the fact that spiral galaxies with their more uniform stellar motion have the highest mass-to-light ratios: up to 10:1, whereas globular clusters have mass-to-light ratios of only around 3:1 (less dark matter effect).[158] The space within globular clusters is everywhere accelerating centripetally with the orbiting stars, but their orbits have various inclinations and directions, preventing the creation of a uniform vortex.

7.6 COSMIC INFLATION AND EXPANSION: SPACE CREATION

In 1917, Einstein realized that his GR equations predicted an unstable Cosmos of stars; it must either be contracting due to gravity or expanding for some reason. To stabilize it he introduced an expansionary "cosmological constant". In 1922-23, Edwin Hubble, using the world's most powerful telescope, discovered that the nebulae were actually other galaxies, and the more distant a galaxy was from us, the greater its velocity away from us, as suggested by the Doppler redshift of its spectra.[159] Recently, astronomers have discovered that this galaxial recession (Cosmic expansion) is

[158] Marina Rejkuba et al., "Masses and M/L Ratios of Bright Globular Clusters in NGC 5128", *Proceedings of the International Astronomical Union*, Symposium No. 246, 2007, p. 418.

[159] Edwin Hubble, "A Relation between Distance and Radial Velocity among Extra-Galactic Nebulae", *Proceedings of the National Academy of Sciences of the U. S. A.*, vol. 15, 1929, p. 168.

accelerating with time.[160] This is inconsistent with any theory of attractive gravity; all other matter should slow the outward motion of the most distant galaxies, not speed it up. To rescue their paradigm, scientists have had to posit a "dark energy" that is pushing the galaxies apart or causing the space among them to expand. Shockingly, its mass-energy is much greater than that of dark matter, many times that of all the visible matter in the Cosmos. There is no other evidence for this energy, no trace of it in our solar system, and no plausible theory of what it is.

Flowing space provides an explanation, although speculative. As Kirkwood, Martin and others have shown, spatial outflows from sources will produce the same acceleration and velocity gradients as inflows—spatial sources will have normal gravity. The velocity of the flow is identical at every distance r, but is outward instead of inward. The deceleration of an outflowing space produces the same accelerational gradients as the acceleration of an inflowing space; so it causes matter to accelerate toward the source. This seems counterintuitive; one would think that a spatial outflow would push matter away. However, matter can move through space at very high uniform velocities without resistance. So the direction of a spatial flow has no effect on matter at sub-luminal velocities. Space interacts strongly with matter only by an accelerational mechanism.[161] All celestial bodies, except black holes, could be sources. However, I think it more likely that stars are spatial sources and inert masses are sinks. There are reasons to believe that the destruction of hadronic matter in nuclear reactions (the mass defect) creates space. Stars could be sources if the nuclear reactions in their cores create so much space that it overwhelms the spatial consumption of their inert matter, producing a spatial outflow with the escape velocity.[162] Our Sun has 99.8% of the apparent mass of our solar system, and in our galaxy stellar mass far exceeds the mass of planets, dust and gas. If stars are sources, then all bright galaxies would be spatial sources too. Locally, a bright star's or galaxy's outflow would produce normal attractive gravity, even between two sources, due to the acceleration gradients in the flows. Each mass alters the other's surrounding space, its inertial frame, causing the masses to accelerate towards one another. On a larger scale, however, another dynamic would exist.

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[160] Saul Perlmutter et al., "Measurements of Ω and Λ from 42 High-Redshift Supernovae", *The Astrophysical Journal*, vol. 517, 1999, p. 565.

[161] I discuss these and other speculative aspects of space physics in an unpublished paper, "The Implications of Flowing Space" at http://henrylindner.net/Writings/PhysessImplications.pdf. (Sept. 1, 2015) Briefly, the dynamic, accelerational nature of matter's spatial inflow field is a sufficient explanation for its inertia. Any forced acceleration of a sink or source creates opposing accelerations, and thereby tension within space, tethering the object to the surrounding space. This theory thereby unifies gravity and inertia as two different aspects of one physical process—sink/source flow. This resolves another long-standing puzzle: the equivalence of inertial and gravitational mass.

[162] Stars have varying amounts of nuclear fusion. If spatial creation and consumption are nearly equal there will be minimal outflow or inflow and the star will have no apparent mass. This theory predicts that we should find dim stars and galaxies whose apparent mass is much lower than expected, given their size.

The Cosmos has a peculiar large-scale structure that cannot be explained by current models of gravity (Fig.4.). Galaxy clusters are the largest accumulations of matter in the Cosmos. These clusters are arranged into central nodes connected by thin walls (filaments) of clusters surrounding vast empty regions. It is similar to the structure of a sponge or of rising dough and has been called the "Cosmic Web". Space creation by galaxies can explain this structure. Locally the clusters are attracted to one another, but all clusters are surrounded by other clusters, in all directions. Even if galaxy clusters initially had a fairly uniform distribution, the space that they expelled would tend to accumulate in some regions more than others. Wherever it accumulated it would reduce the clusters' spatial-accelerational attraction across that space, and eventually cause them to move apart. Once voids formed, space would preferentially accumulate in them, causing them to grow. Such voids would continue

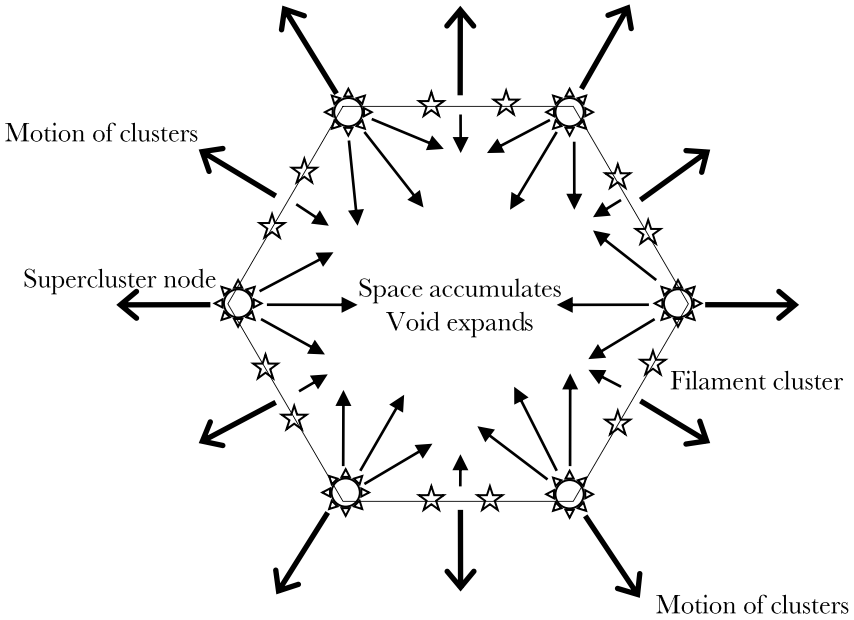

Figure 4. A 2-dimensional representation of the growth of a void in the Cosmic Web

to expand, pushing the nodes and walls farther apart and causing the Cosmos as a whole to expand.[163] The farther away a galaxy cluster is, the more expanding voids there are between it and us, thus the greater its recessional velocity. This space-creation process provides an explanation for Einstein's "cosmological constant".

This theory predicts that the overall expansion rate would change with time according to the amount of stellar fusion. The rate would increase, producing an accelerating expansion, as long as total stellar fusion was increasing (more stars

[163] The idea of expanding voids due to space creation was informed by Conrad Ranzan's "The Story of Gravity and Lambda—How the Theory of Heraclitus Solved the Dark Matter Mystery", *Physics Essays*, vol. 23, 2010, p. 75. He is one of many who have independently produced the flowing space theory.

forming and/or more fusion in existing stars). The expansion must eventually reach a maximum acceleration. Then, as the available hydrogen is consumed, star formation and stellar fusion must begin to decline. The expansion will slow and then stop. When spatial consumption by inert matter becomes dominant the Cosmos will begin to contract. As the remaining space is consumed by inert matter, all matter in the Cosmos will rush together. A Big Crunch will ensue. At some point in the collapse there will be excessive spatial tension—insufficient space to maintain nuclei and eventually hadrons. Most or all of the nuclei and hadrons in the Cosmos will be destroyed, producing a vast amount of space and radiation in a brief time—Cosmic Inflation. As new hadrons form and begin consuming space the Cosmos will contract, but when a sufficient number of stars have formed their space-creation will start another era of expansion. Thus this spatial creation-consumption model provides plausible explanations for the web-like structure of the Cosmos, the accelerating Cosmic expansion, the initial Cosmic Inflation and a Bang-Crunch cyclical Cosmos.

8 SPACE PHILOSOPHY

The spatial cell is the basic unit of the Cosmos, the ultimate integer. Since everything is made of spatial cells and of processes in/of these cells, everything can be described mathematically—more or less so depending upon its complexity.[164] Mathematics doesn't cause anything; it is the language that we invented to quantitatively describe discrete space and its manifestations. For instance, Euclid's geometry is a set of linguistic formulae that approximate the spatial relationships in weak gravitational flows. Mathematical treatments can only be approximations because we can never know or compute what every spatial cell does, even in the simplest physical processes. Since space is quantized-discrete, so too are length, time, and action. This resolves Zeno's paradoxes and the general problem of infinities—they exist only in our equations and imaginations. No particle-field is infinite in extent; it is limited by the surrounding fields. Even if it is isolated, at some distance its influence will become too weak to affect change in the more distant spatial cells.

Space theory provides a Cosmic-physical foundation for our concepts. "Length" refers, ultimately, to a number of spatial cells in a line, and "volume" to a number of spatial cells within a region. "Dimension" is just the name that we give to a quantity that we use for our accounting purposes. The Cosmos does not have dimensions, neither 3 nor 4 nor 10. Time is categorically different than space. It is our way of accounting for or marking evolution—the unending procession of causes and effects, of motions in and of space and its complex structures. We standardize Cosmic evolution by using some highly regular cause-effect process (pendulum, crystal oscillator, atomic frequency, etc.). These physical processes, and therefore clock rates, are variously altered by physical circumstances (temperature, acceleration, velocity,

[164] Discrete space explains "the unreasonable effectiveness of mathematics in the natural sciences". See Eugene Wigner: http://www.dartmouth.edu/~matc/MathDrama/reading/Wigner.html (Sept. 1, 2015).

etc.). While clock rates everywhere change, we still can and do construct a Cosmic (absolute) time using our knowledge of light-travel times, primary and secondary Doppler shifts, etc. Simultaneity is not merely relative; there was a single "now" for the entire Cosmos at the Big Bang and there is a single "now" everywhere, at this moment. Energy is just our accounting for motion—as Francis Bacon concluded long ago.[165] Mass is a measure of the total motion (energy) bound up in matter's structure. Matter and energy are interconvertible because they are the same thing—more or less organized motions or distortions in and of the spatial cells. When matter is destroyed, its tightly-confined motions become free motions in space (e.g., electromagnetic radiation, neutrino-waves, etc.).

Space physics restores the Cosmos and causality to physics and philosophy. It gives us a physics without observers, consciousness, information, other universes, time travel, paradoxes or schisms—a physics that makes sense. It provides the theoretical foundation required to understand the entirety of hierarchical evolution, from space to atoms to molecules to life to linguistic consciousness. This theory of space and its hierarchical evolution resolves many of the long-standing problems in philosophy. For certain, the existence of space, its consumption and creation by matter, and its evolutionary potential are still great mysteries, but they are mysteries better-defined. This new space-evolutionary philosophy will inform and enrich all our sciences and our society as a whole. It will allow us to solve our problems, fulfill our potential as a species, and hopefully, become both able and worthy to survive the death of our planet and to travel among the stars.

Falls, Pennsylvania, USA
hlindner1@yahoo.com

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I was much aided in understanding these issues in recent years by daily conversations with my daughter, who is studying mathematics, physics, and astronomy/astrophysics at a major university.

DEDICATION

To my dear friend, Saeb Al-Khalil (1948-2015). Born into a Shia Muslim family in south Beirut, he dreamt of the fading away of the Abrahamic religions in an enlightened future.

[165] Francis Bacon, *Novum Organum*, 2nd Bk.of Aphorisms, xx.

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