

Etherism over Atomism: Space is a Substance.

Henry H. Lindner

Abstract

Just as the Copernican Revolution replaced the anthropocentric Ptolemaic Cosmology with an objective model of motion in this Cosmos, so we must replace observer-based Relativity and the observer-created reality of Quantum Theory with an objective theory of what exists and what causes the motions and events and we observe. We must ask questions that have been long been suppressed. Relative to what in this Cosmos does light really move at velocity c ? Is light actually a wave? In what? Relative to what in this Cosmos does matter have inertia? Does “empty” space itself have physical qualities or not? Is space a void or is it some sort of substance? The author will demonstrate that today’s four-force/four-exchange- particle atomism is not a considered theory of physical reality at all, but only a default model based upon subjectivistic measurement concepts. He demonstrates that only an ethereal theory of space and a wave model of light are consistent with all the known evidence.

Key words: absolute space, atomic clocks, atomism, Cosmos, ether, etherism, gravity, inertia, light, Mach’s principle, motion, paradox, photon, quanta, Quantum Theory, Relativity, space, space-time, time-dilation, waves

1. INTRODUCTION

My first paper⁽¹⁾ dealt with the metaphysics and epistemology of Relativity and Quantum Theory. It described how they followed directly from Bishop Berkeley's idealistic, subjectivistic, anthropocentric, and essentially religious program of limiting the scope of natural philosophy to the mere modeling of the observer's sensations and measurements, in the observer's frame. He accomplished this only by denying that any physical Cosmos or causes existed. Albert Einstein imposed Berkeley's metaphysics and epistemology on physics with his Special Theory of Relativity and his photonic model of light. For the last 100 years, physics has been locked into this subjectivistic paradigm. In order to understand what kind of paradigm change is needed today, let us look back at the last great revolution in physics.

Like our Einsteinian physics, the Aristotelian/Ptolemaic model of the Cosmos was naively based upon the observer's mere description of his sensations and measurements. The Earth-surface observer felt no movement as he observed and measured the movements of the stars and planets. He created a model of their motion in his frame—the spherical Earth on which he stood. The model “worked” to account for the motions of the heavenly bodies and to predict future positions. It was refined to great accuracy over the centuries. There were only two problems: the strange, unnatural zig-zag movement of the planets in their orbits about the Earth and the requirement for several different kinds of *ad hoc* fixes (deferents, equants, epicycles) resulting in great mathematical complexity.

Copernicus, a monk, physician, and philosopher, did not believe that the God's creation could be so unnatural and complicated. He revived Aristarchus' idea that the Sun, not the Earth, was stationary and that Earth was just another one of the planets circling the Sun. His opponents raised arguments, some of which were eerily similar to those used today by defenders of Relativity and Quantum Theory. They asserted that if the Earth were moving so rapidly, there should be some kind of “wind”—the motion should be evident to their senses and instruments (an idea that eventually produced the Michelson-Morley experiments and their misinterpretation). They argued that if the Earth were rotating, everything on its surface should be flung off into space. Both arguments, we know now, were made from ignorance of the nature of gravity and of space. They also argued that Copernicus' model was inaccurate, even though its calculations were much simpler than those of the Ptolemaic model. This was because Copernicus had presumed that the planets moved in perfect circles around the Sun—an error that was not corrected until Kepler discovered that the orbits were actually elliptical.

The Copernican Revolution demonstrates that the difference between an observer-based system of description and a theory of Cosmic structure and motion is anything but trivial. Even though the Ptolemaic Cosmology “worked” as today's models “work”, mankind had to abandon it completely in order to gain any understanding of space, motion, and gravity. Without the Copernican Revolution, the advances made by Kepler, Galileo, and Newton would never have occurred. Theoretical physics would never have been born. The Copernican Revolution was not a scientific revolution—it was not just an improved model of the facts of observation, it wasn't even more accurate! It was a revolution in the *choice* of the frame to be used for the description of motion. It was an instance of mankind using our theory-creating ability in order to reach beyond the evidence of our senses and instruments to create a theory of what *existed* and *caused* our experiences and measurements. Copernicus replaced anthropocentrism with Cosmism. This was a philosophical, not a scientific revolution.

Relativity and Quantum Theory were a regression to the anthropocentric epistemology of the Ptolemaic Cosmology. It was no fluke that Einstein claimed that he had reversed the Copernican

Revolution! His Special Relativity (SR) is a model of the human observer's sensations and measurements without any reference to any objective Cosmos—as if the only reality is the observer's conscious experience. SR asserts that light moves at c relative to each and every human observer, regardless of his state of motion. Can there possibly be a more anthropocentric concept? Wouldn't *any* objective Cosmology relate the motion of light to some aspect of the Cosmos—perhaps its large masses (galaxies, stars, and planets)? Wouldn't *any* objective Cosmology try to explain why light might *appear* to move at c as measured by every human observer, when it actually did not? General Relativity (GR) does at least include the effect of mass on the observer's space-time measurements—but it remains an anthropocentric model. It is not a model of an objective Cosmos that changes through time. It's a static 4-dimensional model composed of the only thing that different observers can agree upon—their measured space-time intervals between observed events. It's a model a space-time Matrix that coordinates every observer's experiences. Quantum Theory likewise models the observer's experiences of the interactions of light and matter. It neither posits any underlying objective reality nor attempts to model that reality. Its only reality is the observers' conscious experiences. The observer creates reality by his act of observing. In the previous paper I explained why this is so.

Ironically, today's physicists do not grasp the unbridgeable chasm between the subjectivism and idealism of Relativity and Quantum Theory and Cosmism. They do not recognize the true nature and limitations of their own models. They falsely assume that these are objectivistic models of an objective physical Cosmos and they mistakenly use them and their measurement concepts (flying photon, invariant c , space-time) to theorize about the nature and causes of Cosmic phenomena. It doesn't work. As with the Ptolemaic Cosmology, their model makes no sense of the phenomena and they are continually forced to resort to *ad hoc* hypotheses and fixes (renormalization, wave-particle duality, sums-over-histories, many universes, strings, dark matter, dark energy, etc.). They thus generate the schisms, confusions, and the paradoxes of modern physics.

In this paper, I will engage the philosophical task that lies before us—to initiate another Copernican Revolution in physics. I will analyze the subjectivistic ideas currently in use and demonstrate why they are inadequate for any objective Cosmology. I will attempt to find hypotheses that we can use to create an objective theory of the Cosmos.

2. THE QUESTION OF SPACE

When you attempt to accelerate a mass that lies on a frictionless surface, what resists this change in velocity? When you try change the axis of a spinning mass, what causes the resistance you feel and force that pushes the mass perpendicular to the direction you are pushing it? Why does a pendulum continue to swing in the same direction relative to the Sun and stars even as the Earth rotates under it? Is the “frame” that accounts for these phenomena truly relative? Can one choose any frame at random to describe these phenomena or is there a single, specific frame that is uniquely causative? Does the causative frame have anything to do with any human observer, or is it rather due to the distribution of mass in the local and distant Cosmos? Can one truly produce gravity by a mere choice of frame, as Einstein claimed, or does mass alone produce gravity? Does light *really* travel at c relative to every observer, or relative to the immense masses that inhabit this Cosmos? Why?

No, we don't have to resurrect Newton's single, isotropic, absolute “space” to explain these phenomena. That was obviously an inadequate ether theory. We should rather invoke Mach's superior hypothesis that the near and distant matter of the Cosmos creates everywhere a unique

local inertial frame. We can simply incorporate Einstein's insight that space not only affects matter, but matter affects the qualities of space. We can then form hypothesis about the nature of matter and of space that can explain this relationship. So what of the motion of light? We know that matter alters its surrounding space in some way, causing other matter and light itself to accelerate towards it. So it appears again that matter affects its surrounding space—determining its inertial, gravitational, and electromagnetic properties. Is it not possible to recreate physics upon this kind of objective modeling of space and motion, rather than continuing to describe the observer's measurements within his frame? As I said, we are simply changing the perspective of theoretical physics, not rejecting all the data and the useful concepts that have come down to us. In fact it is because of the knowledge gained during the preceding era of "normal" science that we are able now to construct an objective theory of the Cosmos. This was not possible in 1905.

When we attempt to move beyond the mere modeling of the observer's experiences and instead create a model of the Cosmos, we encounter the question of space. We must choose between two and only two fundamental hypotheses: either "empty" space is no-thing or it is some-thing—either not-A or A. There is no middle ground; there are no other possibilities. We must choose between these two mutually exclusive hypotheses:

atomism: Space is nothing, a void, featureless extension, a mere container. Space has no physical qualities and neither causes nor interacts with any phenomenon. Gravity, electromagnetism, and all other Cosmic phenomena are the products of the interactions of various particles flying through a void.

etherism: Space has physical qualities and is therefore some kind of substance. It is the physical substrate of the Cosmos and all its phenomena. Gravity and electromagnetism are just different kinds of stresses or motions of or within this substance. The known particles are themselves persistent patterns of motion in and of space.

If it is even just possible that space is something, then shouldn't theoretical physics turn its attention to identifying and describing this substance? Instead, the issue has been successfully evaded for centuries. Every lawyer's and propagandist's trick has been used to deny and suppress ether theory, even as physicists and Cosmologists are forced to populate "empty" space with more and more unseen "particles" and "energies". Fallacious reasoning is rampant. It is regularly argued that because one particular ether theory has been proven false, therefore *any* ether theory is false. However, Newton and Lorentz's single, static Euclidean space is just one of many possible ether theories—and not a particularly good one. Since 1905 when Albert Einstein's papers on Special Relativity and the light quantum were interpreted as implying that there was no ether, theoretical physicists have simply defaulted to atomism and ignored the evidence for the physicality of "empty space". Yet Einstein's models are subjectivistic; the no-ether assumption is built right into the axioms! Relativity deals only with the observer's sensations and measurements and simply cannot address the existence of a substantial space that may cause rod-shortening and light-clock slowing. Since space itself cannot be seen or measured, it has been ignored. Space/ether is absent from today's physics not because the evidence disproves its existence, but because Relativity was created to ignore/evade its existence. So when physicists attempt to theorize about the nature of Cosmic reality they default to atomistic theory and simply ignore the unreality and the contradictions that follow—all the paradoxes of Relativity and Quantum Theory.

If we ground theoretical physics instead upon the assumption of the existence of the physical Cosmos from which we and our consciousness evolved, if we attempt to model the Cosmos itself and relate all physical processes to the matter and space of the Cosmos instead of to our own conscious experience, then we can create an objective model of space and motion. This will enable us to form meaningful physical hypotheses about the causes of inertia, gravity, and light's velocity. When we admit that there is indeed a unique local frame affecting physical phenomena at any given location, when we admit that there is *always* a preferred frame, then we can attempt to explain that frame's existence and its physical qualities. Instead of filling the void with ever more types of unseen and *ad hoc* particles and "energies" we will create a new physics based on the assumption that space is a substance in which light travels at c , in which matter cannot travel faster than c and which interacts with matter to produce inertia and gravity. We will create a theoretical physics that actually theorizes about the physical Cosmos.

This paper will review the history of atomism and etherism in theoretical physics, and demonstrate that atomism does not work whereas etherism is consistent with all the evidence and exposes a new level of the physical reality for study. Ether theory will bring about a revolution in our understanding of the Cosmos and of ourselves, and if we are fortunate, may give us abundant clean energy and take us to the stars.

3. A BRIEF HISTORY AND ANALYSIS OF ATOMISM, ETHERISM, AND THEISM

The question of space has always been central to mankind's speculations about the Cosmos and about God. From the Vedic times, around 3000 B.C. to 1000 B.C., Indians (Indo-Aryans) classified the material world into four elements: Earth (Prithivi), fire (Agni), air (Vayu) and water (Apa). To these four elements they added a fifth one: ether or Akasha. Indian philosophers believed that except for Akasha (ether), the elements were physically palpable and were comprised of miniscule particles of matter.⁽²⁾ Scientific philosophy was born in Ionia (the central Aegean coast of modern Turkey) in the early 6th century B.C. when humans first theorized about the substance underlying all Cosmic entities and change—the first principle of all things—the "world stuff". Thales of Miletus proposed that all things came from water and returned to water. Anaximander posited a substance he called "the infinite". Anaximenes chose air; Heraclitus fire. Pythagoras, once a disciple of Anaximenes, asserted instead that numbers were the first principles of things. He sought the mathematical relationships inherent in all Cosmic phenomena. Leucippus and Democritus, in the 5th century B.C., invented atomism. They proposed that the Cosmos was composed of minute particles moving in a void. These indivisible, indestructible, unchangeable particles had differing shapes and sizes—they differed quantitatively, not qualitatively. They moved in straight lines through the void until they contacted another particle and either rebounded or stuck together to form combinations. The various known substances and motions were the result of differing interactions and combinations of the various kinds of atoms.

Aristotle refuted the arguments by which the atomists and others claimed to prove the existence of the void.⁽³⁾ He argued that gravity gave space everywhere a directional quality that a void, being nothing, could not possibly have. He theorized that all matter moved towards "natural places" in a Cosmos composed of concentric spatial spheres centered on an immobile Earth. He argued that motion proportional to force could not exist in a void since a void could not resist any motion—natural or forced. He mistakenly assumed that motion in space would require some constant force—as does continued motion through other media like water. (Galileo eventually discovered that only the acceleration of matter required a force.) The Stoic

philosophers identified the ether with a quasi-material *pneuma*, or spirit. They posited that the ether pervaded not just celestial but terrestrial matter as well and interacted with matter as the universal transmitter of force.

From the early Middle Ages on there was there was an intense debate in the Christian world over the nature of space and its relationship to matter, a debate that provoked the intervention of the Catholic church in the Condemnation of 1277.⁽⁴⁾ The Churchmen condemned Aristotle's equation of Cosmos with the Supreme Being (God). They sought to differentiate God and Cosmos and so asserted that God could create a void (non-Cosmos) and could move the Cosmos if he so desired. Christian thinkers pondered: Is God everywhere? Is God coextensive with the Cosmos or is God outside of the Cosmos? Some thinkers posited that space was the intermediary between the corporeal, concrete world of nature with the incorporeal world of spirit. Henry More argued that since both space and God have necessary existence, they are therefore one and the same. Others wanted to completely separate God from Cosmos. Muslim philosophers argued that both space and time were mere creations and that space was nothing but a series of relations—a theory to be taken up later by Ockham, Huyghens, and Mach. However, Nicholas of Cusa, Bruno, Telesio, Patritius, Campanella and Gassendi produced the consensus theory that space was infinite in extension and both independent of and prior to all matter. Gassendi's synthesis was taken up by Isaac Newton.

The question of space and matter always had two faces: the macrocosmic and the microcosmic. In microcosmic theory, Aristotle introduced the idea of *minima naturalia*, which were the qualitatively distinct, irreducibly smallest particles of each kind of substance. Averroës suggested that chemical reactions took place among these minima. Atomism was given new life when Boyle, Lavoisier, and Dalton identified the elemental atoms that combine to produce all substances. Then Thomson, Rutherford, Bohr and others discovered that these atoms were composed of smaller “atoms”—subatomic particles. Atomism seemed to be vindicated. However, other evidence led scientists to believe that space devoid of atoms—the vacuum—was also some sort of substance.

4. ETHER, GOD, AND THE MACROCOSM

In order to model inertial motion in this Cosmos, Isaac Newton posited the existence of an objective, Euclidean, Cosmic ether. He named it “absolute space”. This space was something real; it had definite physical qualities. It resisted the acceleration of matter yet allowed uniform motion at any velocity without resistance. Matter and light traveled in straight lines at constant velocity in this Euclidean space unless disturbed by some force. Every material body had some definite velocity in this ether, even if there were no means of measuring it.⁽⁵⁾ In a time when everyone believed that God was the omnipresent creator and sustainer first principle of all things, Newton chose to call his ether “absolute space” and he scrupulously avoided any *public* discussion about the nature of space and its role in gravity and inertia (“*hypotheses non fingo*”). Nonetheless, Bishop Berkeley accused him of atheistic materialism.⁽⁶⁾ Newton responded to this charge by adding a chapter to his *Principia* in which he claimed that absolute space was the sensorium of God.⁽⁷⁾

Newton's theory of light was atomistic—it consisted of particles flying through absolute space, but Thomas Young later demonstrated that light was a wave. Faraday and Maxwell achieved tremendous successes by modeling electromagnetic fields and waves as alterations in an electromagnetic ether. Maxwell predicted and explained light's fixed velocity. The question then arose, “Is the electromagnetic ether identical to Newton's absolute space? Does light move

as a wave with velocity c in Newton's space? Michelson and Morley tested this hypothesis using a light wave interferometer on the Earth's surface. They did not detect the fringe shift that should have been caused by the Earth's revolutionary motion through Newton's ether. Lorentz, Fitzgerald, and Stokes offered theories to explain the null result without abandoning ether-wave theory. Lorentz and Fitzgerald proposed the existence of a length contraction and frequency reduction caused by motion in Newton's space. Stokes instead modified Newton's space—proposing that a moving mass affected the movement of its surrounding space for some great distance, entraining or dragging into its own motion—thereby eliminating any translational motion of the ether near the Earth's surface.

Einstein's response to this puzzle was to impose an entirely different metaphysics and epistemology upon theoretical physics. Following Bishop Berkeley's metaphysics and epistemology, he simply abandoned objectivistic modeling and physical theory altogether and chose instead to limit theoretical physics to describing the observer's sensations and measurements and relating all motion to the observer—as if *no objective or observer-independent Cosmos existed!* He reduced physics to a mathematical treatment of the observer's conscious experiences, in his own frame, using his rods and clocks. Einstein appropriated the Lorentz-Fitzgerald ether model and equations and applied them only to co-moving observers' frames, eliminating the ethereal middle term and denying the fact that the existence of an EM ether was necessary to produce these quantitative relationships. His Special Relativity (SR) was subjectivistic—it made no reference to the Cosmos or any objective frame. However, as we shall see, neither Einstein nor his followers would remain *consistent* subjectivists. They would hold and develop ideas that contradicted the subjectivist foundations of their science. Therein lies the root of the confusion.

Ernst Mach was a positivist and instrumentalist and had a significant influence on the young Albert Einstein. Mach had taught that science should merely describe our sensations and measurements and that our theories were nothing but instruments that proved useful for this task. To his death in 1916 he refused to believe in the existence of the atoms of the periodic table because they could not be directly sensed. He refused to believe in the existence of Newton's absolute space for the same reason. He tried instead to relate inertia to something that could be seen and measured. He speculated that it was the result of an interaction of all the visible matter in the Cosmos with the test mass. This theory does indeed appear to be a step in the right direction, but it does not work if space is a void:

1. Inertia is not sufficiently explained by gravity, for the gravitational “tug” of all other matter on any mass only explains a test mass's free fall motion. The resistance to any mass's forced acceleration requires another mechanism that is local and instantaneous.
2. It predicts no inertia in the absence of other matter and increasing inertia as the amount and proximity of matter are increased. These possibilities were rejected by Einstein and indeed are contradicted by the known data. Inertia appears to be the same near the Earth as it is in deep interplanetary and interstellar space.
3. It offers no foundation for the explanation of other phenomena like the fixed velocity of light or the resistance to matter's near-luminal velocity.

In Newton's Mechanics, absolute space acted upon matter to resist its acceleration, but was not affected by matter at all! This was an action without a reaction. To his credit, Einstein noted this unlikely asymmetry and sought to eliminate it. Einstein realized that if he combined the

truths of Newton's and Mach's models, he arrived at a dynamic ether that influences matter and is influenced by matter. He stated:

“the fact that “empty space” in its physical relation is neither homogeneous nor isotropic, compelling us to describe its state by ten functions (the gravitational potentials $g_{\mu\nu}$), has, I think, finally disposed of the view that space is physically empty.⁸ ...But this conception of the ether to which we are led by Mach's way of thinking differs essentially from the ether as conceived by Newton, by Fresnel, and by Lorentz. Mach's ether not only conditions the behavior of inert masses, but is also conditioned in its state by them...What is fundamentally new in the ether of general relativity as opposed to the ether of Lorentz consists in this, that the state of the former is at every place determined by connections with the matter and the state of the ether in neighboring places...”⁽⁹⁾

He admitted that this Cosmic, mass-influenced frame constituted an ether; yet he failed to admit that this objectivistic ether concept contradicted his own subjectivistic Principle of Relativity—that all motion could be equally well-described in any coordinate system whatsoever! It also was inconsistent with the method of modeling used in General Relativity—which was also completely subjectivistic. GR modeled the affects of gravity upon the observer's rods and clocks, and therefore upon his constructed space-time intervals. Yet Einstein concluded,

“Recapitulating, we may say that according to the general theory of relativity, space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity, space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense.”⁽¹⁰⁾

Einstein realized, in essence, that GR could not “work” at all unless Cosmic space had some underlying structure that caused inertia and that somehow mediated the propagation of light and affected the rates of clocks and lengths of rods. Notice, however, that Einstein used the term “space” ambiguously, since according to the axioms of SR and his subjectivistic epistemology, space was nothing more than a number of rods counted by the observer. Einstein also spoke of gravitational/inertial and electromagnetic fields and stated that there was no space without a field.

We arrive here at the fatal inconsistency in Einstein's physics—a man who admitted that he was an inconsistent philosopher. When he admitted that space had physical qualities, he introduced an objectivistic concept that was incompatible with his subjectivistic epistemology. SR can work as a purely subjectivistic model of motion any observer's measurements in an imaginary “flat” matter-free space. However, when acceleration and matter-produced gravity are included, it is obvious that a unique physical frame exists in every location—the frame of the near and distant matter! In the real space of the real Cosmos, motion is uniquely, causally affected by matter and must therefore be related to it and not to any arbitrary observer's frame. GR modeled this ether—but only indirectly—as it *affected* the experiences and measurements of observers in various states of motion in the Cosmos! GR's space-time continuum, like SR's,

remains a model of the observer's sensorium, but includes the alterations caused by the presence of matter.

GR thus admits that there exists in any locale a unique physical frame that affects gravitational and inertial motion and affects the moving observers' clocks and rods—there is an ether. Given this fact, shouldn't Einstein have abandoned the subjectivistic method of SR and related all phenomena to the local, matter-influenced frame? Shouldn't he have studied this ether and created theories about its nature and properties? Shouldn't he have sought the causes of gravity and inertia? We find instead that when he faced this fatal conflict between his subjectivistic method and the existence of the ether, Einstein, like Newton, evaded the issue. He not only made no hypotheses about the ether, he actually *prohibited* all hypotheses about it:

“But this ether may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time. The idea of motion may not be applied to it.”⁽¹¹⁾

In other words, space is a substance but we must never think of it as a substance or theorize about it. Why the prohibition? Why did both Newton and Einstein affirm that space was a substance, and then try to ignore and evade the implications? Shouldn't humans always follow the evidence wherever it leads and seek the causes of all physical phenomena? The cause of this particular inhibition is obvious if one studies the debate about space throughout history. The nature and role of space is intimately connected to our ideas about God and our consciousness. An ethereal space fills many of the roles that have been assigned to God and to spiritual/mystical entities. It is invisible yet exists everywhere. It is the ground of all being and sustainer of all phenomena. It would exist even if there were no matter or motion. It is potentially eternal. The conflict between ether theory and traditional theism is clear: an ethereal Cosmos that exists eternally and self-evolves to produce particles, atoms, life, and consciousness necessarily leads to a form of pantheism. It provides an actually working theory of the ultimate nature of all being.

Why is the very mention of space-as-a-substance or “ether” a taboo? Why do we have a standard model that posits a particle for every “force”, including particles never observed and whose “exchange” is supposed to produce both attraction and repulsion among other particles? Why is it that we know that light moves at c among the celestial bodies in this Cosmos yet we continue to use models that assert that light moves at c relative to each and every moving human observer? Why do scholastics continue to assert that the Michelson-Morley experiment and the success of Special Relativity “disproved” any possible ether theory, when in fact they are only arguments only against certain ether theories? Particularly, why is ether theory taboo when the two most influential theoretical physicists of all time, Newton and Einstein, openly asserted that space was a substance? Why did Newton assert the existence of a substantial (absolute) space, yet refuse to make any hypotheses about it? Why did no one pay attention when Einstein asserted that General Relativity proved, once and for all, that there is an ether? Why did Newton eventually equate space with God, and why did Einstein flatly forbid any theorizing about the nature of the Cosmic ether-space?

The answer to all these essential questions lies not in the facts of Cosmic phenomena, which, I will show, are much more easily accommodated by ether theory than by atomism, but in the ancient conflict of ether theory with traditional theism and thus with authoritarianism. The answer is quite clear; and freely admitted by the philosophical architect of Relativity and

Quantum Theory—Bishop Berkeley. The existence of such an omnipresent physical substance that is the ground of all being is a challenge to the traditional view of God as the omnipresent creator and sustainer of the Cosmos! Ether theory forces us to produce a scientifically meaningful theory of the nature of the Cosmos—the only undeniably existing Supreme Being. Ether theory is thus a severe challenge to traditional Judeo-Christian theism and to any theory of a transcendent creator-God. To protect traditional theism from criticism—this is reason that the question of space has been evaded and suppressed for two millennia. This evasion has required the suppression of all natural/scientific theory (philosophy)—suppression of mankind’s most powerful cognitive tool—the means by which we address all questions of existence and causation and purpose.

Philosophy (of the natural and scientific kind) works by identifying essential issues, enumerating the possibilities, and then applying the evidence, logic, and experiment to determine which theory best fits the facts, explains disparate phenomena, and identifies the cause. Philosophy is just theory writ large. Theories determine the direction of experimentation and are judged according to the results. Philosophy requires clear concepts and definitions and does not tolerate contradictions (paradoxes) but resolves them by creating a better theory.

Quality	Ether	Judeo-Christian God
Omnipresent	Yes	Yes
Origin of all things	Yes	Yes
Sustains all things	Yes	Yes
Cares about individual humans		Yes/No
Infinite duration	Yes	Yes
Infinite extension	?	?
Human-like Personality	No	Yes
Immortality of human consciousness	No	Yes

Table 1

4.1. The Hidden Ether in Relativity

It is not enough to understand that the facts of gravity, inertia and EM phenomena require an ethereal space. We also have to deconstruct the entire intellectual apparatus of Relativity and Quantum Mechanics—a system of apologetics designed to ignore and evade the facts and stifle all attempts to explain the facts. For starters, it is well known that in the case of “flat” space-time where SR applies, Lorentz’s theory of an electromagnetic ether that actually, physically slows moving clocks and shortens moving rods perfectly consistent with the known electromagnetic evidence. If two observers in relative motion in a homogeneously flowing ether use Einstein’s method for synchronizing their clocks, and if they are not accelerating with respect to the ether and hence not with respect to themselves, they will observe each other’s clocks as running slow and each other’s lengths as contracted.⁽¹²⁾ All the successes attributed to SR can be explained by Lorentz’s theory. In fact, the equations upon which SR is based were produced by Lorentz. Likewise, Maxwell used ethereal concepts and reasoning to produce the equations of electromagnetism that we still use today.

Lorentz’s theory has two great advantages over SR: it relates all relativistic effects to an objective, physical frame instead of to any observer, and it produces no paradoxes. It is a theory about what actually *exists* and what is actually happening, whereas SR deals only with

appearances: the observer's experiences and measurements. When compared to actual results of with moving clocks. SR produces "paradoxes". "Paradox" is a euphemism for "contradiction". The facts contradict SR, but instead of abandoning SR, Relativists resort to apologetic arguments that would shame a medieval Scholastic philosopher. They dismiss any evidence that contradicts their model as a mere "paradox".

SR's foundational axiom, the Principle of Relativity, asserts that all motion can be equally well related to any observer or any arbitrarily-chosen frame. It thus denies or ignores the existence of any Cosmic or unique physical frame, in any locale, to which motion is uniquely related. However, our experiments in Cosmic space demonstrate that motion and the effects of motion are *not* equally well related to any chosen coordinate system (CS) but are uniquely related to the objective frame(s) defined by the local and distant distribution of matter in the Cosmos—primarily by the celestial bodies. We calculate the motion of satellites and the slowing of their clocks based upon their motion in the Earth's gravitational field. The equations take their simplest form in this frame and not in any one of an infinite number of arbitrarily chosen frames.

The matter of this Cosmos everywhere forms a unique local frame that cannot be ignored or explained away. SR denies the existence of this frame and is therefore disproved by the evidence. Consider SR's twin paradox. One of two twins at a given location goes off on a long journey at nearly the speed of light. When he returns, he has aged much less than the twin who remained on Earth or at rest somewhere among the celestial bodies of the Cosmos. From the data we have, we know that this is indeed what would happen—if the resting twin were truly at rest or had a lower velocity relative to the surrounding celestial bodies. But this result contradicts the Principle of Relativity because the moving clocks' or twins' trajectories are necessarily *symmetrical* in each other's CSs—their *relative* velocities and accelerations are *identical*. Relativity assumes, by its axioms, that all motion is merely relative and thus denies that there is an objective physical space (ether) in which one clock has a higher velocity than the other. Since the Principle of Relativity asserts that no CS can be given priority over any other CS, SR must therefore predict that each twin should see the other's clock run slower than his own and find that the other twin ages less during the journey. The only thing that can break this symmetry is a third, objective, ethereal frame in which one twin is moving faster than the other twin!

In fact, all near-Earth experiments show that the clock with the greater velocity in the non-rotating gravitational field of the Earth is always the one that runs slower. In their attempts to "resolve" this contradiction between their model and the facts, Relativists must introduce a third frame—an objective matter-related Cosmic CS such as the Earth's or Sun's in which one twin *really* moves while the other does not. They must somehow *reintroduce* the Cosmos and its matter into their subjectivistic system. Because this contradicts their epistemology, they do it surreptitiously, e.g., by ascribing the asymmetry to the felt acceleration of one twin (relative to this Cosmic frame), by invoking Doppler or clock slowing effects (caused by this third frame), or by inventing a master observer or master clock (at rest in this Cosmic frame) and describing the motion of the twins from this perspective.⁽¹³⁾ This third, objective frame in which one twin has the greater velocity always corresponds to the non-rotating gravitational/inertial frame of the nearest/nearby celestial bodies—the Earth, Sun, or stars—depending on where the twins are. Another response is to claim that SR does not apply to experiments real non-flat space since gravity and inertia must be treated with GR. I have already demonstrated, however, that GR is a subjectivistic model of the matter-influenced Cosmic ether.

Faced with this contradiction between the Principle of Relativity and reality, many Relativists adopt a schismatic view: they admit that accelerated motion is physical and real (absolute), but maintain that velocity and its effects are merely relative to any chosen frame. This does not work, for we know that it is the velocity of the moving twin, not his accelerations, that slows his clock. Furthermore, by admitting the existence of *any* objective, Cosmic, observer-independent space or frame, even just for acceleration, Relativists have stepped outside of their subjectivistic system and negated the Principle of Relativity. Since acceleration is just a change in velocity, Relativists find themselves in the untenable position of saying that something (velocity) is not real or physical, but any alteration of it (acceleration) is real. In fact, the evidence for the physical reality of velocity in space is just as great as that for acceleration. Matter's velocity is limited to c in the gravitational space/frame of the nearest celestial body. If velocity is not physical and real, how can it be limited? Likewise we know that atomic clocks are slowed due to their velocity and/or their height in the spatial frame of the nearby celestial body. One can easily invent twin experiments in which neither twin ever "feels" any acceleration, yet we know that the twin who is moving at the greater velocity relative to the nearby celestial bodies will have the slower clock. Consider the clocks orbiting the Earth in our global positioning system. They are in uniform motion and experience no acceleration, yet their slowing correlates perfectly with their velocity in the non-rotating Earth CS. Attempting to treat their velocity in any other frame is completely pointless. Relativity has blinded us to the fact that atomic clocks do what Newton and Einstein said that we could not do—detect actual velocity in physical space. *The clock that runs the fastest has the least velocity in Cosmic space, likewise the slowest-running clock has the greatest velocity.* A clock moving at near- c in space must slow almost to a stop. Once we admit the obvious reality of these effects and their relationship to matter-influenced space, then we can use the data to create a working model of what Cosmic space is, how it is influenced by the presence of matter, and how it influences matter's inertia, light's velocity, and the spectra of moving atoms. So what do the facts tell us? The special role of the frame of the celestial bodies implies that gravity involves a tethering or entrainment of the surrounding space—dragging it into translational motion with the gravitating mass.

5. ETHER AND THE MICROCOSM

We have seen, therefore, that the two scientists most successful in modeling the macrocosm were forced to posit an ethereal space yet attempted to restrict any further study of this space. Now what about the microcosm that gives rise to the macrocosm? Are our concepts and models of light, electromagnetism, and particles and their interactions consistent with our models of the macrocosm? Do we recognize the ethereal nature of space in the microcosm?

Here we find that Einstein's subjectivistic epistemology and ambivalence toward ether theory created a schism that remains to this day. In 1905, the same year that he dismissed ether theory in his seminal paper on SR, years before he thought much about gravity and inertia, Einstein asserted Newton's particle theory of light in his treatise on the photoelectric effect, in which he demonstrated that a light quantum or "photon" was quite useful for describing a certain type of light-electron interaction. The two papers were consistent, for if the ether was indeed a "superfluous hypothesis"—if space was nothing—then it could not possibly "wave". His photon and his SR laid the foundation of modern atomism.

Building on Einstein's subjectivistic atomism, Bohr and Heisenberg produced a Quantum Mechanics (QM) that accounted for the interactions of light and matter—inasmuch as they were

merely countable events in the observer's consciousness. Yet here again, physicists were not consistent subjectivists and instrumentalists. While their methods only allowed them to model their experiences, their own conscious experience, they tried to use these models to "explain" the physical world. They therefore reified the particles of their models, considering them to be actual minute physical objects flying through a Cosmic void. They became atomists by default. They posited a void in which moved two kinds of particles: fermions and bosons. Fermions were the building blocks of matter including electrons, protons, neutrons, quarks and neutrinos; and bosons were the generators of the forces of nature. They posited four forces—electromagnetic, strong nuclear, weak nuclear, and gravitational/inertial—each mediated by the exchange of a different kind of real or virtual boson: the photon, the colored gluons, the weak gluons, and the graviton respectively.

They gave these particles attributes like symmetry, spin and mass—whatever was needed to get the calculations right. For reasons we shall discuss, they ran into all kinds of problems. They had to "renormalize" their equations—to remove infinities in order to get the right answers. They produced paradoxes of all kinds (the double slit paradox, Schrodinger's cat, the Bell Inequality, etc.) The number and kinds of particles and other *ad hoc* hypotheses needed to fit the phenomena quickly mushroomed. They had to posit additional unobserved and unobservable particles and entities including virtual particles, zero-point energy, supersymmetry, superluminal communication, strings, loops, baby universes, multiple universes, etc. Cosmologists were forced to fill space with "dark matter" particles and "dark energy". Ironically, Quantum Theorists recognized fairly early on that there were no solid, indivisible particles and that all matter is composed of waves and fields. Yet even as they were forced to fill empty space with "energy" and "virtual particles" they did not think to abandon atomism and consider ether-based wave theory. They continue to dogmatically deny that space is a substance. The result is complete confusion.

Theoretical physics thus remains today at an ideological impasse. Albert Einstein, having treated both gravity and electromagnetism subjectivistically and having refused to theorize about their relationship to the underlying substrate of space, left physics exactly where it remains today:

"the universe presents two realities which are completely separated from each other conceptually, although connected causally, namely, gravitational ether and electromagnetic field, or--as they might also be called--space and matter." ⁽¹⁴⁾

This separation is known as the schism between General Relativity and Quantum Mechanics. The proximate source of this schism is easy to locate in the light of this thesis: *GR describes the observer's experience of the ether's macrocosmic effects, while QM describes the observer's experience of particulate microcosmic events. GR is necessarily ethereal while QM is atomistic.* GR, used as a model of the observer's Cosmos, definitely implies the existence of an ethereal space that causes inertia, gravity, invariant c , the shortening of moving rods, and the slowing of moving atomic clocks. QM, however, denies the existence of any ethereal space and of electromagnetic (EM) waves in space and merely describes the observer's counts of quantized (particulate) phenomena using wave-based statistical methods. These are incompatible models. We cannot model ether effects in the macrocosm and deny the ether's role in the microcosm. The division of the Cosmos into macrocosm and microcosm is itself, after all, anthropocentric and thus artificial. If there is an ether, it surely has a causative role in all phenomena in the

microcosm as well as in the macrocosm. This is not a scientific or mathematical problem and so cannot be resolved within these specialties. It is a philosophical problem and must be analyzed and resolved at the philosophical level of cognition. Let us make the attempt.

5.1. Ether Waves vs. Flying Photons

The two preceding sections dealt with motion in the macrocosm. In the microcosm, we encounter the concepts and equations of Quantum Theory. It is a mathematical treatment of observed events without any reference to or any attempt to explain the physical reality or causes.⁽¹⁵⁾ It is incorrigibly subjectivistic. But few humans are or can be consistent subjectivists. So they have reified their calculational tool—the photon, and populated the void with photons and as many other types of particles as needed to mathematically model for their measurements.

Many of their “real” and “virtual” particles, like the photon itself, have never been observed and do not make any physical sense. How can an “exchange” of particles produce both EM attraction and repulsion? How can particles-in-a-void explain inertia? How can an exchange of flying gravitons produce gravitational attraction, gravitational acceleration and gravitational clock slowing? Why the speed-of-light limitation for particles—relative to what? Why can't all their particles move through the void with infinite velocity?

Atomism simply doesn't work as a theory of physical reality. QM is inconsistent with Newtonian Mechanics and GR since both require an ethereal, physical space. In their attempts to eliminate the schism, Quantum theorists have been forced to create ether-surrogates like “foamy” space-time, space-time loops, strings, baby universes, parallel universes, etc. These mathematical notions, subjectivistic in origins, have not, and cannot form the foundation of a coherent theory of physical phenomena.

Let us examine the source of QM and its paradoxes: Einstein's interpretation of the photoelectric effect. In 1905, nearly everyone believed that light was composed of waves. The wave theory was necessary to explain interference, diffraction, and refraction. At this point in his life, we know that Einstein was wanted to model observations, not create physical theories. He noted that there were two experimental phenomena that were difficult to model using the old, classical wave-theory of light and the old particle-theory of matter: blackbody radiation and the photoelectric effect. In his analysis of the photoelectric effect, he asserted, “the theory of light that operates with continuous spatial functions may lead to contradictions with observations if we apply it to the phenomena of the generation and transformation of light”. He proposed that “the energy from a beam of light is not distributed continuously over larger and larger volumes of space but consists of a finite number of energy quanta, localized at points of space, which move without subdividing and which are absorbed and emitted only as units”.⁽¹⁶⁾

It is quite true that the experimentalist cannot “see” light waves but can only record photomultiplier counts. It is true that the photon has proven to be a useful instrumental concept—it certainly works for the purpose of calculation—but it stood and still stands in the way of a comprehensive theory of the physical Cosmos. That a concept is useful for calculations doesn't mean that it actually exists. The caloric-fluid models of heat and entropy were and still are quite useful. It's also quite useful to treat sound as composed of flying “phonons” for the purpose of describing acoustic-crystalline interactions. We know, however, that the “phonon” is a product of the crystal's structure, of the way the crystal absorbs and emits sound waves. There is nothing “phononic” about freely propagating sound waves.

As a physical hypothesis the flying photon is a non-starter. No matter how useful it is for certain mathematical calculations and predictions, its physical existence is contradicted by the

preponderance of the evidence. If light were composed of particles flying through a void, then it would not always move at c regardless of the motion of its source. Photons flying through a void should be able to move at any velocity whatsoever and their velocity should be relative to their source's velocity. If light were particles, then two photons could not exist in the same place at the same time. They would either stick together or collide and rebound. What can minute light particles possibly have to do with radio waves that are hundreds of meters long? Double slit experiments amply demonstrate the inadequacy of the photonic theory, yet are perfectly consistent with wave theory. Lastly, it is impossible for particles to interact in such a way as to create *any* of the wave phenomena that we observe everyday (interference, diffraction, polarization, etc.) Is it mere coincidence that we must use wave equations to describe the actions of these light "particles"? Only waves can spread, pass through slits and interfere—particles cannot. We routinely filter light to sub-photonic energies—can this be possible if light is composed of particles?

The common response to all these objections to the photonic theory is the notion of *wave-particle duality*. It is held that light has characteristics of both a particle and a continuous spreading wave. However, both hypotheses cannot be true. We may find it convenient to treat light as waves or photons in different circumstances, but that does not mean that it can actually be both a wave and a particle. Either light is a particle flying through a void, or it is a wave in an ethereal medium. These are mutually exclusive hypotheses. They cannot both be true. In fact, there are abundant data that support and indeed require the wave theory of light, and *no data that contradict it*. On the contrary, *there are abundant data that contradict the particle theory of light*.

I will show that in order to create a unified theory of electromagnetism and all physical reality, in order to eliminate the schism between our theories of the macrocosm and microcosm, we must assume that light and electrons are actual, physical waves in an EM space. I will demonstrate that the photoelectric effect, the Compton effect, and other phenomena that are believed to contradict the wave theory of light are easily explicable using wave theory, and in fact are modeled by Quantum Electrodynamics (QED) using wave concepts and mathematics. (See below.) I will argue that the usefulness of the photon is limited to calculations involving light-electron interactions. Because Einstein initially presumed that light itself was quantized, we have since overlooked the possibility that *it is the electron wave structure itself that is quantized* and can absorb or emit light-waves only in certain quantities. Let us now reexamine, in the light of what we know today, the experimental phenomena that originally convinced physicists to accept the photon.

5.1.1. Electrons

Think about the electron. What is it? Is it a particle that absorbs and emits light particles? Is it a little smooth solid sphere? How big is it? Through the years, increasingly sensitive experiments have given us smaller and smaller electrons. In 1990, the radius of the electron was measured at less than 10^{-18} cm. But such a measurement obviously ignores the electron's extended EM field—and isn't it this field that defines what an electron actually is? An electron bound to an isolated hydrogen atom has been detected, by its scattering of light, at a distance of several centimeters.⁽¹⁷⁾ We also know that electrons do not act like little spheres but like extended EM wave-forms. They interfere with themselves and with other electrons in narrow slit interference experiments. (I use the term "electron" to designate the basic charge-creating standing wave structure—whether existing alone (electron and positron), in other types of

particles, or in relationship to nuclei in an atom.) Carver Meade states that electrons are stretched out to over a meter in linear accelerators.

What is an electron made of? We know that under proper circumstances, light can create electrons, and electrons can be annihilated and produce light. Is it not reasonable to conclude that an electron is just light that has curled up into some sort of stable structure in space? This conjecture is supported by the facts that electrons do not participate in the weak or strong forces and the mutual annihilation of positrons and electrons produces only EM radiation. It seems that the EM waves in an electron are uniquely arranged so that the “negative” electric fields are all directed outward from the center, producing the negative charge while the “positive” electric fields are oriented internally. Thus the electron has a charge on the outside and a charge in the inside.¹⁸ The free electron is thus not a point particle at all but a wave-structure that is as large as its sphere of EM influence in space. EM “attraction” and “repulsion” may be explained as motions induced in overlapping standing wave-fields by the interference of their respective directional stresses in space. Constructive interference of their waves (e.g. a positron and an electron) causes attraction, destructive interference (e.g. two electrons) causes repulsion. The presence of spin and electromagnetic moment in electrons indicates that the EM wave-energy propagates around an axis; that there is an axial symmetry. As wave-structures, we would expect electrons to be able to absorb and emit EM waves, and we would expect that the amplitude and length of the light waves absorbed or emitted would be determined by the electron’s own wave structure. (See below.) Notice that, unlike any imaginable particle, a free electron cannot remain at rest in space but propagates through space with a velocity that is proportional to its wave frequency. When it absorbs waves, its frequency and therefore its velocity and momentum are increased. To slow down, it must emit waves, thereby decreasing its number of waves thus its frequency (bremsstrahlung radiation). Free (unbound) electrons in metals can absorb waves and acquire enough momentum to escape the metal’s surface.

The association of hadrons and electrons to form atoms creates a hierarchically new level of complexity involving new principles. It appears that the electronic wave structure somehow expands to surround the nucleus; creating a new composite entity that is stable. The electron’s waves take on new configurations that we call orbital shells, as portrayed by Schrödinger. The more waves an electron has, the larger the shell we would expect it to create around the nucleus. The absorption and emission of integral numbers of waves changes the shell’s size and shape—just as we would be expected of the electron were itself composed of light waves. A nucleus-bound electron can also absorb enough waves and to expand and escape the attraction of its nucleus.

5.1.2. Atomic Clocks

Once we admit the existence of an EM space and of electrons as persistent EM wave structures in that space, then we can create a plausible physical explanation of the slowing of atomic clocks. (Other timekeeping devices, e.g. pendulum and spring-driven clocks, have different mechanisms and behave differently in gravity and in uniform translational motion). If space is physical, then we must assume that it is the velocity of atomic clocks relative to space (RTS) that causes them to slow. The electrons of the clocks, the electrons whose frequencies determine the time-keeping, are themselves bound to nuclei. Because they are bound to the nuclei, they do not “gain” waves (increase in frequency) like free electrons do when forced into higher velocity RTS. Neither do nuclear-bound electrons emit waves when decelerated as free electrons do. Bound electrons, being composed of circulating or oscillating EM waves, are physically analogous to the “bouncing light clock” found in introductions to Relativity. When a bound electron is forced

into motion RTS, its waves must propagate through the greater spatial distance described by the Pythagorean theorem, causing a 2^o Doppler red shift of their frequency⁽¹⁹⁾ and of the waves they absorb and emit. Atomic clocks actually measure the “space wind” to which they are subjected—they are *space speedometers*. In experiments, we find that the clock that moves at a higher velocity in the Earth-entrained space shows a lesser elapsed time than the clock moved at a lower velocity in that space. Interestingly, we can explain the gravitational slowing of atomic clocks by this same velocity-related mechanism—but that will be the subject of another paper.

5.1.3. Electronic Wave-Quanta

Since we have so much evidence that both light and electrons are composed of EM waves, what of the experiments that are purported to “prove” that light consists of particles? Textbooks usually cite three phenomena that support the photonic theory of light: blackbody radiation, the photoelectric effect, and the Compton effect. We shall review each in order to demonstrate they do not require the photonic hypothesis.

5.1.3.1. Blackbody Radiation

The old, or classical theory of the interaction of light and matter was that light waves caused electrons to oscillate, and that their oscillation produced more light waves. We now know that this is the nature of their interaction only at long wavelengths. At low wavelengths, light is actually absorbed and then emitted by electrons. In the case of radiation within a blackbody, the classical theory predicted an “ultraviolet catastrophe” at high frequencies and did not fit the data. Max Planck realized that he could eliminate this discrepancy by assuming that the average total energy in a given frequency approached zero as the frequency approaches infinity. He found that he could obtain this result by treating the energy as if it were a *discrete variable* instead of a *continuous variable*. As the simplest possible fit for the data, he obtained $\Delta E = h\nu$, where h was a proportionality constant. He obtained a value for h close to the currently accepted value of 6.63×10^{-34} joule-sec.

Planck originally believed that this quantization of energies of higher frequencies was a function of the electron, and not of light itself. Only later did he accept the idea that the light itself was quantized. We need only note that his original hypothesis was perfectly consistent with the facts. If indeed the electron is itself an extended EM wave-structure, then it’s reasonable to assume that it would absorb and emit light waves only in discrete *wave-quanta* determined by the electronic structure.

5.1.3.2. The Photoelectric Effect

It was the photoelectric effect that stimulated Einstein to model light as flying photons. Indeed, the photonic model fits some aspects of this effect. However, the phononic model of sound fits some aspects of the sound-crystal interactions also. I will argue that the photonic and phononic models are highly analogous; in both cases, it is the absorbing/emitting structure that is quantized, not the freely propagating waves. The fact that the phonon and photon are useful for certain calculations does not imply that either light or sound is composed of flying particles.

There are three features of the photoelectric effect that are considered inconsistent with the wave theory of light:⁽²⁰⁾

- 1) The kinetic energy of the ejected electrons depends only on the light frequency, not on the intensity.
- 2) No electrons are ejected when the frequency is below the cut-off frequency, no matter how intense the radiation.

- 3) No time lag is observed as would be expected according to classical wave theory. Energy should be uniformly distributed over the wave front, so it should take a longer time for an electron the size of an atom to absorb energy from the wave front and be ejected.

These objections can be answered by the following wave-based theory of light and electrons:

- 1) An electron, bound or free, is composed of circulating EM waves. An electron is not a particle associated with a field; it is an extended EM wave-structure. It is as large as its EM field.
- 2) The amplitude and spatial extension of the electron's waves are fixed by its wave-structure. Its momentum is determined only by the frequency of its waves (de Broglie relation: $p = h / \lambda$).
- 3) An electron can absorb or emit EM waves only in discrete packets or quanta whose physical parameters, length, width (extension), and amplitude, are fixed by the electron's structure. Only the frequency varies and determines the energy of the quantum. *Planck's constant is the electron-structure constant*; it relates the change in an electron's momentum to the wavelength of the EM quantum absorbed or emitted.
- 4) When an electron emits a quantum, it ceases to exist qua quantum. Its EM waves spread spherically from their origin and diminish in amplitude (inverse square law) like all free EM radiation.
- 5) In any space, there is significant EM radiation of all frequencies (man-made, thermal, radioactive, solar, Cosmic, etc.) that, though undetected, creates an energetic EM background.
- 6) An absorbed quantum is almost always the product of the interference of source and background waves. Thus the prediction of quantum absorptions requires a probabilistic calculus.
- 7) The emission of a quantum is not random but is induced by the interaction of the electron with its environment, including the chaotic background radiation.

Thus are the objections to wave theory answered:

- 1) The momentum of the ejected electrons depends only on the light frequency of the absorbed wave or waves because the other physical parameters—length, width, amplitude—of the absorbed wave-quanta are fixed and therefore limited by the structure of the receiving electron.
- 2) Increasing the intensity of the radiation increases the amplitude only. This cannot increase the energy of absorbed quanta whose amplitude is limited/fixed by the electron's structure.
- 3) The wave-energy the electron absorbs does not come from the source wave front only. The source waves interfere with abundant ambient wave-energy to induce a quantum absorption. In addition, the fact that the electron is its entire EM field implies that electrons are larger than generally assumed. Their boundary is the point at which their EM influence—their wave motion—is zero. In sum, there is much more wave energy present than the source alone produces, and the electron is much larger than current models suggest. Therefore little time lag occurs.

These principles were illustrated in an article describing a low-light experimental setup.⁽²¹⁾ The photoelectric detectors registered “dark” counts even when the source was not operating. (This attests to the prominence of the background EM radiation.) The “photons” from the source were then filtered to the intensity of one-tenth “photon”. (The photon is not an indivisible particle but is just a quantity of wave-energy). This filtered, subphotonic EM energy was sufficient, even after spreading over a distance of one meter, to produce the additional photomultiplier counts needed for the experiment. (The sub-quantum EM wave-energy from the source interfered with the background EM to produce more quantum absorptions.)

Quantum theorists also argue that light must be a particle because a source can produce an event at great distance, where spreading light waves would have very little amplitude. We have here a situation where an emission is known to take place in one locality, and an absorption is then observed in a distant locality. Since the energy of the quanta absorbed and emitted are identical, it is argued that an indivisible quantum must have traveled across the given distance and been absorbed by the receiver. W. H. Bragg used this argument for the flying photon, saying that “it was as if a plank dropped from a height of 100 meters into the sea sent out a circular impulse that, after spreading over thousands of kilometers, concentrated its effect on another plank, giving it sufficient energy to impel it 100 meters into the air!”⁽²²⁾ What Bragg and others ignored, however, is that the sea is always stormy! The sea is throwing planks 100 meters into the air at different locations all the time! These are the “dark counts” caused by background radiation. Of course, if one adds additional wave-generating motion to this sea, one will produce additional “Plank events”. Similarly today, physicists argue that a gamma photon detected in a photomultiplier aimed at an astronomical gamma ray source must be caused by a little particle that traversed thousands or millions of light years without striking any particle and actually struck the detector. This is nonsense. They are simply ignoring the possibility that the gamma waves from the astronomical source, diminished though they are by their long journey, are interfering in the detector with gamma waves from all other sources and thus producing the additional counts attributed to the source. Consider how it is that we decide that a given source had a role in a given detection event. We apply two tests: Is our detector aimed at the source, increasing the likelihood that at least some of the wave energy came from that source; and is the travel time consistent with a velocity of c ? If both of these criteria are fulfilled, we may only say, and only with some probability, that the light emitted from the source was *a contributor* to the light absorbed by the receiver. If the absorption at the receiver occurs sooner than the light could have traveled from the source, we needn’t assume that there is a superluminal effect, we should attribute the absorption to background EM.

5.1.3.3. The Compton Effect

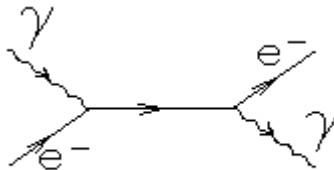
The classical or wave theory of scattering of light by electrons is called Thomson scattering. In it, electrons oscillated with the frequency of the incident EM waves and re-radiated waves of the same frequency. This type of scattering does indeed dominate the scattering of low-frequency EM waves by electrons. What happens when the light’s frequency is high enough that it is near the electron’s own internal wave-frequency? We find that the waves are actually absorbed and then re-emitted by the electrons. This phenomenon is known as the Compton effect. Historically, it was this effect that convinced physicists that Einstein was right—that light really was composed of flying particles. It was argued then that this effect could not possibly be explained by wave theory. This conclusion was a *non-sequitor*. The fact that the Compton effect, like the photoelectric effect, can be treated as an interaction of two particles does not mean that it is such. I will argue that it is not only possible to explain the Compton effect as in

interaction of EM waves with the electronic EM wave-structure, but that this is the *best* interpretation.

In his experiments, Compton allowed x-radiation of sharply a defined wavelength, λ , to strike a graphite target. He found that the scattered x-radiation at any given angle had intensity peaks at two wavelengths; one of them identical to the incident wavelength, the other, λ' , being larger by an amount called the *Compton shift* that varied with the angle at which the scattered x-rays were observed, $\Delta\lambda = \lambda' - \lambda = \lambda_c(1 - \cos\theta)$. The unmodified x-rays were thought to be scattered by electrons that remained bound to their nucleus, while the modified x-rays were scattered by electrons that were freed. Subsequent experiments confirmed that the direction and momentum of the freed or recoil electrons were consistent with the direction and wavelength of the scattered x-rays. Momentum was conserved. Compton and others interpreted this interaction as identical to a billiard-ball type collision between two particles—a photon and an electron.

Since x-ray scattering did not follow the rules of Thomson scattering, the conclusion drawn was that the incident x-radiation could not be a classical EM wave but had to be a particle. This was not a valid conclusion but an argument from ignorance. The fact that they could not explain this effect using their old, inadequate theories of light waves and electron particles did not prove that light consisted of flying particles. Given the overwhelming evidence for the wave nature of light, they should have instead created a better theory of nature of electrons and their interaction with light, as I have attempted to do above. In the Compton effect, consider that:

- 1) We are dealing here with altered wavelengths in the detected light. Wavelengths are a feature of waves, not of particles.
- 2) We now know that this is no “collision between billiard balls”. Our best model of this interaction, QED, implies instead that both the bound and the free electrons *absorb* a quantum of radiation *and then re-emit it*. This is illustrated by the Feynman diagram for Compton scattering:



- 3) The scattered x-rays are detected by a photoelectronic detector, and we have shown that this does not require the photon hypothesis.
- 4) Any physical model, whether wave absorption or particle collision, will yield the same calculated results at various angles as directional energy or motion must be preserved in *any* physical system. Whether light bounces off of an electron or is absorbed and then emitted, whether the Compton effect wavelength is due to a Doppler shift in the light emitted by the moving electron or due to something else, the *total energy and momentum must be conserved*.

In sum, we *now*, nearly 100 years later, that Compton scattering involves the electronic absorption and emission of light. Just as we can now explain our photoelectronic detection process with wave theory, we can also explain the Compton effect as an interaction of light waves with electronic wave-structures.

5.1.3.4. Quantum Electrodynamics

There is another argument for the wave-nature of light. Quantum Electrodynamics (QED), as presented by Richard Feynman,⁽²³⁾ is an application of wave theory. It makes use of Huygens's theory that light spreads by spherical wavelets from every portion of the wave front.⁽²⁴⁾ By adding probabilities for all possible photonic paths, QED is simply accounting for the spherical spreading and interference of EM wave energy from a source. As the light propagates, its amplitude shrinks according to the inverse square law and turns according to its frequency. Interference of these amplitudes determines the wave-energy at any given point in space, and therefore the probability of a quantum being absorbed there. QED uses Schrödinger's wave functions and wave equations *as if* light actually were a spreading wave in a medium!

However, unlike wave theory, QED is subjectivistic—it accounts only for what is instrumentally observed by us humans and ignores what is not observed. For QED, free EM radiation and background radiation are not observed and therefore do not exist; radiation sources therefore don't produce real waves, or even real “photons”, but only wave-like probabilities of observable electronic absorptions and emissions. QED is the mathematical description and prediction of observable photonic “events”—quantized, photomultiplied interactions of light and electrons.⁽²⁵⁾ In QED, light wave amplitudes are transformed into probability amplitudes. Physical light waves are converted into probability waves.⁽²⁶⁾ Probability amplitudes are added then squared to give the probability of an event, reflecting the fact that the physical amplitude of a wave squared yields the wave energy at that point. As explained above, this method is the product of the ideology of subjectivism, and the use of probabilities is necessitated by the unknown EM background radiation and unknown variations in the states of the emitting and receiving electrons. The location with the highest probability for a quantum absorption is where the interference of source radiation produces the highest amplitude or wave-energy.

Thus we see that QED is just a positivistic, instrumental application of wave theory. Indeed, QED illuminates wave phenomena. It helps us to understand why light appears to travel in straight lines even though it is a spherically spreading wave.⁽²⁷⁾ QED accurately describe all aspects of light-electron interactions. *Inasmuch as QED is successful, the wave theory of light is supported.*

The assumption that all EM radiation, microcosmic and macrocosmic, is composed of waves eliminates all the paradoxes of quantum theory and eliminates the current schism between classical and quantum electromagnetics. The distinction between classical and quantum electromagnetics is not the size of Planck's electronic structure constant per se, but the fact that Quantum electrodynamics deals with the physical effects of the electron's internal structure where as classical electrodynamics does not. Classical electrodynamics deals with macroscopic EM fields and waves in space produced by the translational motion of charged particles. Quantum electrodynamics deals specifically with the electronic/positronic absorption and emission of light and with other microscopic physical phenomena involving the electronic/positronic structure.

Explains or can accommodate:	Wave	Photon
Wavelength and frequency	Yes	No
Invariant velocity (grav. field frame)	Yes	No
Interference, diffraction	Yes	No
Reflection	Yes	Yes*
Long wavelengths-radio	Yes	No
Blackbody spectrum	Yes	Yes*
Photoelectric effect	Yes	Yes*
Compton effect	Yes	Yes*

***must use wave model to predict photonic events**

Table 3

6. ETHERISM OVER ATOMISM

Looking back, we can say that the problem with “classical” physics was not its objectivism or its goal of explaining the reality underlying the appearances. Its problem was ignorance. Newton simply did not know that light’s velocity in space was independent of its source’s velocity. He did not know that atoms moving in space or stationary in a gravitational field suffered a red shift of their electronic frequencies. Likewise, early Quantum Theorists did not know that electrons were themselves extended electromagnetic waveforms. They thought in terms of light “particles” interacting with electron “particles” like a couple of billiard balls. Only later did they discover that electrons’ momentum and energy were intimately related to their frequencies.

To resolve the schism in physics and create a working physical theory of Cosmic space and matter we must reject the metaphysics, epistemology, and “physical” concepts of Relativistic and Quantum physics. We must start from scratch and create a consistently objective model of physical reality as it exists and evolves independent of any human observer or arbitrary frame and we must theorize about that exists and how it causes the phenomena that we experience and measure. As philosophers, we will not accept contradictions or paradoxes but will eliminate them by creating a better theory. We will violate Newton’s and Einstein’s prohibitions and theorize about the nature of space. We will make hypotheses. We will give space both parts and motion if the evidence so demands.

Some might respond, “So what if space is a physical substance? No ether theory has ever been proved correct so far, so why not just go on using subjectivistic Relativity Quantum Theory to describe reality?” This is indeed what has been done, but there are weighty arguments against this practice. Firstly, it assumes that theories of the ether can be proved; they cannot. We can only create the best theory possible and then try to disprove it. Secondly, it’s an evasion. If one accepts the reality of a physical Cosmos and the physicality of space, then one ought to attempt to describe it and explain it, not perpetuate the anthropocentric technique of describing the observer’s conscious experiences and relating all phenomena to the observer. Thirdly, Relativity and Quantum Theory don’t fill our innate need to understand the physical nature and mechanisms of the Cosmos or to create new technologies based on this understanding. Fourthly, it doesn’t work—subjectivism and space-as-void produce paradoxes and have led to the current schism in physics. Fifthly, the acceptance of paradoxes (contradictions) in our most fundamental Cosmic models and theories effectively destroys all philosophical cognition—thereby disabling the most powerful faculty of the human intellect in all realms of knowledge. We must reassert the first rule of philosophical cognition—non-contradiction. We must recognize that

contradictions reveal the inadequacy of our models and theories and we must seek to create theories that produce no contradictions—no ineradicable paradoxes.

We must base our new physics on Newton and Einstein’s discovery that space is physical—a substance. Atomism simply doesn’t work. Just consider what that Cosmos would be like if space were a void. A void is nothing; it has no physical qualities. In a void, every place and every movement is physically indistinguishable and equally devoid of any physical effects. A void cannot have “curvature”. A void cannot resist or affect any motion of anything—neither the acceleration nor the velocity of any matter, light, or “energy”. Since the void offers no resistance at all, the slightest push on any object could instantly accelerate it to infinite velocity. In a void, there could be no proportionality between applied force and motion as there is nothing to interact with the pushed object and so determine its acceleration and resultant velocity. In a void, matter could not be limited to moving at c but could move at infinite velocity in any frame. In a void there would be no centrifugal effects with rotation. In a void, the rate of atomic clocks could not be affected by motion. A void could not sustain any waves, either electromagnetic or gravitational. If light were to consist of particles moving in a void, then these particles should move at any velocity from zero to infinity, depending on their source’s velocity. In short, *if space were a void, nothing could be the way that it is*. There would be Chaos instead of Cosmos.

Even if we reject orthodox atomism and instead populate the void with a new kind of a new kind of fundamental particle, we still face the problem of the void. Many “ether theorists” do in fact fill the void with a gas of “ether particles” with names like “aethrons” and “gyrons”. This gas is supposed to resist the acceleration of matter, transmit light at c , etc. However, since these “ether” particles move in a void, the same objections apply. How can this gas resist acceleration when the particle can’t have any inertia themselves since they move in a void? How can a gas support transverse light waves? How can this gas always transmit light at c if the velocity of the “ether particles” in a void can be infinite? In a void, any impetus could accelerate any ether particle to infinite velocity. Atomistic pushing or shielding theories of gravity can never explain gravity’s essential nature—it consists of the acceleration of the local inertial frame itself towards the gravitator. The way out of all these difficulties is to admit that space itself is a substance. Space is the inertial frame. Space is ether. Ether is space. Space without ether is an imaginary geometrical construct like the point or the line, it has no physical referent in this Cosmos.

Think of it this way. Regarding space we are in the same position as the ancient Greeks were regarding air. They could not see air, but they had every reason to believe it was some sort of substance because they could see and feel the effects of its motion and the resistance it posed to the motion of objects. They witnessed how vibrations produced sounds that traveled through the air as through water and other materials. Empedocles (c. 450 B.C.) produced a convincing demonstration of air’s substantiality by means of an experiment with a water-clock. He showed that air could keep water out of a vessel, and that the water could only enter as the air escaped. Likewise we now have every reason to believe that space is a substance even though it is not the same kind of matter with which we are acquainted. We know that *something* resists the acceleration of and near-luminal velocity of matter and that *something* transmits transverse light waves like an elastic solid. Gravity itself appears to be a kind of spatial wind—the acceleration of inertial space itself towards all matter. Let us now address in detail several of the key issues surrounding modern physics and the question of space.

Explains or can accommodate:	Ether theory	Atomistic theory
Inertia and rotation	Yes	No
Invariant light speed	Yes	No
Limiting velocity for matter	Yes	No
Gravity	Yes	No
Transverse wave nature of light	Yes	No
Secondary redshift	Yes	No
Primary redshift	Yes	No
Twin paradox	Yes	No

In thinking about the ether that is space, we must avoid giving it the characteristics of the ponderable materials with which we are familiar. The ether cannot itself have mass, inertia, electrical charge, etc. It is the seat, the cause of these phenomena. As Einstein put it, "The ether of the general theory of relativity is a medium which is itself devoid of all mechanical and kinematical qualities, but helps determine mechanical (and electromagnetic) events."⁽²⁸⁾

What can we say about the substance that transmits EM waves? It is reasonable to presume it has some sort of fine particulate structure, perhaps it is composed of volume-creating "cells" on the scale of the Planck length (10^{-33} cm). Perhaps EM motions involve a distortion or rotation of the ether cells that is transmitted from cell-to-cell at c . Electromagnetism is thus one kind of activity of the ether cells. It is not an irreducible "wave-like energy" in an empty void; it is a wave-like disturbance in the electromagnetic ether. The permittivity and permeability of "free space" are fundamental characteristics of the ether. Light moves at c among the masses in this Cosmos because it is a wave in a mass-influenced medium, not because it is mysteriously linked to each and every observer.

It has been argued that the ether should have an extreme mechanical rigidity in order to transmit light at c , and that this is incompatible with the passage of mass through ether without resistance. This argument wrongly assumes that the ether must have properties identical to those of the ponderable materials of our experience. The ether is a unique substance and the substrate of all known phenomena; we must give it whatever qualities are demanded by the evidence. Our only constraint is that we must avoid contradictions. For instance, we can simply hypothesize that the same ether cells that transmit EM motions with such great rigidity can, at the same time, flow without friction (hydrodynamically) into and/or around mass, permitting matter to move through it at high velocities without resistance. The facts force us to ascribe to the ether a bipartite character—it can flow into and around nuclear matter like a massless, frictionless liquid and can at the same time conducting EM motions like an elastic solid.

7. CONCLUSION

Like the theory of evolution by natural selection, a working theory of ethereal space would increase our understanding of the Cosmos as a natural, self-contained, self-organizing physical system and would reduce the need for the hypothesis of an extra-Cosmic creator-God. Ether theory thus follows Copernicus' and Darwin's theories as yet another challenge to traditional theism. Like the Copernican and Darwinian theories, ether theory also removes man the observer and his "spirit" from the center of the Cosmos and from theoretical physics. Indeed, it takes Darwin's idea of the natural evolution of the species one step farther—to the natural evolution of the entire physical Cosmos and all its phenomena including man and his experiences. Darwin understood too well the destructive potential of his own limited theory of

the evolution of the species including man. He became ill as he was torn for years between his desire to publish his theory and his wish to avoid offending Victorian society and possibly destroying its very foundations. Imagine the impact of a theory that describes the evolution of all physical phenomena from a single Cosmic substance! It is the ultimate anti-anthropocentric revolution! We are not the product of a Mind-God but of the natural evolution of Cosmic space itself! We thus can understand why Newton equated God with space, and why both Newton and Einstein, theists, decided to suppress and evade any further discussion of ethereal space. A working ethereal theory of the Cosmos will discard theistic and Relativistic mysticism and produce a revolution in our understanding of the Cosmos and ourselves.

As astrophysics could not advance until Copernican heliocentrism replaced the observer's geocentrism; as biology could not advance until Darwinian evolution replaced observer-projected creationism; so physics cannot advance until etherism replaces observer-based atomism. Mankind must give up yet one more religious fantasy. We must continue down the path of understanding. Of course, as in the Copernican and Darwinian revolutions, embracing etherism brings with it great uncertainty and unease, for mankind has admit his ignorance of natural phenomena and face a whole host of new questions that he is currently ill-equipped to answer.

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