

Beyond Relativity: Ethereal Space

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Abstract

Just as the Copernican Revolution replaced the anthropocentric Ptolemaic Cosmology with an objective and much simpler model of motion in this Cosmos, so we can replace observer-based Relativity with an objective and simpler theory of what exists and what causes the motions and events and we observe. We must start by asking questions that have been long been suppressed: Relative to what in this Cosmos does light really move at velocity c ? Relative to what in this Cosmos does matter have inertia? Does “empty” space itself have physical qualities or not? The author discusses these questions and presents an objective model of space and motion that explains the facts with greater simplicity than Relativity.

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

1. REVOLUTION

My first paper⁽¹⁾ exposed 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, as if there were no material Cosmos to describe or explain. Through Hume, Kant, and Ernst Mach, Albert Einstein inherited Berkeley's metaphysics and epistemology and imposed them 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. A philosophical revolution in physics is long overdue. In order to understand the nature of the paradigm change that is needed, let us look back at the last great revolution in physics.

Like Einsteinian physics, the Aristotelian/Ptolemaic model of the Cosmos was naively based upon the observer's description of his sensations and measurements. Like Relativity, the Ptolemaic Cosmology was not an objective theory of what was *really* moving relative to what in the Cosmos. Since the Earth-surface observer felt no movement as he observed and measured the movements of the stars and planets, he simply modeled their motion in his frame—the spherical Earth on which he stood. The model was perfectly good science—it “worked” to account for the motions of the heavenly bodies and to predict future positions. It was refined to great accuracy over the centuries. However, there were 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, and epicycles) resulting in excessive 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. 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 orthodox interpretation). 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, quite correctly, 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 unavoidable error that was not corrected until Kepler, with access to more accurate data, discovered that the orbits were actually elliptical. (Notice that a new theory, even if essentially correct, can still be “worse” in some ways until it is refined.)

The Copernican Revolution demonstrated that the difference between a subjectivistic, observer-based system of description and an objective model of Cosmic space and motion is anything but trivial. Even though the Ptolemaic Cosmology “worked” to describe human experience, 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 just a scientific revolution. It was not merely another more accurate tweaking to fit the facts of observation; it wasn't even more accurate! It was an epistemological revolution—a different *choice* of the frame to be used for the description of motion—objectivistic over subjectivistic modeling; Cosmocentrism over anthropocentrism. It was a demonstration of mankind's ability to use our theory-creating ability in order to reach beyond the evidence of our senses and instruments to create a theory of what *actually existed* and *caused* our experiences and measurements. It was a philosophical revolution.

Relativity was a regression to the anthropocentric epistemology of the Ptolemaic Cosmology—Einstein admitted as much.⁽²⁾ Think about it. Wouldn't *any* objective Cosmology relate the motion of light to some aspect of the Cosmos—like its large masses (galaxies, stars, and planets)—and *not to any and every* human observer or arbitrarily chosen frame? Wouldn't *any* objective Cosmology try to explain why light could *appear* to move at c as measured by every human observer, though it *actually* did not? General Relativity (GR) did not solve this problem. I demonstrated previously that GR remained a subjectivistic/anthropocentric model even as it included the effect of mass on the observer's space-time measurements. In GR light still travels at c relative to every observer—it does not travel at c in any objective Cosmic space. GR's space-time 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. Einstein understood that the space-time interval itself had no physical correlate or meaning.⁽³⁾ GR is merely a description of gravity's effects on the observer's measured intervals; it is a descriptive model, *not* a theory of gravity. Quantum Theory, based upon Einstein's photonic accounting system, likewise merely models the observer's experiences of the interactions of light and matter; it is not a theory of the physical reality that causes these experiences. It neither posits any underlying objective reality nor attempts to model that reality. The observer “creates” the “reality” by his act of observing—just as Bishop Berkeley asserted.

Ironically, today's physicists do not grasp the complete incompatibility of idealism/subjectivism and Cosmism. They are objectivists using subjectivistic tools. They do not recognize the true nature and limitations of their own models. They mistakenly use their subjectivistic measurement concepts (flying photon, no-ether, invariant c , mass-energy, space-time) as hypotheses in their theories about the nature and causes of Cosmic phenomena! It doesn't work. Like the Ptolemaic Cosmology, their models make 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, third frames, strings, dark matter, dark energy, etc.). They thus continually generate schisms, paradoxes, and confusion.

We need another Copernican Revolution in physics. We need to abandon anthropocentric physics; we must remove the observer and his consciousness from the center of physics and begin to think clearly about what is really moving relative to what *in the Cosmos*. We need an objective theory of space and motion in this Cosmos. How can we start all over? Where do we begin?

2. THE QUESTION OF SPACE

When you attempt to accelerate a mass that lies on a frictionless surface, what pushes back at you? Nothing? What is it that resists this change in the mass's velocity? Why? When you try change the axis of a spinning mass, what causes the resistance you feel and the force that pushes the mass perpendicular to the direction you are tilting it? Nothing? Why does a pendulum continue to swing in the same direction relative to the Sun and stars even as the Earth rotates under it? What creates this local-Cosmic "absolute" frame for rotation? Does it make any sense at all to claim that one can choose *any* arbitrary frame to account for these phenomena? Isn't it obvious that we cannot produce gravity by a mere choice of frame, as Einstein attempted to assert? Let's abandon the fruitless "absolute" vs. "relative" controversy. Let's talk instead about the local and Cosmic frames that appear to determine what's happening? We know that it is matter that produces gravity and we know that the local inertial frame is the product of the distribution of the near and distant celestial bodies. Let us also relate the motion of light to the nearby and distant celestial bodies. Let us assume that it is matter that affects light's velocity, not the human observer. Let's admit the obvious—that light actually travels at c , and matter cannot travel faster than c in the frame of the local and distant masses that form this Cosmos. Such simple commonsense assumptions repudiate the ideological foundations of Relativity and Quantum Theory.

How does all matter influence all other matter and light through space? Does it accomplish this through a continuous "exchange" of particle in a void or by influencing the qualities of a substantial physical substance we know only as "space"? Is it not possible that in our understanding of space, we are in the same position as the ancient Greeks were with regard to air? They could feel, see, and measure air's effects, but they couldn't see air itself. They had no *direct sensory* evidence of its existence. It was, for them, a theoretical construct. It remained a theoretical construct even after Empedocles (*circa* 450 B.C.) demonstrated that air was a substance by putting a bucket upside down in water and showing that the water did not rush into the bucket as it ought to if there were nothing in it. He showed that air had to be a substance since it could keep water out of the bucket, and that the water could only enter as the air escaped through a hole in the top of the bucket. Even then, mankind did not really know what air "was". In fact, even in the late 19th century, Ernst Mach was still denying that atoms existed!

No, I'm not saying that we must resurrect Newton's single, isotropic, absolute "space". That was an abstract and inadequate theory of space and motion. Given the singular importance of Earth as the frame for all our near-Earth experiments, like the operation of our Global Positioning System (GPS), and of the star-Galaxy frame for rotation, we should rather invoke Mach's hypothesis that the near and distant matter of the Cosmos interact to create everywhere a *unique* local inertial frame—they determine the local qualities of Cosmic space. We can thus incorporate Einstein's insight that space not only affects matter (inertia), but matter also affects its surrounding space (gravity). What *is* space that matter can affect it? How does light move and in what? Is gravity caused by an exchange of particles through a void, or it is an effect of matter on its surrounding inertial space? Rather than positing photons and gravitons, let us try to explain inertia, gravity, and light as alterations in and of space.

My point is that when we attempt to move beyond the mere modeling of the observer's experiences and instead create a physical theory of Cosmic phenomena, we

encounter the question of space. We must choose between two and only two fundamental hypotheses about space: either “empty” space is no-thing or it is something—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 itself has no physical qualities and neither causes nor interacts with any physical 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.

Ethereal models and theories are much more common today than admitted, for whenever one tries to explain physical phenomena by inventing some substance or energy that inhabits all empty space and is not immediately available to our senses or instruments, one is indulging in ether theory. However, because of the ether taboo, theorists talk instead of strings, loops, many universes, negative energy sea, quantum foam, zero-point energy, Higgs fields, dark energy, and the “fabric” of space-time. Because of the taboo, they avoid any hypothesis that has any similarity to the inertial-electromagnetic ether of Newton and Lorentz.

Now if, in order to explain the phenomena, we have to fill space *ad hoc* with unknown and unseen particles and energies, shouldn't we consider that possibility that space itself is a substance? If the evidence indicates that space is substantial, shouldn't theoretical physics turn its attention to identifying and describing this substance? Why is it that the hypothesis has been evaded for centuries? Why the hysterical anti-ether tirades that fill the first chapters of textbooks on Relativity? There we encounter variations on the argument that because the Newton/Lorentz ether theory was proven false, therefore there is no ether! This is an obvious fallacy. Newton and Lorentz's single, static Euclidean space is just one of many possible ether theories. The fact is that since 1905 when Albert Einstein's papers on Special Relativity and the light quantum were falsely interpreted as proving that there was no ether, theoretical physicists simply defaulted to atomism and ignored all the obvious evidence of the physicality of “empty space”. Space-as-ether is absent from today's physics not because the evidence disproves its existence, but because Relativity and Quantum Theory were created to ignore/evade its existence. So when today's physicists try to go beyond subjectivistic modeling and theorize about the nature of Cosmic reality they default to atomism.

When we admit that there is indeed *always* a preferred, physically unique frame that is determined by matter and not by human beings, then we can attempt to model and explain that frame and its physical qualities. Instead of filling the void with ever more types of unseen and *ad hoc* particles and “energies” we can create a new physics based on the simplifying assumption that the “frame” is actually the local physical space, 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 can create a theoretical physics that actually theorizes about the physical Cosmos.

This paper will focus on replacing Relativity with an objective theory of the relationship between space and matter. A second paper will focus on replacing Quantum Theory with an objective wave-based theory of light and its interactions with matter. I hope to demonstrate that by recreating theoretical physics as the *study of space* we can bring about a revolution in our understanding of the Cosmos and of ourselves. If we are fortunate, this revolution may give us abundant clean energy and take us to the stars.

3. PRE-NEWTONIAN CONCEPTS OF SPACE AND MOTION

First, please bear with me while I review mankind's ideas about space through history. This study is crucial for our understanding of why theoretical physics has ignored or suppressed ideas about the physical nature of space for hundreds of years.

The question of space has always been central to mankind's speculations about the Cosmos. 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.⁽⁴⁾ 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 *apeiron*—“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.⁽⁵⁾ 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. In a void, the slightest push on a mass could accelerate it to infinite velocity! Aristotle was mistaken in assuming 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.

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.

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.⁽⁶⁾ 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? If God is everywhere, does he fill all space and mediate all physical phenomena? 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.

In my first paper, I described in great length how and why William of Ockham, Descartes, Locke, and Berkeley, devout Christians all, sought to evade the questions of natural causation and instead reduce all science to the mere description of our sensations and measurements. They wanted science to only describes God’s acts, not discover the natural, God-independent causes of things. They influenced Hume and Kant, and through them, Ernst Mach and Einstein.

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 this singular physical frame “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.⁽⁷⁾ In a time when everyone believed that God was the omnipresent creator and sustainer first principle of all things, Newton carefully chose this abstract name “absolute space” and scrupulously avoided any *public* discussion about the nature of space and its role in gravity and inertia (“*hypotheses non fingo*”). Nonetheless, Bishop Berkeley was not fooled and publicly accused him of atheistic materialism.⁽⁸⁾ Newton responded to this charge by adding a

chapter to his *Principia* in which he asserted that absolute space was the sensorium of God.⁽⁹⁾

Newton's theory of light was atomistic—particles flying through absolute space at varying velocities. Thomas Young, however, demonstrated that light was a wave. Faraday and Maxwell achieved tremendous success 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 *could* 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. Fitzgerald and Lorentz 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, to mankind's great ignorance about the nature of space, light, and gravity, was to impose an entirely different metaphysics and epistemology upon theoretical physics. Following Bishop Berkeley, 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. He *initially* denied that the existence of an EM ether was necessary to produce these quantitative relationships. However, as we shall see, neither Einstein nor his followers would remain *consistent* subjectivists or atomists.

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. He refused to believe in the existence of Newton's absolute space because it was not directly perceived. 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. His theory does indeed appear to be a step in the right direction, but how can it work if space is a void?

1. If space is a void, then all matter must somehow communicate with all other matter instantaneously by some action-at-a-distance—impossible to explain by "particle exchange" through a void.
2. Inertia is not sufficiently explained by gravity, for the gravitational "tug" of all other matter on any mass—by whatever mechanism—only explains a test mass's free fall motion. The resistance to that test mass's forced acceleration requires *another* mechanism that is local and instantaneous.

3. Mach's principle predicts no inertia in the absence of other matter, and therefore there would be increasing inertia as the amount and proximity of matter are increased. On the contrary, inertia appears to be the same near the Earth as it is in deep interplanetary and interstellar space.
4. Mach's principle offers no foundation for the explanation of other phenomena like the fixed velocity of light (relative to the celestial bodies) or the resistance that exists to matter's near-luminal velocity (relative to the celestial bodies).

Perhaps we can start over by creating an explicitly ethereal theory of matter's interaction with space that can incorporate the true aspects of Newton's, Mach's, and Einstein's hypotheses. We know that 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 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.⁽¹⁰⁾ ...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...”⁽¹¹⁾

He admitted that this Cosmic, mass-influenced frame constituted an ether; yet he failed to admit that this obviated his own subjectivistic Principle of Relativity—that asserted that *all motion* could be *equally well-described* in *any* coordinate system whatsoever! 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.”⁽¹²⁾

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 extension—a number of rods counted by the observer.

We arrive here at the fatal inconsistency in Einstein’s physics: by admitting that space had physical qualities, he introduced an objectivistic concept that was incompatible with his subjectivistic epistemology. SR did “work” as a subjectivistic model an 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 thus exists in every location—a frame determined by near and distant matter! GR modeled this ether—but only *indirectly—as it affected* the experiences and measurements of observers in various states of motion in the Cosmos! In the real space of the real Cosmos, we know that motion is uniquely, causally affected by matter and must therefore be related to it and *not* to any arbitrary observer’s frame.

Given the facts, 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 physical causes of gravity and inertia? We find instead that, faced by this conflict between his subjectivistic method and the reality of the ether, Einstein did as Newton had done; he 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.”⁽¹³⁾

In other words, space is a substance but we must never think of it as a substance or theorize about it. Why the prohibition? What is the source of this anti-philosophical, anti-ethereal bias? Why did both Newton and Einstein affirm that space was a substance, and then try to ignore and evade the obvious implications? Shouldn’t scientists and philosophers always follow the evidence wherever it leads and seek the causes of all physical phenomena? The origin of the bias is quite clear—it is traditional theism. 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 thus a competitor to the anthropomorphic or mind-like God-theory. Space is likewise invisible yet exists everywhere. It is the ground of all being and it sustains all phenomena. It could exist even if there were no matter. 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 and away from the God-theory of Judaism, Christianity, and Islam. (See Table 1) It provides the foundation for a working theory of the nature and evolution of the Cosmos.

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

Table 1

Religion is why we have subjectivism and atomism instead of a *theoretical* physics. Religion is why we continue to use models that assert that light moves at c relative to each and every moving human observer when we know that light *really* moves at c among the celestial bodies in this Cosmos. It is because of religion that we have an atomism 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. It is because of religion that we have academics continuing 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 against certain ether theories. It is because of religion that we have this taboo against ether theory inspite of the fact that the two most influential theoretical physicists of all time, Newton and Einstein, were forced, by the facts, to assert that space was a substance! Of course, many if not most believers in Relativity and Quantum Theory are not traditional theists, they simply do not understand the origins and nature of the models they were taught in school.

The question of space has been evaded and suppressed for two millennia in order to protect traditional theism from criticism. This evasion has required the suppression of all natural/scientific theory (philosophy)—the suppression of mankind’s most powerful cognitive tool and the means by which we address all questions of existence, causation and purpose. To replace this merely descriptionistic “Science”, we need only to start using all of our cognitive abilities. We need to become natural philosophers in addition to being scientific specialists. Philosophy (of the natural and scientific kind) identifies essential facts and questions, enumerates the possibilities, and applies evidence, logic, and experiment to determine which theory best fits the facts, explains disparate phenomena, and identifies the cause. Philosophy requires clear concepts and definitions and does not tolerate contradictions (paradoxes) but resolves them by creating a better theory. Philosophy is just theory writ large. Theories determine the direction of experimentation and can be judged according to their explanatory power and their utility.

5. 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 is perfectly consistent with the known electromagnetic evidence. 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 using ether-based reasoning.

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 flatly contradict SR, but instead of abandoning SR, Relativists resort to apologetic arguments. Let us examine the "Twin Paradox" as an example of contradiction and apology in Relativity.

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—the celestial bodies. We calculate the motion of the GPS 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.

It is obvious that the matter of this Cosmos everywhere forms a unique local frame. 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 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 *actually moving faster* than the other twin! That frame is obviously connected to the distribution of mass in this Cosmos.

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.⁽¹⁴⁾ 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 in non-flat space since gravity and inertia must be treated with GR. I have already demonstrated, however, that GR is actually a subjectivistic model of the matter-influenced Cosmic ether—and Einstein admitted that GR requires the existence of an ethereal space. So an appeal to GR is an admission of the existence of a unique local ethereal frame.

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 acceleration, 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 in space 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 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 the local, matter-influenced space, likewise the slowest-running clock has the greatest velocity.* A clock moving at near- c in space would 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. If it is velocity in space that slows atomic clocks by redshifting the spectra of their atoms, could it be that gravity produces a similar velocity?

6. THE EQUIVALENCE OF GRAVITATIONAL AND INERTIAL ACCELERATION

What follows is a simple kinematic model of space and motion that incorporates the successful concepts of Newton, Lorentz, Stokes, and Einstein. Like the Copernican

model, it is an objective model of what is actually moving, relative to what in this Cosmos. It is doubtless not a complete model, aspects of it might not be true, but I believe that the very fact that such a simple objective model can account for almost everything we know about space and motion indicates that it is an important step in the right direction.

Isaac Newton speculated that gravity was caused by a flow of ether, or space, into celestial bodies. He discussed this theory in letters to Oldenburg, Halley, and Boyle.⁽¹⁵⁾ For reasons discussed above, he declined to present this hypothesis in the *Principia*. He instead posited the existence of a universal, isotropic, immobile, “absolute space” that resisted matter’s acceleration but was not itself affected by matter. He asserted that all matter had some definite velocity in this space, even if it could not be determined.⁽¹⁶⁾ Newton did not know, of course, that an atom’s velocity relative to, and its proximity to a celestial body produced a spectral red-shift. Newton also did not know that light had a fixed velocity in space that was independent of its source’s velocity or that matter’s velocity was limited to $< c$. Had he known these things, he might have been able to develop the flowing space hypothesis as we shall do here.

Einstein removed several of the deficiencies in Newton’s theory by modeling what falling and accelerating observers would experience. He realized that being held stationary in a gravitational field (as on the Earth’s surface) had similar effects on one’s sensations and measurements as being accelerated in deep space by a rocket (at 9.8 m/s^2). He reached the conclusion that gravity is an accelerational field, not a force. Thus he formulated his principle of the *equivalence of gravitational and inertial acceleration* (EGIA). Using his subjectivistic method, Einstein was able to predict other effects of gravity, but could not draw the objective and physical implications of the EGIA.

We shall assume that gravity is a physical process caused by matter’s interaction with its surrounding space. If we treat inertial space as a physical entity and presume that like physical effects result from like physical causes, we can get beyond the observer’s experiences to the physical reality. We can relate Einstein’s EGIA to physical space with a simple conjecture: *A frame is inertial if it is not accelerating relative to its surrounding inertial space.* We thus infer that the accelerating space ship and the Earth-surface observer are not inertial frames because both are in a state of acceleration relative to their surrounding inertial space; neither being free to return to the natural state of non-acceleration relative to space. It thus appears that in a gravitational field, inertial space itself is accelerating towards the gravitational attractor. Indeed, an inertial space that accelerates radially towards all matter at GM / r^2 explains the ballistic and mechanical aspects of gravity. We have thus used Einstein’s subjectivistic insights to improve Newton’s objectivistic theory--transforming his absolute space from a uniform solid into a fluid that everywhere flows into matter as into a sink. Can this simple hypothesis explain the other effects of gravity that Einstein modeled--the redshift of atomic spectra, black holes, and the curvature of light? If so, can it possibly be mere coincidence?

7. THE EQUIVALENCE OF GRAVITATIONAL AND INERTIAL VELOCITY

If inertial space flows into the Earth, and all matter, then it must have not only an acceleration at any given radial distance, r , but also a definite velocity. Its velocity at the Earth’s surface ought to be the sum of its total acceleration from rest at infinite distance to the Earth’s surface. This velocity must be identical to Newton’s escape velocity--the initial velocity that allows any object on the surface of a large mass to escape the mass’s

entire accelerational field. Thus at the Earth's surface, space should be moving radially Earthward at $\sqrt{2GM/r}$, or 11.2km/s. The velocity of this inflowing space at any r , outside any mass, M , should be:

$$v_{space} = \sqrt{2GM/r} . \quad (1)$$

(Interestingly, these equations of spatial flow indicate that space is not an ideal fluid but appears to be compressible. (**Appendix A**)⁽¹⁷⁾ Its flow towards matter is accompanied by a partial compression or collapse. Note also that spatial outflow from matter, with an accompanying spatial expansion, could produce identical velocity and acceleration gradients and therefore could be the cause of the gravity of some or all celestial bodies.)

If, as the evidence suggests, it is velocity in a physical space influenced by nearby matter, not merely relative velocity, that red-shifts atomic spectra and slows atomic clocks, then an atomic clock held stationary at any given height in a gravitational field should be affected by the velocity of the inflowing space and should slow just as if it were moving at the escape velocity for that height. This is indeed the case. The experimentally confirmed formula for the gravitational slowing of atomic clocks is:

$$\Delta\nu/\nu = 1 - \sqrt{1 - 2GM/rc^2} . \quad (2)$$

Since $v^2 = 2GM/r$ in our model of the velocity of the gravitational space flow, the gravitational red-shift formula is identical to that for the 2^o or transverse Doppler shift produced by velocity:

$$\Delta\nu/\nu = 1 - \sqrt{1 - v^2/c^2} . \quad (3)$$

Thus the expected velocity of space at any given height in a gravitational field correctly predicts the slowing of atomic clocks at that height. We have thus derived the formula for the gravitational red-shift from the simplest possible physical hypothesis *and* produced a physical link between the mechanical effects of gravity and its effects on atomic spectra--the former is due to the acceleration of space, the latter to its velocity. The Lorentz transformations and the EGIA are hereby related to an objective matter-influenced Cosmic space instead of to arbitrary coordinate systems. We have unified 2^o Doppler shifting by velocity and by gravity; revealing that both are caused by *the velocity of the atom relative to its surrounding space*. We can say, indeed, that an atomic clock acts as a space speedometer. Its actual slowing in any trajectory directly reflects its velocity in physical space. This simple physical model is consistent with all the clock-slowness evidence we have. We have thus exposed a new principle of the *equivalence of gravitational and inertial velocity* (EGIV). This principle was not exposed by, and cannot be explained within Relativity. (**Appendix B**) Combining the two equivalence principles yields a new principle of the *equivalence of gravitational and inertial acceleration and velocity* (EGIAV). This principle reflects our finding that a body's acceleration and velocity relative to its surrounding space produce their respective physical effects,

whether the body's motion relative to space results from a radial gravitational space flow or from its tangential movement in that flow, or from a combination of the two.

Consider the simplicity with which this theory predicts and explains the existence of black holes. If the spatial velocity into the surface of a massive body is $\geq c$, and if light propagates through space at c , then light cannot escape the body. We can calculate the the radius of a given mass that would produce an inflow velocity of c , by solving the escape velocity formula (1) for r , and setting the spatial inflow velocity equal to c :

$$r_c = 2GM / c^2 = R_s . \quad (4)$$

This is the formula for the Schwarzschild radius⁽¹⁸⁾, R_s , of a black hole. This derivation is far simpler than Schwarzschild's, follows from a simple physical postulate, and produces predictions not found in Relativity (see below). It does not require four-dimensional space-time. It implies no mathematical singularities, nor loss of information, nor wormholes, nor other universes; only a conglomeration of matter so massive and compact that light cannot propagate out through the space that is flowing inward at $\geq c$. The more massive and compact the black hole, the greater the inflow velocity at its surface; it could be $2c$ or more.

Can this theory reproduce the other successful predictions of Einstein's General Relativity? After I had formulated this theory independently and attempted to publish it several times, I was informed by a colleague⁽¹⁹⁾ that Herbert Ives and Robert Kirkwood had published advanced mathematical treatments of the flowing space hypothesis in mainstream, peer-reviewed journals between 1939 and 1954. Herbert Ives demonstrated that if an object in a gravitational field were affected *as if it had* the escape velocity for that height--if its frequency were red-shifted, if it were shortened in the vertical direction, and if its effective mass were increased--then the successful predictions of GR were produced with greater simplicity, including gravitational lensing, the gravitational red-shift, and the advance of Mercury's perihelion.⁽²⁰⁾ Whereas Ives considered these effects to occur in an isotropic Newtonian and Lorentzian space, Robert Kirkwood posited a physical space that actually flowed into all matter.⁽²¹⁾

Recently, Tom Martin has demonstrated that, for an isolated gravitational attractor, a Galilean frame with a spatial inflow or outflow of speed $\mathbf{w} = \sqrt{2GM / r} \hat{e}_r$, gives all of the correct General Relativistic physical effects usually associated with the static and curved space-time Schwarzschild solution. He has also suggested a test which would easily distinguish between the usual curved space-time solution of Schwarzschild and the General-Relativistically-valid flowing space solution in the region of the gravitational saddle point of the Sun and Earth and at other parts of the boundary between the solar and terrestrial flows.⁽²²⁾

This paper adds to the above works by presenting the flowing space theory as a program that is philosophically superior to Relativity, by discussing the entrainment of space that it implies, and by suggesting several other tests that could further distinguish it from Relativity and from static-ether theories. This model is such an immense simplification that, even *if* it is incomplete or untrue, it should be used as a teaching tool! The same was true of Copernicus' theory long before it was corrected and collaborated by further evidence.

8. THE ENTRAINMENT OF SPACE BY MATTER

The evidence indicates that the celestial bodies affect their surrounding space in such a way as to determine the local inertial frames and light frames. Thus the frame of the Cosmos as a whole is determined by the interactions of the frames of every celestial body. The regions of influence of these celestial bodies must interact in some way in the space that lies between them. Does this idea of a flowing/collapsing space offer any physical model for how each body determines the condition of its surrounding space and how the fields of nearby celestial bodies interact?

If indeed matter is a space sink, how would it affect the motion of its surrounding space as it moved through it? We would expect that a large, powerful sink, like the Earth, would create a large field of uniform sink flow in its surrounding space. This effect would be all the more pronounced if space were a massless and frictionless fluid, as seems most likely given the minimal resistance it poses to matter at subluminal velocities. Were the Earth's field of flow not uniform, then the inflow velocity into the leading surface of the Earth might be greater by 30 km/s than the inflow velocity at the trailing surface--there would be an "ether wind". Such a diurnal/locational variation in the behavior of spectra, light, and atomic clock rates on the Earth's surface has not been observed. Sink flow is a sufficient explanation for the space-drag or entrainment first propounded by Stokes⁽²³⁾ to explain the null Michelson-Morley experiment. Indeed, the data from all sources, including our extensive experience with satellites, can be *most simply* interpreted as indicating that our Earth completely conditions the motion of its surrounding inflowing space for many hundreds of kilometers out, pulling it along with it into its 30 km/s freefall motion through the larger volume of surrounding space that is entrained by our Sun and Solar system. An Earth satellite thus is moving through an Earth-centered, radially-oriented field of sink flow. The satellite accelerates Earthward with this flow, and its atomic clock is slowed by its combined tangential and radial velocities in this flow. Due to the surrounding celestial bodies and their own entrainment effects, the Earth's entrainment of space must diminish with increasing distance from the Earth in a manner that is susceptible to mathematical and experimental modeling.

While the Earth sweeps its surrounding gravitating space into its inertial motion about the Sun, it clearly does not sweep space into its own rotation to any significant degree. There is irrefutable evidence of several kinds that the inflowing space is not significantly dragged into rotation with the Earth: the Coriolis effect, the rotation of the Foucault pendulum, the Cosmic-directional stability of gyroscopes, the Michelson-Gale experiment,⁽²⁴⁾ and the east-west asymmetry in the slowing of moving atomic clocks.⁽²⁵⁾ Therefore, for an Earth-surface observer, light travels at $c-v_{\text{rot}}$ in the easterly direction, and at $c+v_{\text{rot}}$ in the westerly direction. This rotational space drift (464 m/s at the equator) was apparently detected by the Brillet and Hall interferometer,⁽²⁶⁾ casting doubt on the physical reality of the Fitzgerald length contraction. Experiments in which light signals take different times to travel around the Earth in opposite directions⁽²⁷⁾ are also consistent with this rotational space wind.

Why would the Earth entrain space into its inertial motion but not into its rotation? Inflow requires only a medium under pressure so that it moves into any region of lower pressure--as where the medium is being condensed or removed. For the rotation of the Earth-sink to cause a rotation of the surrounding space, space would also require significant internal friction and sheer strength. Space, however, appears to be essentially

frictionless, as matter can move through it with very little resistance--at least at subluminal velocities. Thus only the position and relative motion of celestial bodies (sinks) should affect the motion of their surrounding space; their rotation should have little, if any effect.

Because of entrainment, the Earth appears to be stationary but rotating to us and to our instruments while it and its surrounding field of sink flow are moving together within the larger sink or source-flow field of our Sun. Our Solar system's entrained spatial field of flow is moving within that of the Milky Way, and the Milky Way with its entrained space is moving in the entrained space of the surrounding galaxies. Entrainment thus explains how all the matter in the Cosmos influences both the Cosmic and the local inertial and luminiferous "frame", it provides a physical explanation for Mach's Principle. It is because of entrainment that we neither feel or measure any "ether wind" due to the Earth's motion relative to the Sun or Milky Way. It is because of entrainment that all motion is most simply treated in the frame of the nearby celestial mass or masses and not in any arbitrary observer's frame. It is because of entrainment that the twin who remains at rest relative to the nearby celestial body(ies) has a lesser space velocity and faster clock than the twin who is in motion relative to same. It is because of entrainment that the clocks aboard Earth satellites are slowed by their orbital motion and not the Earth-surface clocks, even though the clocks' motions, like the twins' motions, are *symmetrical* in each others' frames. A physical space that flows toward or away from matter and is entrained by matter correctly "breaks the symmetry" of any two frames' merely relative motion; it explains the phenomena and eliminates Relativity's paradoxes.

The entrainment of space offers solutions to two vexing problems in astrophysics. Galaxies are spinning much faster than they should, given their visible matter. As Cosmologists must work with Relativity and Quantum Theory, and therefore lack any coherent theory of Cosmic space, they have had to posit the existence of invisible particles to provide the missing mass that keeps the galaxy's stars from flying apart. However, with entrainment of a large region of space by each star, much of the space of the galaxy must be dragged into rotation about the galaxial center. Thus, relative to the surrounding galaxies, a galaxy's local inertial "frame" should itself rotate in the direction of its stars' motion, at a net angular velocity that is probably less than that of the stars themselves because their entrainment of the galaxial space is not complete. The result is that the actual velocity of the stars in their own local galaxial inertial space is less than it appears. If inert matter consumes space, while nuclear reactions produce space, it may be that stars and even galaxies are net spatial producers. The flow of space out of every galaxy could push the galaxies apart. This would explain the Cosmic expansion we see today and eliminate the need for the proposed "dark energy".

Some have argued that the Earth cannot be entraining its surrounding space as that would eliminate stellar aberration for the Earth observer. Such arguments have, like most anti-ether arguments, are based on old and inadequate theories of the ether. They do not apply to the radially inflowing and entrained space of this theory. When it comes to aberration, it is Relativity that is actually inconsistent with the facts. (**Appendix C**)

9. TESTING FLOWING SPACE

Since, Relativity is only an observer-based measurement scheme, it does not model the Cosmos nor can it theorize about the causes of physical phenomena. Relativity is *not a direct competitor* to this or to any other objective and physical theory of Cosmic

phenomena; it follows an altogether different program. Relativity may correctly model the observer's measurements in certain circumstances, but any ether theory attempts to model and explain the objective Cosmos that produces the observer's experiences. The flowing space theory offered by Ives, Kirkwood, Martin, and myself must be compared with, and tested against other objective theories of Cosmic space and motion. In addition, Relativity has become essentially non-falsifiable as Relativists have shown a willingness to "save the appearances" by accepting contradictions as "paradoxes". They apply the Lorentz transformations in ways that contradict Relativity's axioms, i.e. by surreptitiously invoking a third (Cosmic ether) frame to "break the symmetry" of the twins' motions in each others' frames, by placing observers in the specific frames that yield the correct answer, etc.

With the entrainment of space that it implies, this theory constitutes a working objective model of space and motion encompassing the entire Cosmos. It specifies the velocity and acceleration of space at any point near any celestial body, and thus at any location or in any chosen frame anywhere in the Cosmos. Assuming that light is propagated at c in space, and that atomic clocks and atomic spectra are red-shifted by their velocity in the local space, this theory specifies the behavior of light and atomic clocks at any point, and in any state of motion near a gravitating body. It specifies the actual spatial velocity of any atomic clock. It is rich in predictions and aspects of it are falsifiable.

10. TESTING FLOWING SPACE VS. STATIC SPACE-TIME

Flowing Space makes many predictions not found in any *static*-space model, such as Newton's absolute space, Lorentz's isotropic luminiferous space, or Einstein's space-time. Consider the many immediate implications of spatial flow into or out of matter:

1. Light rising away from the Earth's surface, against an Earthward spatial flow, will move at approximately $c-11.2\text{km/s}$ relative to the Earth's surface. Likewise, light falling downwards towards the Earth will move at $c+11.2\text{km/s}$. All celestial bodies should produce a corresponding anisotropy that Relativity does not predict. This effect is difficult to measure locally using atomic clocks due to the well-known problem of synchronizing clocks using the very signal whose velocity one is trying to determine. This fact does not imply, however, that it is *a priori* impossible to detect any light velocity anisotropy. The use of astronomical data might circumvent the clock-synchronization problem. We might find evidence of this anisotropy in the velocity and spectra of light or particles moving towards or away from a celestial body.
2. Matter may be observed falling into celestial bodies at velocities greater than c (relative to the sink). In the case of a black hole, the velocity may exceed $2c$. Tom Martin has demonstrated that spatial sources would produce gravitational effects that are identical to those of spatial sinks.⁽²⁸⁾ It is thus possible that stars and even entire galaxies are spatial sources. Astronomical observations may detect light or matter moving away from space sources at velocities $\geq c$. Relativity excludes velocities $>$ or $<$ c in *any* frame.
3. A one-way light speedometer⁽²⁹⁾, if feasible, could directly detect the gravitational 11.2km/s space wind, and all other velocity relative to space.

4. This theory with its Earth-entrained space does not require the Fitzgerald length contraction to explain the null Michelson-Morley experiment. *If* the length contraction is not a physical reality, then an interferometer mounted *vertically* on the Earth's surface will produce a fringe-shift consistent with the gravitational 11.2km/s space wind. Likewise, an interferometer orbiting the Earth will produce a fringe-shift consistent with its velocity in Earth-entrained space.
5. Actual light round-trip travel time experiments between any two points on the Earth's surface in *vacuo* will show light moving slower than true space- c due to its propagation through the vertical 11.2km/s space flow. Perhaps this small discrepancy is already apparent in the different values of c produced by Earth-surface vs. astronomical methods.
6. A spreading sphere of light from an Earth-surface source will be displaced Earthward by the 11.2km/s flow. On the Earth's surface, any light emitted should drop 0.112m over a 3km distance (11.2km/s space velocity \times 3×10^5 km/s light velocity in space). This local velocity effect is not a curvature but only linear displacement--as in the downstream displacement of the waves produced when a pebble is tossed into a flowing stream. To detect this effect will require ingenuity as both source and observer on the Earth's surface have identical velocities in the space flow. For the observer, the propagating light's downward displacement is countered by upward aberration due his own upward velocity in the medium, so the apparent vertical position of the source is not altered. Neither will lasers work to expose this effect. A horizontally-mounted laser, because of its construction, can only emit a beam of light that does travel horizontally. In the frame of the inflowing space, the same beam is directed upwards at an angle of 3.73×10^{-5} radians. The matter-ward displacement of light may be evident astronomically, but such an analysis requires also sorting out the various spatial flow and/or compression effects that combine to produce gravitational lensing.
7. In Relativity, the rate of an atomic clock in motion in the Earth's gravitational field is produced by calculating the gravitational red-shift at that height (v^2 / c^2), and adding a "time dilation" factor (v^2 / c^2) for the clock's velocity relative to the Earth-observer. In flowing space, one does not add the squared radial flow and tangential velocities but instead uses vector addition to obtain the absolute spatial velocity of the satellite clock and then squares this velocity and divides by c^2 to get the 2^o Doppler effect. In flowing space, the velocity of a satellite's clock will be a vector addition of radial space flow velocity at its height and its tangential velocity in the flow field. Richard Benish has shown that these different procedures produce significantly different results, with the greatest divergence occurring for clocks falling towards the Earth. Flowing space predicts that radially falling clocks will run faster than predicted by Relativity as they are moving in the same direction as space itself. An atomic clock falling radially towards the Earth with the same velocity as space at that r , the escape velocity, will be at rest in space and will run at the fastest rate. The Vessot rocket experiment⁽³⁰⁾ involved a rising and falling clock, but it was not designed to distinguish between Relativity and flowing space. Richard Benish's analysis reveals that it also was not sensitive enough to distinguish between the two models. It may be necessary to perform simpler experiments, such as firing a

clock downward from a high altitude so that its velocity is nearly that of the inflowing space. When recovered, its elapsed time will be greater than that predicted by Relativity.

8. Muons rising against the space inflow with at *near-c* relative to the Earth will persist longer than muons falling with the same Earth-velocity since the rising muons' space velocity is actually $v+11.2\text{km/s}$ compared with $v-11.2\text{km/s}$ for the falling muons.
9. At the boundary between the space-flows of two bodies, such as that between the Earth and Sun, there will be anomalous atomic clock-slowness and accelerational effects which are not predicted by the static solutions of the field equations of General Relativity.⁽³¹⁾ These can be detected by observing the motion and atomic-clock rate of a satellite which passes through the boundary.

11. TESTING ENTRAINMENT VS. NON-ENTRAINMENT

Entrainment not only explains the phenomena without paradoxes, it also provides additional tests to distinguish this theory from others. Relativity cannot include entrainment since it treats all motion as only relative to any chosen coordinate system. To admit entrainment is to admit a physical space that is swept into motion by nearby matter thus creating a unique local environment or frame. Clear evidence for entrainment ought to be sufficient to disprove Relativity.

1. With entrainment of space by all large celestial bodies, the relative slowing of atomic clocks or atomic spectra on their different surfaces will be predicted by their individual spatial inflow velocities only. The relative motion of celestial bodies will not produce any additional 2^o Doppler slowing as such motion will produce no space-wind for clocks on either surface. For instance, a clock on the Earth's surface is slowed by an 11.2km/s gravitational space flow and a clock on the Sun's surface by a 617 km/s space flow. With entrainment, the observed spectra will reflect this difference only (having factored out the 1^o Doppler effect). With entrainment, and disregarding the small rotational velocities, waves emitted by identical sources on the surfaces of the Sun and Earth should have periods differing by

$$\left(v_{Sun}^2 - v_{Earth}^2\right) / c^2 = 4.24 \times 10^{-6}, \quad (5)$$

where v is the spatial inflow velocity. This is indeed what the data appear to show⁽³²⁾ and, surprisingly, this is how the data are treated in the Relativists' own textbooks.^(33,34) However, this result and its treatment are incompatible with Relativity. In Relativity, without entrainment of space by the Earth, the Earth-Sun period difference should reflect not only the gravitational redshifts but also the relative motion of Sun and Earth. Relativity, which must factor in all relative motion, must assert that the Earth-surface clock is slowed not only by the Earth's gravitational red-shift but *also* by the Sun's own gravitational red-shift at the Earth's distance (a 42 km/s space wind) and by the Earth's 30 km/s orbital velocity relative to the Sun-surface clock. A valid, non-entrainment Relativistic

treatment, where ϕ is the gravitational potential, GM/r , with units m^2/s^2 , corresponding to $\frac{1}{2}v^2$, should predict:

$$\left(2\phi_{Sun} - 2\phi_{Earth} - 2\phi_{Sun@Earth} - v_{Earth-r/t-Sun}^2\right) / c^2 = 4.21 \times 10^{-6}. \quad (6)$$

Relativity, and physical theories without entrainment, must predict a larger Earth-clock red-shift, and therefore a smaller difference between the periods of the two clocks than does this entrained-space theory. Unfortunately, the Sun's spectral red-shift is hard too determine with sufficient accuracy due to the rising and falling of emitters on the Sun's surface. Other tests of this difference may be possible using spectra or clocks on other planets or on probes in orbit about other planets. To support entrainment, one need only find that the relative velocity of the star, planet, or galaxy and Earth is *not* reflected in the observed 2° Doppler shift of their atoms' spectra. As a galaxy should entrain a large region of surrounding space, its motion away from the Earth should produce only a 1° Doppler red-shift of its spectra and not a 2° Doppler red-shift (there should be no galaxial time-dilation).

2. The existence of galaxial vortices due to entrainment of space by stars can be tested. For instance, we may be able, on Earth, to detect whether our local galaxial inertial frame, the Milky Way, is indeed rotating with respect to the surrounding galaxies in the same direction as its stars' revolutionary motion.

12. CONCLUSION

Relativity did not eliminate the ether or physical space from physics, it only forbade us to think about it. It is time for us to return to studying space and motion objectivistically, as related to and affected by the distribution of matter in the Cosmos. This flowing space theory is a step in this direction and is firmly grounded in the evidence and in the successful insights of Newton and Einstein. It explains the phenomena in the simplest possible manner and produces no paradoxes. It provides a physical theory of gravity's effects and unifies our understanding of 2° Doppler red-shifting by gravity and by velocity. It produces the successful predictions of General Relativity with greater simplicity, and also makes many other predictions that can be tested.

Of course, any theory of physical space and motion raises innumerable difficult questions, as it goes beyond the mere mathematical description of measurements and attempts to explain the causes of all physical phenomena. It reopens a book of nature that has been closed for 100 years. I have found that flowing space theory invites many fascinating and fruitful conjectures on the physical causes of many phenomena that are currently unexplained, including the nuclear "strong force", the 2° Doppler shift, Cosmic inflation, galaxial recession, atomic blasts, geothermal heat, gravity waves, electrons, neutrinos, and light.⁽³⁵⁾ Even if some aspects of this theory prove incorrect, we must not again default to merely modeling our measurements. We must persist in our attempts to model Cosmic space and motion and to explain the causes of all phenomena.

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 Relativity. 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.

Appendix A: The Gravitational Collapse of the Ether

The formula for ether velocity: $v_{ether} = \sqrt{2GM / r}$ differs in r -dependence from the formula for the velocity of an ideal fluid flowing into a sink: $v_{fluid} = S / r^2$ where S is the sink strength. Therefore, as the ether flows into mass, its velocity increases at a slower rate than that of an incompressible fluid. For an ideal fluid, S has the units L^3/T , which reflects a consistent volume rate at any given r . But GM has the units L^3/T^2 which indicates a volume rate that *decreases* with time and proximity to matter. The apparent ether volume rate, which is the product of the apparent ether velocity and the spherical area at a given r , $\sqrt{2GM / r} \times 4\pi r^2$, *decreases* as the ether approaches the earth. For instance, the apparent volume rate at 1000 earth radii (1000_{er}) is $\sqrt{1/1000} \times 1000^2$ or $1000^{3/2}$ or 31,600 times that of the surface. At 10_{er} the rate is $10^{3/4}$ or 31.6 times that of the surface. At 2_{er} the volume rate is $2^{3/2}$ or 2.83 times greater than the volume rate at the earth's surface.

The simplest explanation for the apparent volume loss is that the ether is compressed as it flows into mass. Its constituent parts, or cells, must lose volume and thus not increase in velocity as much as an incompressible fluid would. (Ether velocity being what we measure with atomic clocks or escape velocity experiments and corresponding to some number of ether cells per second.) Other hypotheses for the decreasing volume rate are possible. Ether cells might condense or simply disappear as they approach mass. Perhaps the cells elongate as they approach mass and thus produce a lower cell/sec flow rate and a slower apparent atomic clock velocity than they would otherwise. Since our eyes and instruments would also elongate in the same direction, we would not perceive any optical distortion of the images of distant spheres like the moon and sun. Perhaps some other process is involved which I simply have not imagined. Notice that GR also predicts the compression of space near mass, and thus that objects are larger when farther from mass. I am not aware of any discussion of the resulting optical effects in GR except for the time delay in light signals passing through the compressed space near the sun (Shapiro 1964).

Appendix B: Relativity and the Equivalence of Gravitational and Inertial Velocity

Can Relativists “explain” the equivalence of gravitational and inertial and velocity (EGIV) within their own system, without the flowing space hypothesis? They cannot. Some Relativists have, in fact, simply dismissed the evidence for this equivalence as a fortuitous coincidence,⁽³⁶⁾ against which assertion the theory here presented is sufficient argument. A previous reviewer claimed that the EGIV is merely a consequence of the observer-based equivalence of gravitational and inertial acceleration (EGIA) and does not require the flowing space hypothesis. He argued that an observer falling toward the Earth from an infinite distance (in *vacuo*) would accelerate to a velocity of 11.2km/s at the

Earth's surface; and thus to him a clock on the Earth's surface would appear slowed when he passed by it. This is the typical Relativist's technique of ignoring the physical reality of any local spatial frame by placing an observer in that frame and modeling what that observer measures. I will show that this observer-based rationalization does not follow from Einstein's EGIA, contradicts SR, and again exposes the ambiguity of Relativity. The EGIV has not been noticed or seriously discussed until this time precisely because it cannot be understood within Relativity. Consider that:

1. Relativists assert that the physical effect of the mass of the Earth on the rate of an atomic clock is "explained" by inventing an observer, letting him fall towards the Earth, and speculating on what he would "see". This is their subjectivistic method. On the contrary, atomic clock-slowness on the Earth's surface is, in fact, evident to the Earth-surface observer, even though he is not in free-fall and has no velocity relative to the clock. He can put a clock on a high tower for some time, bring it back down, and find that it ran faster than his Earth-surface clock; even though both clocks remained at rest relative to himself. This fact alone demonstrates the objective and physical nature of this effect and exposes the complete artificiality of trying to "explain" gravitational clock-slowness using falling observers.
2. The EGIA only applies to frames in which an accelerometer detects acceleration. The EGIA asserts only that inertial and gravitational *acceleration* "feel" the same and produce the same effects on the observer's local experiments. But the observer to which the Relativists appeal here is in free-fall. His accelerometer measures no acceleration, he is not in an accelerated "frame". The fact that the free-fall observer is accelerating relative to the clocks and the Earth even though he feels no acceleration is an objective effect of the Earth's gravity and must be explained as such, as it is in this theory.
3. We know that inertial acceleration does not slow atomic clocks, whereas gravity and velocity do. The EGIA alone thus cannot explain gravitational clock-slowness. Since any velocity can be associated with any acceleration, the association of this particular velocity with this free-fall observer requires an additional assumption that stipulates the velocity and thus violates the strong version of the EGIA. Flowing space predicts this velocity on the basis of a physical model of gravity. The Relativists, as is their wont, simply create an observer whose observations will fit the data at hand, with no regard to the causes of things.
4. Relativists apply the Lorentz transformations to this observer's velocity to explain the slowing of the clocks. But SR, the subjectivistic (observer/frame-based) interpretation of the Lorentz transformations, does not provide the needed velocity assumption. SR does not treat gravity or acceleration and thus did not predict and cannot explain why gravity produces this apparent velocity. The only link that Einstein made between SR, acceleration, and velocity in his presentations of GR was his thought experiment involving the slowing of clocks due to their velocity on the periphery of a rotating disc,³⁷ and this has no relevance to the relationship between gravity and velocity discussed here.
5. The appeal to SR creates another problem for the Relativists. According to SR, the Earth-surface clock would appear to be slowed to the required rate *only* for the

observer who falls from infinity. The same clock should appear to be slowed less for an observer who falls from a lower height and has a lesser velocity. To invoke SR here is to abandon the equivalence principle of SR: the doctrine that SR is valid in every freely falling frame. Relativists would need to posit that Lorentz transformations are actually valid only in the *unique* frame that falls from infinity and whose velocity at every point outside a mass equals the escape velocity-- which is indeed an implication of the theory presented here.

I conclude that the EGIV that was predicted and explained by this theory was not predicted and cannot be explained within Relativity by appeal to observers using the EGIA and/or SR. Atomic clock-slowness by gravity is a physical reality that must be related to space as it is affected by nearby mass. How Einstein predicted the escape velocity formula for the gravitational red-shift using his subjectivistic method I do not know, this is a matter for mathematicians and historians. I have demonstrated that the simplest explanation for this phenomenon is that mass causes its surrounding space to flow towards it, attaining a velocity of $\sqrt{2GM/r}$ relative to any stationary atomic clock at any given r .

Appendix C: Aberration, Flowing Space, and Relativity

In Relativity, aberration must be due only to the relative motion of source and observer. Stark's experiment refutes this claim.⁽³⁸⁾ In this laboratory experiment, the direction of light arriving from stationary and high-velocity moving atoms at the same location was identical. The data from the aberration of individual stars in a binary system is also refutes Relativity.^(39, 40) The stars' aberration does not vary with the stars' velocity relative to the Earth, i.e. when they're moving with or against the Earth's motion. These data instead support the theory that space is the physical medium of light transmission. In such a space, aberration is produced only by the *observer's* velocity in the luminiferous medium; not by the *source's* velocity in the medium. Specifically, in this entrained-space theory, annual stellar aberration is caused by the Earth and its entrained space's nearly circular motion within the larger entrained space of the Sun and surrounding stars. Some have argued that an Earth-entrained space would eliminate stellar aberration. However, the kinematic effect of the motion of the Earth on the apparent position of a distant star can only be eliminated if the Earth's entrained space *rotates* in the precise direction needed to eliminate the aberration. In fact, all the evidence indicates that the Earth's space does not rotate relative to the space of our Sun and surrounding stars. In aberration, the difference between an unentrained vs. an entrained physical space is that with entrainment the change in the apparent direction of the starlight is produced not at the Earth-surface observer, as in an absolute or unentrained-space theory, but at the interface of the inflowing Earth-entrained space with the Sun-entrained space. An observer at great distance would see the starlight bend as it propagates from the interstellar and Solar space into the (moving) entrained space of the Earth. This matter certainly bears further investigation both in the laboratory and astronomically.

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