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Sachs-Wolfe Effect Disproof – The Fundamental Flaw in the Spectral Analysis of Gravity Wells

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Abstract: The Sachs-Wolfe Effect, a popular wavelength modifying hypothesis involving galaxy clusters and cosmic voids, is based on the belief that a propagating photon gains energy (is blueshifted) during its descent into a gravity well and loses energy (is redshifted) during the ascent as it escapes from the gravity well. A straightforward proof exposes the underlying flaw ---a flaw that extends to the spectral analysis of gravity wells, and hills, in general. The argument is based on three undeniable properties; no reputable physicist refutes these. (1) The photon is not a point-like particle; the particle of light is an extended entity. (2) The three dimensional space of the Universe is not a region of nothingness. (3) Gravity's influence on photons involves altering the propagation direction and changes to the wavelength. Remarkable agreement with observational evidence is presented. The logic of the arguments and the supporting evidence lead to truly profound implications for cosmology: The expanding-universe hypothesis is untenable. It turns out, we live in a Dynamic Steady State Universe.

Keywords: Sachs-Wolfe, Photon Propagation, Cosmic Redshift, Velocity-Differential Redshift, Gravity Well, Space Medium, Cellular Cosmology, DSSU Theory

1. Sachs-Wolfe Effect Basics

The core idea behind the Sachs-Wolfe effect is that a photon propagating through a gravity well will gain energy during the descent portion of the journey and then lose energy during the ascent portion. If there is no change in the gravity well's configuration, the supposition is that the gain will be balanced (cancelled) by the loss and no effect will be registered. No net energy change in the photon should occur. However, if the gravity well deepens during the photon's cross-transit journey (say by ongoing gravitational contraction and density increase), then the expectation is a net energy loss. On the other hand, if the gravity well loses some of its depth during the traverse of the light (say by the expansion of the space within the well), then a net energy gain is expected.

In terms of the General Relativity view, any change in the metric of the gravitational field is said to determine the photon's loss or gain in energy.

"Any kind of fluctuation of the metric, including gravitational waves of very long wavelength, will produce a Sachs-Wolfe effect." [1]

The Sachs-Wolfe effect has been an integral part of astrophysics since 1967 when Rainer Kurt Sachs and Arthur M. Wolfe published the details in an article "Perturbations of a Cosmological Model and Angular Variations of the Microwave Background" [2]. The idea is that the photons from the Cosmic Microwave Background (CMB) are gravitationally redshifted, depending on the direction of the sources, causing small scale anisotropy —causing the CMB spectrum to appear patchy and uneven.

Now, the originating photons (the ones that become the CMB photons), after having been emitted by their sources, are said to encounter two main perturbing effects. The first is called the *non-integrated* Sachs–Wolfe effect. It relates to the energy lost while emerging from their local originating gravity well. The non-integrated Sachs–Wolfe effect is caused by the gravitational redshift occurring while emerging from "the surface of last scattering." (This so-called "last scattering" refers to a brief period hypothesized as an early stage in the evolution of the Big Bang, a stage in which the entire universe had the characteristic surface temperature of a typical star much like the present Sun.) The intensity of the effect varies due to differences in the matter/energy density at the time of last scattering. And this variation is cited by experts as a contributing factor in an attempt to explain the temperature variation (the small-scale anisotropy) in the CMB all-sky map. The second is known as the *integrated* Sachs–Wolfe effect. It relates to the energy lost, again due to the gravitational redshift, while photons are travelling the rest of the way across the expanding universe to be detectable at the Earth.

As additional contributions to the complexity of expanding-universe cosmology, the CMB specialists have also come up with what is called the *late-time integrated* Sachs–Wolfe effect, the *early-time integrated* Sachs–Wolfe effect, and the *Rees–Sciama effect* —all in an effort to explain the CMB observed temperature variations. The Rees–Sciama effect (named after Martin Rees and Dennis Sciama) accommodates the belief that "the accelerated expansion [of the universe] due to dark energy causes even strong large-scale potential wells (superclusters) and hills (voids) to decay over the time it takes a photon to travel through them." [3] … With these multiple and changing effects, it does get complicated. But as we will see in a moment, their distinctions are unimportant. What is important is the fundamental assumption shared by all of them.

We need to be absolutely clear about the key assumption, so let me cite someone who has based much of his research (including his 1995 PhD Thesis) on this topic.

Wayne Hu, professor of Astronomy and Astrophysics at the University of Chicago, is one of the CMB specialists. He is an expert on the Sachs-Wolfe effect and its purported influence on the CMB —its bearing on the small-scale anisotropy. Essentially, he believes (along with most astrophysicists) that if a gravity well remains stable, if the *depth* of the potential well remains unchanged, then the blueshift from falling in and the redshift from climbing out will cancel each other. According to Professor Hu there will be no net spectral shift —no net change in the light's wavelength. Based on this premise the Sachs-Wolfe effect predicts:

"If the depth of the potential well changes as the photon crosses it, the blueshift from falling in and the redshift from climbing out no longer cancel leading to a residual temperature shift." –Wayne Hu [4]

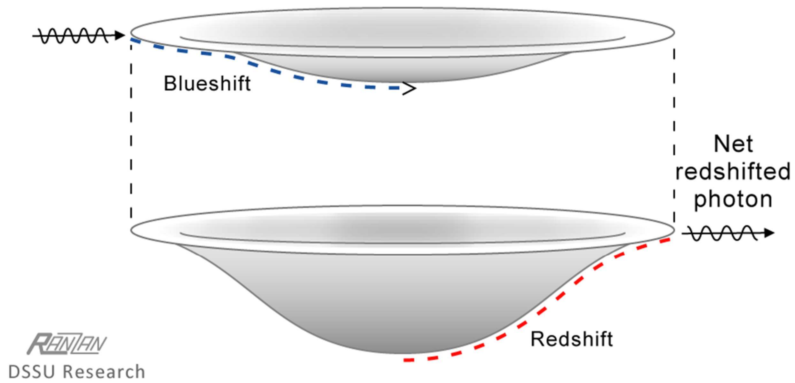

Figure 1. *According to the Sachs-Wolfe view, if a gravitating region's space-time curvature increases during the light's transit, the light should acquire a net redshift. Putting it another way, if the fabric of space-time is "stretched," then so should the light's wavelength.*

And if the premise were true, the Sachs-Wolfe effect would logically follow.

Figures 1 and 2 illustrate how a change in the gravity well affects the spectral shift.

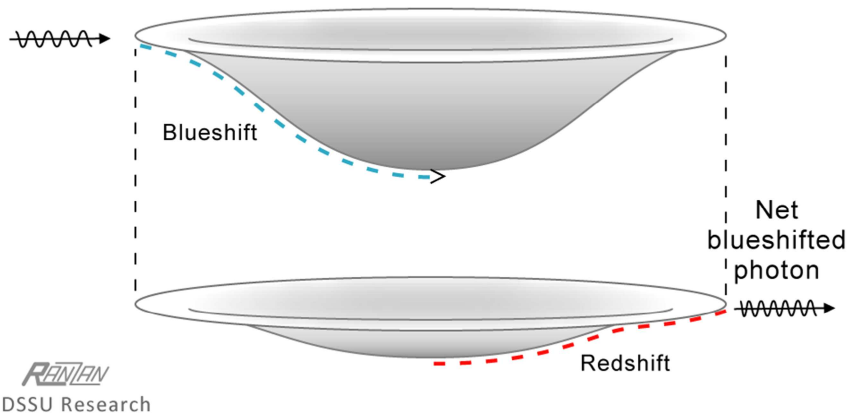

Figure 2. *According to the Sachs-Wolfe view, if a gravitational potential well decays during the photon's journey, the photon should be blueshifted. Stated another way, as the space-time curvature diminishes, as the space-time fabric "contracts," so should the photon's wavelength. "A photon gets a kick of energy going into a potential well (a supercluster), and it keeps some of that energy after it exits, after the well has been stretched out and shallowed.".*

When light encounters a cosmic void, it is effectively faced with a large-scale gravitational hill —a hill surrounded by the gravity valleys of galaxy clusters (of the supercluster network). In an expanding universe, voids are stretched out; the "hills" become shallower; and the light suffers the integrated Sachs-Wolfe effect. As described by University of Hawaii astronomer István Szapudi,

"When light crosses a supervoid, it acts like a ball rolling over a hill. Because the supervoid lacks mass, its gravitational pull is less than that of the surrounding dense areas and would cause an object entering it to slow like a ball rolling up a hill. As the object came out of the void, it would speed up like a ball rolling down the hill. Light does not slow down or speed up (because the speed of light is constant), but it loses and gains energy, which is directly proportional to its temperature."

"In a stable universe the light would lose and then gain the same amount of energy, coming out just as it started, but the accelerated expansion of the universe changes the game. Because the void and all of space grow larger as the light passes through, it is as if the plain surrounding the hill rose while the ball was crossing it, so the ground on the other side is higher than the floor at the beginning. Thus, the photons cannot regain all of the energy they lost, and they come out cooler than they were going in." [5]

The Sachs-Wolfe effect as it is purported to work for the cosmic voids in an expanding universe is shown in Figure 3.

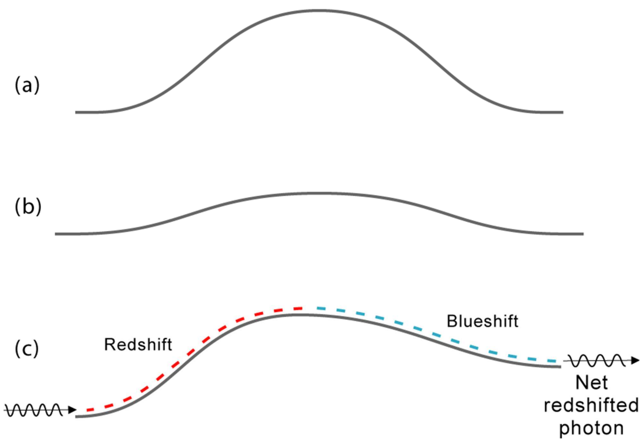

Figure 3. *Sachs-Wolfe effect as it applies to cosmic voids within an expanding universe. When the light entered the void (or supervoid) it had a gravitational-potential profile something like the one shown in (a). But, because of ongoing cosmic expansion, by the time the light reaches the center of the void, the void will present a shallower potential profile (b). The zones of redshift and blueshift are identified in (c) by the red and blue dashed curves respectively. Astrophysicists claim the light acquires a net redshift: "a photon has to expend energy entering a supervoid, but will not get all of it back upon exiting the slightly squashed potential hill." The light emerges with a lower temperature. Thus, voids and supervoids are identified as colder patches in the cosmic microwave radiation.*

Let me again point out: If the premise underlying the Sachs-Wolfe effect (and its variants) were true, then the scenarios illustrated in Figures 1, 2, and 3 would represent logical outcomes. We would be looking at valid effects.

But here is the problem: The assumption, upon which the Sachs-Wolfe effects are based, is fundamentally flawed.

It can be, and will be, shown that there is never an intrinsic energy gain—not in the descent into a gravity well, not in the descent from a gravity hill, and not in the total crossing of a gravity potential (or gravity domain). The descending photon does *not* gain energy. Energy loss actually occurs during both the descent and the ascent portions of the photon's journey.

Before explaining why this is so and what, in detail, happens to the propagating photon, let me illustrate with a simple analogy.

2. An Analogy Using the Earth's Gravity Well

2.1. Meteoroids Freefalling into a Gravity Well

Let us assume two small meteoroids, originating from deep interplanetary space, are falling towards the Earth. The pair of baseball-size rocks is freefalling in tandem —along a common trajectory.

At the instant the meteoroids reach a point 63,780 kilometers from Earth's center (a distance of 10-Earth radii), they trigger some remote detectors which manage to record the gap between the leading and trailing objects. Think of the "detection" as a high-speed snapshot; and let us say the gap measures a very convenient 1.00 meter (Figure 4a). (The remote instruments also measure the speed, confirming for us that the objects possess the Newtonian-predicted freefall speed.)

Something else: We ignore the Sun's gravitational influence throughout the long course of the fall; and we ignore the air resistance during the fall through the Earth's atmosphere. Our focus is just on the Earth's gravitational influence.

A fundamental fact of physics is that the greater the distance from a gravitating body, the less will be the magnitude of the freefall velocity. This means there will be some small relative velocity between the tandem meteoroids. It follows that when the objects reach the surface of the Earth (Figure 4b), their separation will be considerably greater than the originally measured 1.00 meter.

In order to examine this in detail, we draw the freefall velocity profile for the Earth. The necessary equation is obtained by combining the Newtonian gravity equation, $F_{\text{gravity}} = -GMm/r^2$; and Newton's 2nd Law of Motion, (*Force*) = (*mass*)×(*acceleration*).

$$\upsilon_{\text{freefall}} = -\sqrt{2GM/r}\,, \qquad (1)$$

where G is the gravitational constant and r is the radial distance (from the center of the mass M) to any position of interest, at the surface of M, or external to M. The negative sign indicates that motion is in the opposite direction of any radial vector.

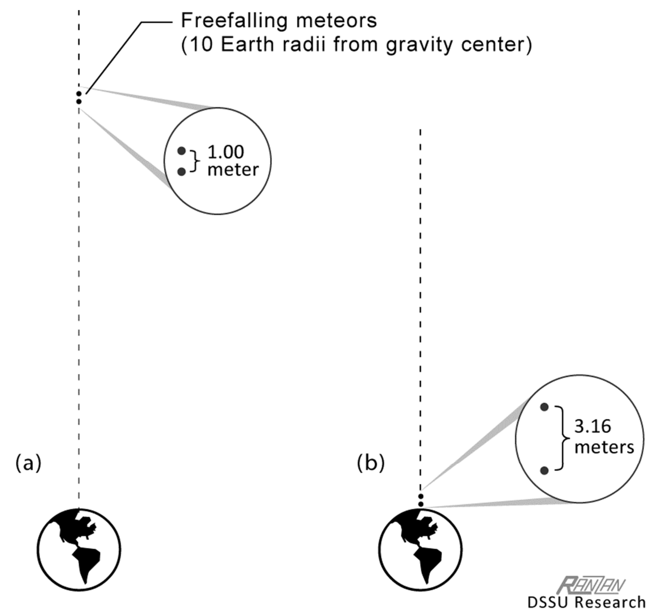

Figure 4. *When the freefalling meteoroids are 10 Earth radii away, in (a), they just happen to be one meter apart. Once they reach the Earth, in (b), they would then be, in the absence of atmospheric resistance, 3.16 meters apart. The two objects, by virtue of their separation, "experience" a gravitational differential, which manifests as an acceleration and velocity differential.*

Next, take a close look at the following figure, Figure 5; it should be easy to see that the leading meteoroid is falling faster than the trailing one. The two are, as a consequence, actually moving apart.

We subtract the velocity of the nearer object from the more distant one.

(Relative velocity between objects)

= (vel. of more distant object) − (vel. of nearer object);

(Relative velocity between objects)

= (vel. of trailer) − (vel. of leader);

$$= (\upsilon_2 - \upsilon_1) > 0. \tag{2}$$

Since υ_1 is more negative than υ_2 (υ_1 is lower on the velocity scale than υ_2), the "difference" expression must be positive. Hence, there is a velocity of separation between the two meteoroids.

This moving-apart velocity —the rate of separation between the two objects— can be expressed as *ds/dt*. Furthermore, it is proportional to the separation *s* itself. That is, ${}^{ds}\!/\!{}_{dt} \propto s$. Expressed as an equation,

$$\frac{ds}{dt} = ks\,, \tag{3}$$

where k is the parameter of proportionality, the fractional time-rate-of-change parameter, and

$$k = \frac{1}{s}\frac{ds}{dt}\,. \tag{4}$$

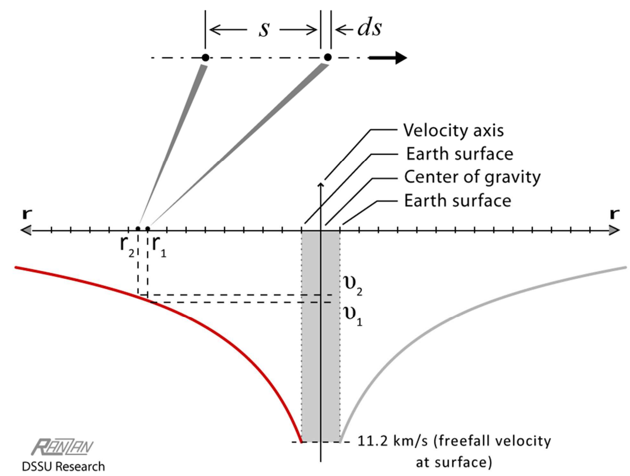

Figure 5. *The separation s between the two meteoroids (black dots) increases during the freefall into the Earth's gravity well, which is shown here by its freefall-velocity curve. The curve and the identified parameters are used in the text to derive (i) the function for the* rate of separation *of the meteoroids, and (ii) the function for the separation itself. Of key importance, here, is the velocity differential, the difference between* υ_1 *and* υ_2.

Notice, in Figure 5, that the separation length is $s = (r_2 - r_1)$. And *ds/dt* is simply the *algebraic* velocity difference between the objects, which is $(\upsilon_2 - \upsilon_1)$. Then,

$$k = \frac{(\upsilon_2 - \upsilon_1)}{(r_2 - r_1)}\,, \tag{5}$$

which, by definition and by simple inspection, is just the slope of the curve of the gravity well's freefall velocity function.

But the slope of the velocity curve in Figure 5 is simply the derivative of: $\upsilon_{\text{freefall}} = -\sqrt{{}^{2GM}\!/\!{}_{r}}$, Equation (1) from above. By performing the calculus, we obtain the expression for the slope as

$$\frac{d\upsilon}{dr} = \frac{d}{dr}\left(-\sqrt{2GM/r}\right) = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \tag{6}$$

The slope k, then, can be expressed for any radial location, r, as

$$k(r) = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \tag{7}$$

With the substitution of Equation (7) into Equation (3), the "separation velocity" expression becomes

$$\frac{ds}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right)s\,, \tag{8}$$

or equivalently (by using the chain rule)

$$ds\frac{dr}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right)sdr\,. \tag{9}$$

But *dr/dt* is just the freefall velocity at r, which is given by Equation (1); and so,

$$\frac{ds}{s}\left(-\sqrt{2GM/_{r}}\right)=\frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right)dr\,,$$

which simplifies to

$$\frac{ds}{s}=-\frac{1}{2}\frac{dr}{r}\,. \tag{10}$$

The separation, as a function of radial distance, is found by simply integrating Equation (10):

$$\int_{s\text{-initial}}^{s\text{-final}}\frac{ds}{s}=-\frac{1}{2}\int_{r\text{-initial}}^{r\text{-final}}\frac{dr}{r}\,. \tag{11}$$

$$\ln s\Big|_{s\text{-i}}^{s\text{-f}}=-\tfrac{1}{2}\ln r\Big|_{r_\text{i}}^{r_\text{f}}\,,$$

$$\ln s_\text{f}-\ln s_\text{i}=-\tfrac{1}{2}\left(\ln r_\text{f}-\ln r_\text{i}\right),$$

$$\ln\left(\frac{s_\text{f}}{s_\text{i}}\right)=\tfrac{1}{2}\left(\ln r_\text{i}-\ln r_\text{f}\right)=\tfrac{1}{2}\ln\left(\frac{r_\text{i}}{r_\text{f}}\right),$$

$$\frac{s_\text{f}}{s_\text{i}}=\sqrt{\frac{r_\text{i}}{r_\text{f}}}\,. \tag{12}$$

If the original separation of the meteoroids was 1.0 meters (at the location of 10 Earth radii), then the final separation (at the location of 1 Earth radius) would be

$$s_\text{final}=\sqrt{\frac{10R_\text{E}}{1R_\text{E}}}\cdot s_\text{initial}=3.16\ \text{ meters.}$$

The separation has increased considerably. The logic behind this outcome is unassailable. Throughout the freefall journey, the nearer object experienced a greater gravitational effect than did its trailing partner. A miniscule differential in the acceleration produced, during the time it took to reach the Earth's surface, a tripling of the separating gap (Figure 4).

2.2. Ejection/Escape from a Gravity Well

Now, let us extend the analogy. Let us apply the same logic to a pair of projectiles being ejected from our planet. Picture, if you will, the fanciful escape mechanism portrayed in Jules Verne's 19th-century classic *From the Earth to the Moon*. Imagine the tandem pair blasted out and upward from an extremely long-barreled cannon (and continue to disregard air resistance). During the escape journey, the nearer-to-Earth object experiences a greater gravitational effect than does the leading partner. One object continually experiences a slightly greater retarding acceleration (gravitational acceleration) than does the other object. The logical result is that, again, the tandem separation increases over time.

But to make the analogy more relevant, the focus is on the actual velocities involved. Both objects travel in accordance with the escape velocity function $v_\text{escape}(r)=\sqrt{2GM/_{r}}$. The escape speed diminishes as the square root of the distance r from the center of gravity. (Note again, there is no atmospheric resistance, total vacuum is assumed.) If the objects are launched simultaneously with the exact same initial velocity, then a simple graphic argument can be made: The individual velocity curves are simply offset (along the radial axis) by the in-line gap between the objects at the moment of launch. This offset, assumed to be 1.0 meter, is shown (greatly exaggerated) in Figure 6. At the moment of launch the individual objects are travelling with the same speed, but after the launch, the leading object is always moving faster than its tandem partner. The figure makes it graphically clear that for any radial position the leader's velocity curve is always above the other. Thus, there exists a motion of tandem separation during the ascent from a gravity well.

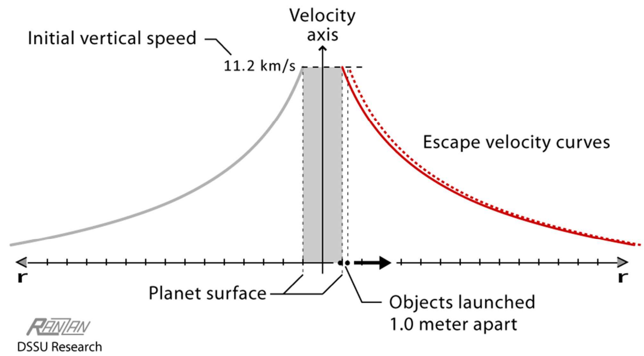

Figure 6. *Two rocks, one meter apart, are simultaneously ejected from the planetary surface. The initial launch speed is sufficient for total escape. The graphs trace the progressive slowing of the speed. Since the graph of the leading object is, after initial launch, always higher on the velocity scale, meaning that it is always moving faster, it follows that the two rocks are separating during the ascent. (Atmospheric resistance is ignored; total vacuum is assumed. The speed of escape from Earth's surface is 11.2 km/s).*

The point to remember from this analogy is that the gap between the tandem objects increased both times—during the descent into the gravity well *and* during the ejection. Freefall or escape, the separation distance always increases.

Incidentally, the magnitude of the escape-velocity function is identical to the magnitude of the freefall-velocity function. This is not by coincidence.

3. Light Pulses Crossing a Gravity Well

The influence of gravity applies to electromagnetic radiation. It can cause a change in the direction of propagation and the spacing between light pulses.

When spaced-apart light pulses descend into a gravity well, the gravitational effect acting on the leading pulse is greater than the effect on the trailing pulse. See Figure 7. A difference in the accelerations exists throughout the inbound journey. It follows that, with respect to the *background* Euclidean space, there will occur a separation of the pulses.

Then, when the light pulses emerge from the gravity well, the gravitational effect acting on the leading pulse is *less* than the effect on the trailing pulse. See Figure 7. Once again there is a difference in the accelerations, but now the gravitational acceleration is in the opposing direction of propagation. The trailing pulse "feels" a stronger backwards pull throughout the outbound journey. Once more, it follows that there will be an intrinsic separation of the pulses.

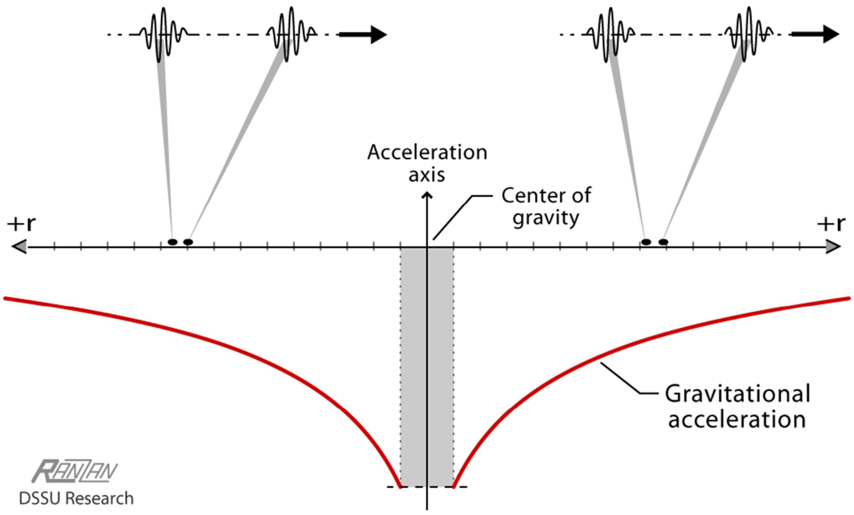

Figure 7. Spaced-apart light pulses are transiting a gravity well. *During the descent, the gravitational acceleration acting on the leading pulse is slightly more intense than the acceleration on the trailing pulse. This differential in the acceleration manifests as an intrinsic separation of the pulses. During the ascent, the situation is reversed; the gravitational acceleration acting on the leading pulse is slightly* less intense *than what is experienced by the trailing pulse. In other words, the trailing pulse is being "dragged back" more than is the leading pulse. Consequently, there is again an intrinsic separation of the pulses. (Gravitational acceleration:* $a=-\frac{GM}{r^2}$*).*

What is true of light pulses, or a train of light pulses, is also true of the length of the lightwave itself. The logic that applies to periodic light pulses also applies to the wavelength of any electromagnetic radiation. (The proof of wavelength elongation is presented in Section 5.)

4. Essential Aspects of the Lightwave Particle and the Space Medium

4.1. Introduction

Let us turn to the situation —that of light waves crossing a gravity well— at a more fundamental level. There are certain essential aspects that need to be discussed in preparation for the upcoming in-depth analysis.

First, it must be understood that the particle of light, the photon, is an extended entity —it has a longitudinal dimension. As physicists like to say, the photon is not a point-like object. According to quantum theory "photons are not located at a point but are spread out as a probability wave." It may also be viewed as a packet of energy whose density is distributed along the wave —along its wavelength. For the purpose of the analysis, the photon's essential feature is that it has a front end and a back end.

Second, light requires an ethereal medium for propagation. As Poincaré long ago explained, when a packet of light streams from a distant star on its way to Earth, it is no longer at the star and it is not yet at the Earth. It is somewhere in between. While it is there "somewhere in between," how is its location to be defined (irrespective of its origin and of its future observer)? What holds it in its place? Moreover, in the absence of an observer how does it know that it has to travel with a speed of 300,000 km/s? Poincaré concluded, "It must be somewhere, and supported, so to speak, by some material agency." [6] He was right, light had to be supported by a medium. His error, however, was to call it a material agency.

Third, an ethereal medium is required for conveying the gravitational effect. The existence of a "space" medium is essential.

4.2. The Space Medium

The use of a space medium by physicists is exceedingly common and imaginatively diverse. The most common descriptives include *the fabric of space*, *the quantum foam*, and *the vacuum ocean*. Every fundamental type of particle is said to have its own fluid-like "field." An electromagnetic fluid permeates all space and supports particles of light. The *Higgs fluid* that also permeates all space is said to bestow the property of mass onto particles. It is interesting to note that the dynamics of *general relativity* can be replicated by a fluid-flow theory. Other space-medium examples include *essence* and *quintessence*. Science writer Tom Siegfried describes the latter as follows: "Quintessence, supposedly, would be a 'field,' some sort of mysterious fluid permeating all of space, like Aristotle's fifth essence [element]." [7] It is said to be "…some bizarre form of matter-energy that differs from Einstein's cosmological constant in an important respect —it isn't constant." [7] Read the previous sentence carefully. Notice what is being invoked here, a space medium of "matter-energy." And recognize this is a modern repeat of Poincaré's error of equating the space medium (aether of antiquity and the quintessence of modernity) with some material agency.

A space medium is positively essential. Without some conducting medium there would be no propagation of light. Einstein, in the early 1920s, stated clearly, in speech and in writing, "According to the general theory of relativity space without aether is unthinkable; for in such space there … would be no propagation of light." [8]

Evidently, empty space is much more than nothingness. In the words of Sir Arthur Stanley Eddington, "In any case the physicist does not conceive of space as void. Where it is empty of all else there is still the aether. Those who for some reason dislike the word aether, scatter mathematical symbols freely through the vacuum, and I presume that they must conceive some kind of characteristic background for these symbols." [9]

Yes, it turns out that the universe's background 3-dimensional space is permeated by aether. No, not the 19th-century physical aether. Not at all. The modern aether, in its static state, is not any sort of mass-or-energy medium. Rather, it is —and I emphasize, *in its static state*— nonphysical in conformity with Einstein's medium. After stating the condition that without aether "in such space there … would be no propagation of light," Einstein then makes it quite clear, "But this aether may not be thought of as endowed with the quality characteristic of ponderable media…" [10] In other words, Einstein's aether was *nonmaterial*.

However, while Einstein believed the aether to be a nonmaterial *continuum*, the aether of the real world is a dense sea of discrete entities —nonmaterial, of course. It is these entities that are intimately involved in the conduction of electromagnetic waves/particles.

For the phenomenon of the conduction-propagation of light, the unavoidable and unambiguous premise is this: There are fundamental fluctuating entities (entities of a mechanical aether) everywhere within otherwise empty space; and "everywhere" means exactly that, *everywhere*. And let me point out, physicists do agree, in fact, they insist that this is the case. They describe it as a bubbling foam at the smallest quantum scale. But the big difference —a world of difference— is that the vibratory activity of their entities represent a form of energy, whereas our fundamental space-medium entities possess no energy (as energy is normally defined). So here is the situation, with a spatially-dense ubiquitous aether; a propagating packet of light, then, cannot simply squeeze between the fluctuating entities, for there is no in-between gap, and must therefore propagate *through* the fluctuating entities. In other words, light must be conducted by the fluctuators *of* the space medium. When I say "the fluctuators of the space medium" I mean that the space medium consists entirely of these fluctuators. For reasons that will not be discussed here, these fluctuators need not, and are not, equated with any form of energy. They are simply considered to exist as subquantum entities. Within DSSU theory, where they play a major role, they are described as fundamental essence pulsators —discrete entities which are simultaneously real *and* nonphysical. They are "real" in the sense that they persist under normal conditions (absence of excitation, absence of compression-like stress) and they are "nonphysical" in the sense that they possess no energy and no mass.

In addition to serving as the conducting medium for the propagation of light, the space medium is required for conveying the gravitational effect. It is the acceleration of aether that is the essential mechanism of gravity. The inhomogeneous flow of aether is what makes gravity work. (It is the space medium's dynamic ability to expand and contract that allows aether to function as the causal mechanism of gravity, as described in DSSU theory and supported by Reginald T. Cahill's mathematical model.) For the purpose of the following analysis, the only thing we need to know about the aether theory of gravity is the aether flow equation, whose derivation is given in the Appendix.

The groundwork has been laid: A photon is a lengthwise extended particle. By absolute necessity, it propagates within a nonmaterial space-permeating medium. And this medium, the nonponderable aether, is dynamic and possesses self-motion. We are, thus, ready for a definitive analysis of photon propagation.

5. Analysis of Photon Propagating Through a Gravity Well

The following analysis makes use of the photon as an extended particle embedded in a kinetic and dynamic aether —all in accordance with the aether theory of gravity that underlies DSSU cosmology [11] [12].

Any background aether flow is unimportant and can be ignored. It is simply assumed that the gravitating body is isolated and at-rest in the space medium.

The purpose here is to show that *both paths—the one in and the one out— cause wavelength elongation*.

5.1. Detailed Analysis of Lightwave (Photon) During Descent

Consider a photon propagating into a gravity well produced by a central mass body. By simple inspection (see Figure 8), it should be apparent that the front end of the photon is moving forward faster than the back end. The front and back ends seem to be moving apart (analogous to the way the two spaced meteoroids were moving apart).

The first step in the analysis is to confirm that the two ends are moving apart.

We subtract the velocity of the nearer end from the more distant end (with respect to the center of gravity).

$$\begin{aligned}&(\text{Relative velocity between ends of photon})\\&= (\text{vel. of distant end}) - (\text{vel. of near end})\\&= (-c + \upsilon_2) - (-c + \upsilon_1)\\&= (\upsilon_2 - \upsilon_1) > 0,\end{aligned} \tag{13}$$

where υ_2 and υ_1, are the radial velocities of the aether flow.

Since υ_2 is higher on the velocity scale than υ_1, the expression must be positive. Hence, there is a velocity of separation between the two ends of the photon.

Note the intrinsic nature of the situation. Special Relativity does not apply here. The reasons should be obvious. Consider the question of where to place the "observer" to whom *the velocities to be summed* are to be referenced. An *observer* at the center of gravity (at $r = 0$, Figure 8) obviously cannot see a receding photon. An *observer* riding the back end of the photon attempting to measure the change in the distance to the front end faces a different problem: Moving at the speed of light, his time stops and he will therefore be unable to measure anything. Moreover, Equation (13) is not a relative motion in the conventional Einstein sense. The velocity difference is the consequence of the constancy of the speed of light with respect to the conducting medium —a medium whose own velocity is not exactly the same at the front and back ends of the photon. While the constancy of the propagation speed *is* a Special Relativity feature, the variation in the motion of the aether is not.

The point is, it is not an observable situation. Only the accumulated result is observable when the photon is eventually detected and its wavelength measured.

This moving-apart velocity of Equation (13), the elongation of the photon wavelength, can be expressed as $d\lambda/dt$. Furthermore, it is proportional to the wavelength λ itself. That is, $d\lambda/_{dt} \propto \lambda$. Expressed as an equation,

$$\frac{d\lambda}{dt} = k\lambda \,, \tag{14}$$

where k is the parameter of proportionality, the fractional time-rate-of-change parameter, and

$$k = \frac{1}{\lambda}\frac{d\lambda}{dt} \,. \tag{15}$$

Notice, in Figure 8, that the photon's wavelength is $\lambda = (r_2 - r_1)$. And $d\lambda/dt$ is simply the velocity difference between the photon's two ends, which difference, from Equation (13) above, is $(\upsilon_2 - \upsilon_1)$. Then,

$$k = \frac{(\upsilon_2 - \upsilon_1)}{(r_2 - r_1)} \,, \tag{16}$$

which, by definition and by simple inspection, is just the slope of the curve (in this case, the aether-inflow velocity function).

The expression for approximating the aether-flow velocity, as derived in the Appendix, is

$$\upsilon_{\text{aetherflow}} = -\sqrt{2GM/_{r}} \,, \tag{17}$$

where $r \geq$ (radius of mass M), G is the gravitational constant, and M is the spherical gravitating mass.

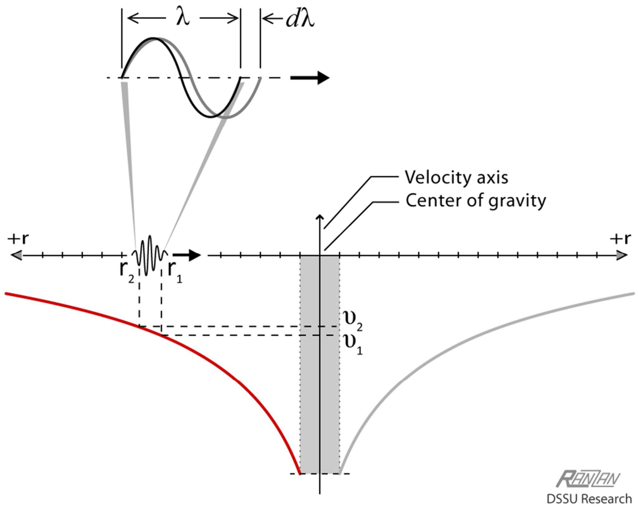

Figure 8. *Photon elongation during inbound propagation through the gravity well. The photon is being conducted by a space medium whose speed of inflow increases with proximity to the gravitating structure. As a result, the front and back ends of the photon "experience" a flow differential. The wavelength increases during the descent into the gravity well, which is shown here by its aether-flow velocity curve.*

And the slope of the velocity curve is just the derivative

$$\frac{d\upsilon}{dr} = \frac{d}{dr}\left(-\sqrt{2GM/r}\right) = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \tag{18}$$

Thus the slope k can be expressed for any radial location, r, as

$$k(r) = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \tag{19}$$

With the substitution of Equation (19) into Equation (14), the λ-growth expression becomes

$$\frac{d\lambda}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right)\lambda \,, \tag{20}$$

or equivalently (by using the chain rule)

$$d\lambda\frac{dr}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right)\lambda dr \,. \tag{21}$$

But dr/dt is just the velocity of the photon itself, which is $-c$. It has a negative sign because it is in the negative direction along the radius axis. And so

$$\frac{d\lambda}{\lambda} = -\frac{1}{2c}\sqrt{2GM}\left(r^{-3/2}\right)dr \,. \tag{22}$$

The wavelength, as a function of radial distance, is found by simply integrating Equation (22) from *initial* to *final* "values":

$$\int_{\lambda_i}^{\lambda_f}\frac{d\lambda}{\lambda} = -\frac{1}{2c}\sqrt{2GM}\int_{ri}^{rf}\left(r^{-3/2}\right)dr \,. \tag{23}$$

$$\ln\lambda\Big|_{\lambda_i}^{\lambda_f} = -\frac{1}{2}\sqrt{2GM/_{c^2}}\left(-2r^{-1/2}\right)\Big|_{r_i}^{r_f} \,,$$

$$\ln \lambda \Big|_{\lambda_i}^{\lambda_f} = \sqrt{2GM/c^2}\left(r^{-1/2}\right)\Big|_{r_i}^{r_f},$$

$$\left(\begin{array}{l}\leftarrow \text{This step just cancels out} \\ \text{the previous two negatives.}\end{array}\right)$$

$$\ln \lambda_f - \ln \lambda_i = \sqrt{2GM/c^2}\left(r_f^{-1/2} - r_i^{-1/2}\right),$$

$$\ln\left(\frac{\lambda_f}{\lambda_i}\right) = \sqrt{2GM/c^2}\left(r_f^{-1/2} - r_i^{-1/2}\right),$$

$$\frac{\lambda_f}{\lambda_i} = \exp\left(\sqrt{2GM/c^2}\left(r_f^{-1/2} - r_i^{-1/2}\right)\right). \tag{24}$$

This expression gives the ratio of the *intrinsic* "final" and "initial" wavelengths, for light propagating *into* a gravity well. It may be applied to the wavelength of the light or to the gap (the distance) between periodic light pulses.

Now for the corresponding *intrinsic* redshift: We make use of the basic redshift expression, which is, by definition,

$$z = \frac{\lambda_f - \lambda_i}{\lambda_i} = \frac{\lambda_f}{\lambda_i} - 1, \tag{25}$$

$$z_{\text{intrinsic}} = \exp\left(\sqrt{2GM/c^2}\left(r_f^{-1/2} - r_i^{-1/2}\right)\right) - 1. \tag{26}$$

Consider a simple example; and remember, we are regarding the gravity source in isolation and assuming the absence of any other gravity wells. Light that has travel from a significant distance to reach Earth will have acquired an intrinsic spectral shift as follows:

(With the insertion, into Equation (26), of the values $c = 3.0 \times 10^8\ \text{m·s}^{-1}$; $G = 6.673\times10^{-11}\ \text{N·m}^2\text{·kg}^{-2}$; $M_E = 5.98\times10^{24}$ kg; $r_{\text{initial}} \approx \infty$, and $r_{\text{final}} = R_E = 6.37\times10^6$ m);

$$z_{\text{intrinsic-E}} = \exp\left(\sqrt{2GM_E/c^2}\left(R_E^{-1/2} - 0\right)\right) - 1;$$

$$z_{\text{intrisic-E}} = 0.000\,03733.$$

The value, as expected, is positive—identifying it as a redshift. And it is clearly contrary to the Sachs-Wolfe prediction of a blueshift!

5.2. Detailed Analysis of Lightwave During Ascent

Next, we consider a photon propagating through the ascending half of a gravity well. We again find that the front end of the photon is moving forward faster than the back end. See Figure 9. By subtracting the velocity of the nearer end from more distant end (with respect to the center of gravity), we confirm that the two ends are moving apart.

(Relative velocity between ends of photon)

= (vel. of distant end) − (vel. of near end)

$= (+c + \upsilon_1) - (+c + \upsilon_2)$

$$= (\upsilon_1 - \upsilon_2) > 0, \tag{27}$$

where υ_1 and υ_2, are the radial velocities of the aether flow.

Since υ_1 is higher on the velocity scale than υ_2, the expression must be positive. Hence, there is a velocity of separation between the two ends of the photon. (And be reminded that (i) the gravitating body is at-rest within the *space medium*, (ii) consequently, the aether flow is simply described by Equation (17), and (iii) the aether flow is with respect to background Euclidean space.)

The moving-apart velocity of Equation (27), can be expressed as a differential equation,

$$\frac{d\lambda}{dt} = k\lambda, \tag{28}$$

where k is the parameter of proportionality, the fractional time-rate-of-change parameter, and

$$k = \frac{1}{\lambda}\frac{d\lambda}{dt}. \tag{29}$$

Notice, in Figure 9, that the photon's intrinsic wavelength is $\lambda = (r_1 - r_2)$. And $d\lambda/dt$ is again the velocity difference between the photon's two ends, which difference, from Equation (27) above, is $(\upsilon_1 - \upsilon_2)$. Then,

$$k = \frac{(\upsilon_1 - \upsilon_2)}{(r_1 - r_2)}, \tag{30}$$

which, by definition, is just the slope of the curve (the aether-inflow velocity function in Figure 9).

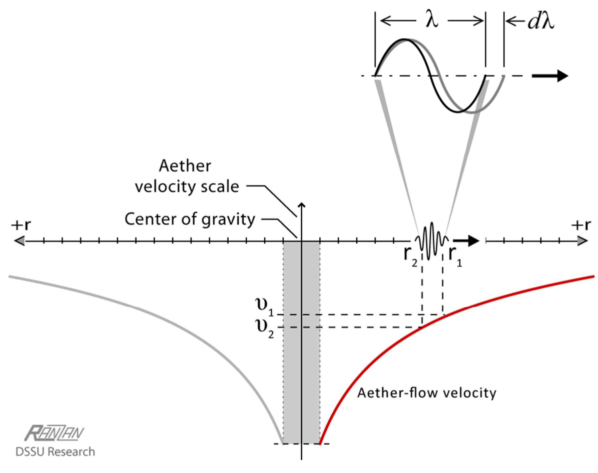

Figure 9. *Photon elongation during* outbound *propagation through a gravity well. The photon is being conducted by aether whose speed of inflow increases with proximity to the gravitating structure. As a result, the front and back ends of the photon "experience" a flow differential. The wavelength increases during the ascent within the gravity well (which is shown here by its aether-flow velocity curve).*

The slope of the curve in the figure is the derivative, with respect to r, of

$$\upsilon_{\text{aetherflow}} = -\sqrt{2GM/r} \text{ . (from Appendix)} \qquad (31)$$

Previously, the slope (expressed as a function of r) was found to be

$$k(r) = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \qquad (32)$$

Combining Equations (29) and (32), we get

$$\frac{1}{\lambda}\frac{d\lambda}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \qquad (33)$$

Apply the chain rule to obtain

$$\frac{1}{\lambda}\frac{d\lambda}{dr}\frac{dr}{dt} = \frac{1}{2}\sqrt{2GM}\left(r^{-3/2}\right). \qquad (34)$$

But dr/dt is just the velocity of the photon itself, which in this case is $+c$ since *the propagation is in the positive direction along the radius axis*. And so the λ-growth expression simplifies to

$$\frac{d\lambda}{\lambda} = \frac{1}{2c}\sqrt{2GM}\left(r^{-3/2}\right)dr . \qquad (35)$$

The wavelength, as a function of radial distance, is found by simply integrating between "initial" and "final" limits:

$$\int_{\lambda_i}^{\lambda_f}\frac{d\lambda}{\lambda} = \frac{1}{2c}\sqrt{2GM}\int_{r_i}^{r_f}\left(r^{-3/2}\right)dr . \qquad (36)$$

After completing similar steps detailed in the previous section, we obtain a slightly different equation (note carefully the radius subscripts),

$$\frac{\lambda_f}{\lambda_i} = \exp\left(\sqrt{2GM/c^2}\left(r_i^{-1/2} - r_f^{-1/2}\right)\right), \qquad (37)$$

where G is the gravitational constant, M is the gravitating mass, and $r \geq$ (radius of mass M).

This expression gives the ratio of the *intrinsic* "final" and "initial" wavelengths, for light propagating out of a gravity well. It may be applied to the wavelength of the light or to the distance between periodic light pulses.

And here is the corresponding *intrinsic* redshift:

$$z = \frac{\lambda_f - \lambda_i}{\lambda_i} = \frac{\lambda_f}{\lambda_i} - 1 ,$$

$$z_{\text{intrinsic}} = \exp\left(\sqrt{2GM/c^2}\left(r_i^{-1/2} - r_f^{-1/2}\right)\right) - 1 \qquad (38)$$

If we evaluate this for the isolated-Earth example (using the values $c = 2.997 \times 10^8$ m·s^{-1}; $G = 6.673\times10^{-11}$ N·m^2·kg^{-2}; $M_E = 5.98\times10^{24}$ kg; $r_{\text{initial}} = R_E = 6.37\times10^6$ m, and $r_{\text{final}} \approx \infty$), we find the outbound journey's redshift to be:

$$z_{\text{intrinsic-E}} = \exp\left(\sqrt{2GM_E/c^2}\left(R_E^{-1/2} - 0\right)\right) - 1 ;$$

$$z_{\text{intrisic-E}} = 0.000\,03733. \text{ (Outbound)}$$

Again, there is a redshift. It is identical to the redshift acquired during the inbound portion of the journey.

5.3. Total Redshift Across Example Gravity Well

The total redshift across an isolated Earth-like gravity well is calculated as follows:

(Total redshift factor)

= (Inbound redshift factor) × (Outbound redshift factor)

$(1+z_{\text{total}}) = (1+z_{\text{inbound}})\ (1+z_{\text{outbound}})$

$z_{\text{Earth}} = (1.000\,03733)^2 - 1.0$

$= 0.000\,07466.$

5.4. Apparent Wavelength Versus the Intrinsic Wavelength

There is a crucial distinction between the observable redshift and the intrinsic redshift.

The intrinsic shifts are not directly observable from inside the gravity well. The underlying reason is that any observer inside the well is always, and everywhere, under the influence of accelerated motion with respect to the inflowing space medium (aether). For instance, the seemingly "stationary" observer positioned on the Earth's surface is subject to an upward acceleration of 9.8 meters per second per second. And as part of the same mechanism, the observer is subject to a constant relative-to-aether motion of 11.2 kilometers per second (ignoring the background aether flow that surrounds the well). What this means is that Earth-surface detectors, by virtue of location, are in radially upward "motion"; consequently, incoming light waves and pulses are subject to a Doppler effect and a clock-slowing factor.

Earth observers are impaired in detecting the velocity-differential redshift (intrinsic redshift) of incoming light because the medium conveying the light is itself accelerating towards the gravitating body. In the case of the Earth example, the associated surface speed of the inflow, per Equation (31), is 11.2 km/s. This introduces a *Doppler* blueshift effect —but is unrecognized within conventional gravity theory. … The main reason that the intrinsic redshift is not observed is attributed to the canceling effect of the Doppler blueshift. For the Earth example, the two cancel each other to within 4 significant digits. (For inbound light reaching the Earth's surface, the velocity-differential redshift is 0.000,03733 and the Doppler blueshift is −0.000,03733.)

At the bottom of a gravity well, instead of detecting any loss in energy, one actually measures a gain in energy. For meteors there is an obvious gain in kinetic energy, and for light pulses the energy gain comes from the gravitational blueshift (the "Einstein shift"). The Earth-surface observer will measure an increase in the frequency of incoming pulses —an increase of almost 7 pulses per 10 billion (corresponding to a gravitational blueshift of $z = -6.965\times10^{-10}$). The observer will conclude that the train of pulses and the light has gained energy from the gravity field; and that there has been a corresponding decrease in wavelength. But it is an illusion. We seem to be stationary observers, but we are not. The illusion is the consequence of our unavoidable accelerated motion —inherent in our accelerating Earth-surface frame of reference.

The thing to understand is that the velocity differential shift is an intrinsic feature. It is independent of the observer. The photons, or light pulses, do not care who is doing the observing or what motion the observer is undergoing. A quantum of electromagnetic radiation has an intrinsic wavelength —a wavelength that changes in accordance with changes in the gravitational-and-luminiferous aether.

Since our main interest lies with cosmic-scale gravity wells, let me put the Earth's well into perspective. In the course of measuring the intrinsic wavelength from astronomical and cosmic sources, the distorting influence of the Earth's gravity well is negligible. However, astronomers are careful to make compensating corrections for Earth's Doppler motion caused by its orbit about the Sun. They then refer to the 'corrected' redshift as being heliocentric. The idea is to record, as near as possible, the intrinsic wavelength (and redshift).

6. Photon Propagating Through a Cosmic Gravity Well

A typical cosmic gravity well can be modeled by selecting a significant amount of mass, say a galaxy cluster, and surrounding it with large relatively empty regions. The empty regions, or Voids, separate our chosen galaxy cluster from neighboring clusters. Since these clusters are gravitationally "pulling" on each other, cosmic tension manifests across and within the Voids. And when the universal medium is subjected to cosmic tension, it expands. It expands in the sense that there is an ongoing emergence of new aether. We treat this expansion/emergence process of aether as being axiomatic. While the Voids serve as the font of aether, the galaxy cluster plays the countervailing consumptive role.

The velocity profile of such a gravity domain is shown in Figure 10. The aether emerges from the Voids and flows toward the cluster. As it flows, the aether is absorbed and dissipated within the cluster and its gravitational field. The volume of on-going emergence is balanced by the volume of continuous contraction. The rate of expansion, in terms of volume, is matched by the rate of contraction. Consequently, the overall size of the well does not change. Essentially, what we have is a *steady-state cosmic gravity well* —a gravity sink in accordance with the DSSU-cosmology theory.

We have a simplified version of a cosmic gravity CELL of the Dynamic Steady State Universe.

The nominal diameter of the representative gravity well is 350 million light years. The galaxy cluster, with a mass of 3×10^{15} Suns, a mass considered to be typical for large clusters, occupies the central 20 million light years. The total contractile portion of the well, consisting of the cluster and its extended gravitational field, occupies the central 110 million light years. And the largest region, the part between the contractile field and the outer limits, is the zone of aether emergence. The velocity curve of the latter region is linear. It is linear to reflect the homologous nature of the space-medium expansion. It was constructed so that it runs tangent to the cluster's gravity field. The gravity field's velocity curve is proportional to $1/\sqrt{r}$; this portion of the curve is simply a graph of the inflow equation (from the Appendix) for the central mass (of 3×10^{15} Suns). Dimensions, of the three regions, are shown in Figure 11.

We follow the photon as it journeys across the cosmic cell; all the while, the photon acquires velocity-differential redshifts from within the cell's defined regions. Imagine the photon starting at the left-hand Void center where the aether flow is zero. The photon travels through 120 million lightyears of uniformly expanding aether and acquires a redshift,

$$z_1 = \left(e^{kt} - 1\right),$$

where k is the slope (which is positive in Figure 10) and t is the transit time (which is 120 million years). The derivation of this equation is found in reference [12].

$z_1 = 0.004132$. (Inbound redshift within expansion zone.)

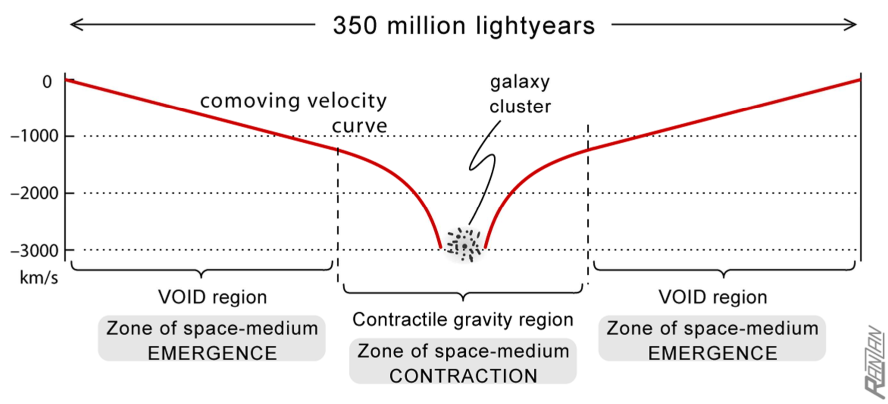

Figure 10. *Velocity profile of a steady-state cosmic gravity well. The void region is where the space medium continuously emerges. The rate of emergence is constant; hence, this region's flow velocity is linear. The contractile gravity region is where the space medium undergoes contraction. The inflow velocity in the curved region is proportional to 1/√r.*

Next, the photon propagates through the inbound portion of the contractile-gravity field. The redshift acquired during this phase may be calculated using the equation derived earlier, Equation (26),

$$z_{\text{intrinsic}} = \exp\left(\sqrt{2GM/c^2}\left(r_{\text{f}}^{-1/2} - r_{\text{i}}^{-1/2}\right)\right) - 1 .$$

With cluster mass M equal to 3×10^{15} Suns, and r_{initial} and r_{final} equal to 55 and 10 million light years respectively, we have

$z_2 = 0.005581$. (Inbound redshift within contractile field.)

Next comes the passage through the cluster itself. This is a region "filled" with large and small gravity wells —the overlapping gravity wells of all the individual galaxies and objects that comprise the cluster. The rule is: Whenever light traverses any gravity well, it acquires a velocity-differential redshift. And so, the process of intrinsic redshifting continues within the interior of the galaxy cluster. As photons pass through those sub-domains, they continue to acquire velocity-differential redshift. For the intra-clusteral region, a reasonable estimate is made; a redshift index of 0.004544 is assigned.

$z_3 = 0.004544$. (Estimated redshift within cluster interior.)

For the outbound leg of the contractile-gravity field, we use the previously derived equation (Equation (38)):

$$z_{\text{intrinsic}} = \exp\left(\sqrt{2GM/c^2}\left(r_{\text{i}}^{-1/2} - r_{\text{f}}^{-1/2}\right)\right) - 1 .$$

where mass M remains the same, while r_{initial} and r_{final} are equal to 10 and 55 million light years respectively. The resulting velocity-differential redshift is

$z_4 = 0.005581$. (Outbound redshift within contractile field.)

Lastly, there is the outbound journey through 120 million lightyears of the homologous expansion zone. (Remember, it is not the region that is expanding; but only the aether within it.) The calculation is identical to the inbound linear segment. So that

$z_5 = z_1 = 0.004132$. (Outbound redshift within emergence zone.)

Total intrinsic redshift across a cosmic cell. Throughout a photon's unobstructed journey spanning the cosmic well, the velocity-differential mechanism is active. The increments of the fractional wavelength elongations are shown in Figure 11. The total value may be approximated by a simple summation. However, because of the compounding nature of the wavelength elongation process, the proper method of calculating the effective total zCC across the cosmic cell is by multiplication:

$1 + z_{\text{CC}} = (1 + z_1)\,(1 + z_2)\,(1 + z_3)\ \ldots\ (1 + z_5)$

$= (1.004132)\,(1.005581)\,(1.004544)\,(1.005581)\,(1.004132)$

$= 1.0242.$

Thus, the estimated total redshift is 0.0242.

7. Prediction Agrees with Observational Evidence

The real Universe is a world of galaxy clusters and voids —a world filled with cosmic cells. Wherever one cell ends, there, another cell begins. Gravitational domains, one after another, without end. They exist not as something that Nature made, or fabricated, but rather as something that Nature sustains. The cosmic cells exist —in the sense of being sustained— in all directions and for all time.

Given that these cells are stable and nonexpanding, they naturally preclude any sort of universe-wide expansion or acceleration. In other words, these steady-state cells define a steady-state nonexpanding, cosmos. It is called the Dynamic Steady State Universe. Let us see how it compares with the observational universe as pieced together by astronomers.

The focus of the comparison is on the relationship between cosmic distance and cosmic redshift.

Any model of the universe, if it is to be of any practical use, must, in a predictive way, relate cosmic distance to the light of far-away sources. For the mind-created cosmos, there must be a theoretical distance relationship.

The real Universe, on the other hand, provides a strictly empirical relationship between distance and redshift. The relationship reveals itself in the physical measurements that have been gathered by astronomers over many years, often involving extremely sophisticated methods.

The predictive value of the model with the steady-state gravity wells will be assessed against the astronomically observed universe.

Graphing the distance-redshift function for the DSSU. A cellular universe requires a logarithmic distance-versus-redshift equation. Specifically, the DSSU, with its reasonably uniform cell-size and cell-stability, requires the following *redshift-distance law* [13]:

$$D(z) = \frac{\ln(1+z)}{\ln(1+z_{\text{cc}})} \times D_{\text{cc}} ,$$

where D_{CC}, is the cell diameter, 350 Mly. And z_{CC} is the intrinsic redshift acquired over that distance. The value of z_{CC} (see Figure 11) is based on two discernible features: cell diameter and cluster mass. This is significant; it means the DSSU distance function has no arbitrarily adjustable parameters.

The function is plotted, as the solid curve in Figure 12, and represents the distance predicted for the nonexpanding cellular universe (the DSSU).

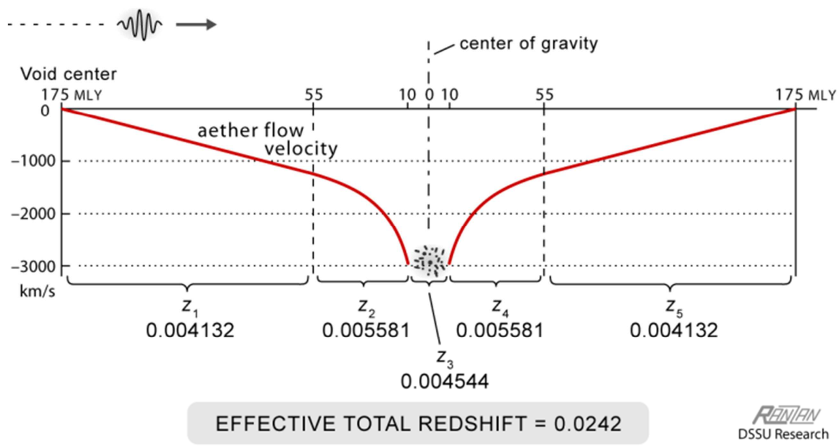

Figure 11. *Velocity-differential redshifts acquired during photon propagation across a representative steady-state cosmic gravity well. The journey takes 350 million years and causes the wavelength to elongate, making the final wavelength 1.0242 times the initial. The change corresponds to the redshift index of 0.0242 shown.*

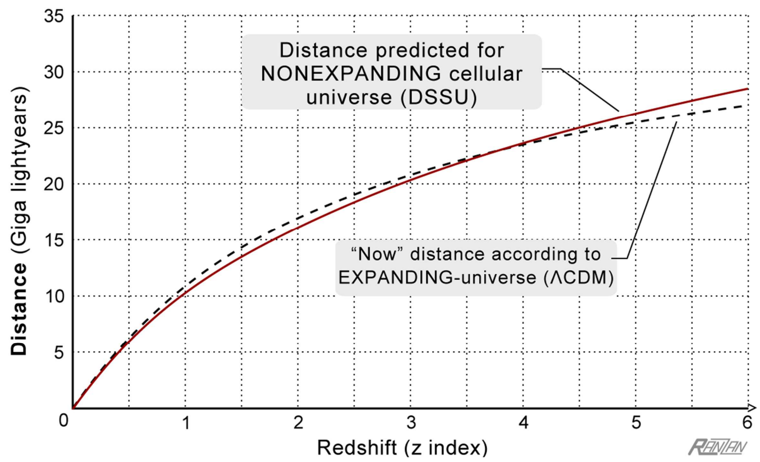

Figure 12. Cosmic redshift versus cosmic distance. *The redshift index of received light is plotted against the distance of the light source. The solid curve shows what is predicted for the nonexpanding universe of steady-state cosmic gravity wells. The dashed curve gives the "now" distance according to the standard expanding model, i.e., the ΛCDM model. Despite the radical difference, they both agree with the observational evidence; they both fit inside the distance-tolerance limits generally agreed to be within 5 to 10% of the dashed line. (DSSU model specs: z_{CC} = 0.0242, D_{CC} = 350 Mly) (The ΛCDM model specs: H_0 = 70.0 km/s/Mps, Ω_M = 0.30, Ω_Λ = 0.70, as calculated with Edward Wright's Cosmology Calculator, www.astro.ucla.edu/~wright/CosmoCalc.html.)*

The dashed curve in Figure 12 represents the theoretical Lambda-Cold-Dark-Matter (ΛCDM) model, which adherents have designed so as to provide a "best fit" to the data that astronomers have actually accumulated. However, the model fits only if one applies the measured redshift (measured directly or indirectly) to the "now" distance of the emitting source, not to the "emission" distance of the source. The astronomical observations, of course, are theory independent; the redshift, itself, does not say how it is related to distance. The measuring of redshifts is pretty straight forward. The challenge is determining the corresponding distances. Astronomical observations, therefore, included methods independent of the redshift, methods such as the use of "standard distance candles" and, notably, the use of intrinsic properties of a certain class of supernovae. A recent example is the Supernova Legacy Survey. The ΛCDM model curve also makes use of the final observed results of the Wilkinson Microwave Anisotropy Probe, which determined that the rate-of-expansion parameter $H_o = 70^{+}/_{-}\ 2.2$ km/sec/Mpc [14]. This parameter is a key component of the ΛCDM model, which many consider to be the standard model of Expansion cosmology because of its agreement with observations [15].

Based on the convergence of the observations —measurements independent of cosmology theory— astronomers believe the distance-redshift correlation lies within 5 to 10% of the dashed distance curve (Figure 12). Or stated another way, the ΛCDM-theory curve fits inside the tolerance allowed by the observational data, a tolerance range of 5 to 10% (the greater the distance, the wider the margin).

Now compare the two curves. Both agree with observations, both are within the 5 to 10% tolerance. The DSSU prediction curve, with an absence of free parameters, works just as well as the ΛCDM theory curve, with an abundance of free parameters. Remarkably, the DSSU distance-redshift formulation does not need the speed-of-light constant and the Hubble constant; in contrast, the conventional formulation will not work without them.

But here is what should raise eyebrows: The DSSU prediction curve fits like a glove and yet does not require the universe to blow itself apart into a state of regressive dilutedness and irrelevance. But this is just what the standard model calls for. The ΛCDM version, as well as its broader genre, demands the most outrageous hypothesis ever conceived within the domain of science.

The take-away point is this: When the velocity-differential interpretation of cosmic redshift is ignored, as is done by the Sachs-Wolfe adherents, the observable Universe makes little sense. When the velocity-differential mechanism is omitted from a theoretical cosmology, the ensuing model must fail. The inevitable outcome is, to borrow the term popularized by Sean M. Carroll, *a preposterous universe*. One ends up predicting effects that are not real.

8. Summations and Implications

"... we may have an exciting opportunity to understand the universe on a deeper level than we currently know." – University of Hawaii astronomer István Szapudi [16]

Gravitational versus intrinsic shifts. The gravitational shift (the Einstein shift) and the intrinsic shift are decidedly different. The *gravitational shift* encodes the observable wavelength for an observer stationed within a gravity well; it depends on the observer's location. The *intrinsic shift* is a cumulative effect and is observer-independent.

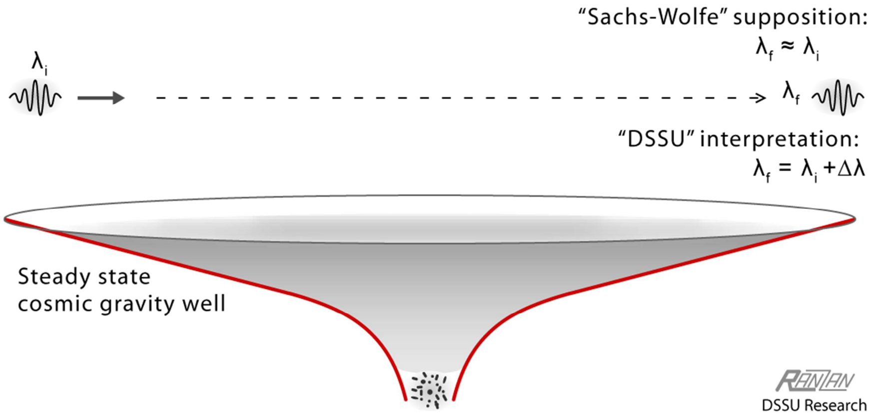

Figure 13. *For the given steady-state cosmic gravity well, one whose diameter remains for the most part constant, one theory predicts no net spectral shift while the other predicts a significant redshift. Why? Because the DSSU incorporates the velocity-differential redshift mechanism, which the Sachs-Wolfe adherents have simply failed to recognize.*

Intrinsic wavelength versus Sachs–Wolfe wavelength —predictions. Given the steady-state cosmic gravity well, shown in Figure 13, a Sachs–Wolfe observer expects to obtain an entirely different measurement from the one expected by the DSSU observer. With the diameter of the well remaining constant, the Sachs–Wolfe adherent is bound by theory to predict that there will be no spectral shift for an undisturbed transit across the gravity well. The DSSU theorist predicts an unmistakable redshift. What the one theory ignores and the other theory embraces is the *velocity-differential redshift* mechanism.

Hot and cold patches on the CMB. By advancing the Sachs–Wolfe concept, astrophysicists have seriously failed the astronomers. Under the Big Bang hypothesis, the Sachs–Wolfe effect is the dominant component causing the variation in the temperature anisotropy power spectrum. It is claimed to be the biggest contributor to the differences of the CMBR across the celestial map. According to the popular view, as professed by the experts, "Accelerated cosmic expansion causes gravitational potential wells and hills to flatten as photons pass through them, producing cold spots and hot spots on the CMB aligned with vast supervoids and superclusters. This so-called late-time Integrated Sachs–Wolfe effect is a direct signal of dark energy in a flat universe." The effect is considered to be highly significant [15]. The question now is: If the Sachs–Wolfe effect is disproved and is not the cause of the temperature patchiness of the celestial sphere, then what is?

Here is the new understanding. The cool and warm variations represent the cluster-and-void network at some cosmic distance corresponding to the redshift region z = 1000+. It is the light, having been ultra-redshifted, arriving after a long journey from a network that is fundamentally no different from our own corner of the Universe. The same steady-state dynamic gravitational processes are at play there as they are here. As they were then and as they are now. Now and forever.

More specifically, when the photons have journeyed predominantly through galaxy clusters, then they will be redshifted more (per Figure 11, clusters induce more redshift than voids) and will therefore produce a comparatively cool patch. On the other hand, if the journey happens to pass through a predominance of voids, then the result will be less redshift and a comparatively warm patch on the CMB map. It sounds counterintuitive at first glance, but is entirely consistent with theory and what is predicted by the values shown in Figure 11. And keep in mind, these photons originated from a distance of over 100 billion (10^{11}) lightyears away [11]. As a recap, in the context of DSSU cosmology the cooler spots and patches identify lines-of-sight along more and deeper cosmic gravity wells, while "warmer" spots and patches identify lines-of-sight along comparatively fewer and shallower gravity wells (and also more *gravity hills*).

The new velocity-differential interpretation of cosmic redshift fits the observational evidence just as competently as the expanding-space interpretation. The agreement with observational evidence (of the correlation between cosmic distance and redshift, Figure 12) was achieved by rejecting the key assumption built into the Sachs–Wolfe effect and its variants. Rejected was the notion that photons necessarily gain energy when they descend into a gravity well.

The argument used in this paper, in order to achieve compliance with that evidence, rests on a foundation of three incontrovertible features:

1. The particle of light, the photon, is an extended entity —it has a wavelength. It has a longitudinal dimension along the axis of its propagation.

2. The space of the Universe, by which is meant *space as a container* or the *background space* of three dimensions, is not a region of nothingness. It is permeated by an ethereal medium.

3. The influence of gravitation applies to photons. It can cause a change in the direction of propagation and a change in the wavelength.

The aether theory of gravity is highly useful but is probably not essential to the validity of the argument.

These features, or assumptions, if not self-evident, are certainly well-established. No reasonable person would deny their validity. So, an obvious question arises.

Why was this line of reasoning not considered by the designers and users of the Sachs-Wolfe effect? Why was such a self-evident argument not developed? Or if it was, why was it ignored? … The answer may be found in the long-standing overemphasis on relativity theory. Instead of confining the analysis to the photon, and to the medium in which it propagates, and to the background 3-dimensional framework (Euclidean space); the experts insisted on using an accelerating frame of reference. Their approach was, and is, to point out that we observers on the Earth's surface measure a small blueshift when light propagates into the Earth's gravity well. We, on the Earth's surface involuntarily accelerating at about 10 meters per second per second, measure an energy gain for descending photons. But the photons do not care what the observers are doing or how those observers are moving. The relativistic approach distracted the experts from the fact that photons really do have intrinsic properties.

From a historical perspective, it may be accurately said that Einstein's mathematical space was promoted, while his luminiferous aether was shunned. (See Einstein's quote, above.)

Yes, the emphasis was on space-time geometry. But almost no one looked at the much simpler meaning of "space." There was a strange aversion to the use of background 3-dimensional basic space and to let it serve as a universal container —as a repository for whatever one's theory favors, such as for Einstein's general-relativity fluid, or for the generic vacuum, or for the quantum foam, or for the *nonmaterial aether*. It is my long held opinion that the Sachs-Wolfe concept stems from the failure to make use of background Euclidean space *and* the failure to recognize the reality and the significance of the luminiferous aether. Had the experts turned to these, they might have found a properly functioning space medium. They might have found the aether as defined within DSSU theory —the broad worldview that has been conceptually and observationally validated [12].

Profound implications. The Big Bang believers tenaciously hang on to the Zachs-Wolfe effect and deny everything that doesn't accord with their simplistic worldview. It is a worldview they have been conditioned to accept, or have conditioned themselves to accept. Knowingly or unknowingly, they deny reality. They have to, otherwise their dream world would come crashing down and they would have to wake up to some very harsh truths and confront the profound implications.

The Universe does not expand.

The Universe does not accelerate.

The Universe does not have an expansion history.

There exists an intrinsic redshift, defined independently of the gravitational shift (the Einstein shift). Light propagates with an intrinsic wavelength.

The flaw that infects the Sachs-Wolfe hypothesis, also infects the Integrated Sachs-Wolfe, the Rees-Sciama effect, and the analysis of cosmic gravity wells in general.

In conclusion, it matters not whether the Sachs-Wolfe effect (and its sister effect, the Rees-Sciama) is applied to gravity wells or gravity hills; whether those wells and hills are growing and expanding, contracting and collapsing, or steady-state stable; its underlying assumptions are wrong. Its conclusions worthless.

Appendix: Basic Aether-Inflow Equation

The test mass shown in Figure A1 is resting on the surface of a large mass (an isolated-and-free-floating body). Although seemingly motionless, the object is "experiencing" acceleration. This acceleration may be described in two ways: The platform on which the test mass rests is accelerating it upward into the aether; meanwhile the inflowing aether is accelerating it downward toward the center of gravity. The two are perfectly balanced, as evident by the lack of motion (with respect to the surface).

The accelerating flow of the aether —the radially inward inhomogeneous flow— is the essential cause of the acceleration "experienced" by the test mass.

In order to express the flow mathematically, we take advantage of the fact that the acceleration of any object in freefall is equal to the acceleration of the aether flow (in accordance with DSSU theory). Object-in-freefall acceleration, of course, is directly proportional to the mass M of the gravitating body and inversely proportional to R^2 or r^2 (the square of the distance to the center of the body). The equation looks like this:

$$a = -(\text{constant}) \times \frac{M}{r^2} . \tag{A1}$$

The constant of proportionality is G, whose experimentally determined value is about 6.673×10^{-11} N·m^2/kg. For any location at, or above, the surface of the large mass, this acceleration expression describes a body in freefall as well as the aether inflow:

$$a = -G\frac{M}{r^2}\text{, where r} \geq \text{R.} \tag{A2}$$

Replace *a* with its definition *dυ/dt* and apply the chain rule:

$$\frac{d\upsilon}{dt} = \frac{d\upsilon}{dr}\frac{dr}{dt} = -\frac{GM}{r^2}\,. \tag{A3}$$

Then replace *dr/dt* with its identity υ, rearrange terms, integrate, and solved for the velocity:

$$\int \upsilon d\upsilon = -\int \frac{GM}{r^2}dr\,, \tag{A4}$$

$$\frac{\upsilon^2}{2} = -\frac{GM}{-r} + C\,. \tag{A5}$$

Now, since the test mass (in Figure A1) is stationary, located as it is at a fixed distance to the center of the large body, it means the velocity in the equation must be related to the aether. It must be related to the radial inflow of aether. Notice again, there are two perspectives here: The aether is streaming *downward* past the test mass; but one could also say, the small mass is travelling *upward* through the aether. Both interpretations are embedded in the equation (and are made explicit in the next set of equations). The integration constant *C* can be dropped by noting that when the radial distance is extreme then obviously the aether inflow, due specifically to mass *M*, must be virtually zero. (Keep in mind, the large body is assumed to be comoving with the cosmic background flow; meaning that there is zero relative aether flow.) This means *C* equals zero. Thus,

$$\upsilon^2 = \frac{2GM}{r} \quad\text{and}\quad \upsilon = \pm\sqrt{2GM/r}\,, \tag{A6}$$

where *G* is the gravitational constant and *r* is the radial distance (from the center of the mass *M*) to any position of interest, at the surface of *M*, or external to *M*. The positive solution expresses the "upward" motion of the test mass *through* the aether (in the positive radial direction). The negative solution represents the *aether flow velocity* (in the negative radial direction) streaming past the test mass.

The negative solution represents a spherically symmetrical inflow field—giving the speed of *inflowing aether* at any radial location specified by *r*.

In vector form:

$$\vec{\upsilon}_{\text{flow}} = -\sqrt{2GM/r} \times (\vec{r}_{\text{unit}})\,. \tag{A7}$$

When a background aether flow is also present, as happens with objects within galaxies, the expression is

$$\vec{\upsilon}_{\text{net flow}} = -\sqrt{2GM/r} \times (\vec{r}_{\text{unit}}) + \left(\vec{\upsilon}_{\text{background}}\right). \tag{A8}$$

A more detailed analysis of aether flow, in which a second gravitational constant "α" is included, is available in the works of physicist Reginald T. Cahill [17].

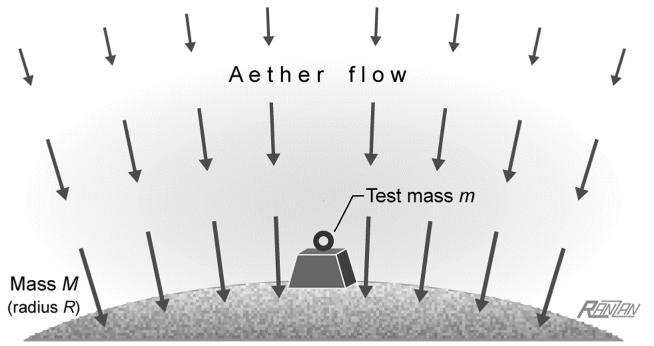

Figure A1. *Aether streams and accelerates towards and into the large mass. The "stationary" test-mass "experiences" the inflow acceleration as a gravity effect, and "experiences" the inflow speed as a radial component of absolute (aether-referenced) motion according to the formula (2GM/r)$^{1/2}$. The large body is assumed to be at rest within the universal medium.*

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