Space Flow Equations and Expansion-Contraction Rates

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In fact, [Newton] was convinced that the propagation of gravitational forces across space was in dire need of an explanation, but he simply didn't know of one. ... But he offered two explanations: Either there was the emission and absorption of tiny spheres that race across empty space and act as the carriers of gravity, or some sort of [a]ether transfers the action of gravity by its currents. –Henning Genz [1]

ABSTRACT: The focus is on the numerical aspects the *Space Postulates* of the DSSU (**D**ynamic **S**teady **S**tate **U**niverse). The simple equations for the space fluid, aether, are derived, including expressions that describe the contraction, expansion, comoving flow and bulk flow. In the process of formulating space flow this paper resolves the *mystery of anomalous redshifted galaxies*, reveals the three *causal mechanisms of gravity* (primary, secondary, tertiary), and deduces the existence and nature of *unified gravitation cells* (fields) of cosmic scale.

KEYWORDS: Cosmology, Non-expanding universe, Dynamic Steady State Universe, DSSU, Steady State, Cellular universe, DSSU postulates, Anomalous redshift, Aether, Aether dynamics, Aether acceleration, Expanding space, Contracting space, Space flow, Gravity, Unified gravity.

In this paper we consider some of the mathematical aspects of the *space expansion postulate* and the *space contraction postulate* of DSSU theory[2] —and some of the profound consequences.

1. Speed of Aether Inflow

We wish to determine the speed of inflow of aether-space towards and into an astronomical gravitating body. From the *gravity postulate* of DSSU theory we know that the contraction of space between the position of any unconstrained object and the center of the gravitating body, the Earth for example, causes the object to accelerate in that direction. Space contraction is part of the causal mechanism of the object's acceleration. Space contraction is also the cause of its own acceleration, the cause of the inflowing aether. But even more fundamental is the absorption/assimilation of aether by matter; it is this consumption that is the direct cause of the continuous inflow of aether.

It would be natural to suspect that the inflow speed has some connection with the speed of freefalling objects.

Let us consider an Earth-like gravitating body. And to remove all other sources of aether flow (such as the Moon, the Sun, and the Milky Way galaxy) we imagine our planet in deep cosmic space. We imagine an Earth-like planet completely isolated and experiencing no external aether flow (other than the self-induced intrinsic inflow).

Near its surface the simple Galilean laws of motion apply. If we drop a test object from a height of, say, 30 meters with initial freefall speed (v_0) equal to zero then its final freefall speed —just before it impacts the ground— will be

$$v^2 = (v_0)^2 - 2\,g\,(\text{change in height})$$
$$= 0 - 2\,(9.8\text{m/s}^2)\,(-30\text{m})$$
$$v = 24 \text{ m/s}\,,$$

where g is the gravitational acceleration near the surface of our isolated Planet.

And if the test object is dropped from a height of 500m then the final speed (ignoring air resistance) will be

$$v = 99 \text{ m/s}\,.$$

However, in both cases, the test mass is not comoving with aether.

Next we drop the object from, a height of 500 kilometers, about the altitude of a space-shuttle orbit. We again ignore air resistance. This time we use Newton's law of gravity and find that the final freefall speed just before impact will be

$$v_{FINAL} = 3{,}020 \text{ m/s}.$$

But our test object would still not be comoving with aether-space.

It is only when we 'drop' the test object from a distance vastly greater than the diameter (or radius) of the gravitating body, from a distance we may nominally consider to be infinite, that we will have a comoving situation.

What this means is that by determining the speed of freefall from a great distance we are also determining the speed of space inflow. An object that is comoving with aether, by definition, shares the same speed as that of the flow. (Speed relative to what? Speed relative to the astronomical body sucking in the aether.) Fortunately, we don't need anything more complicated than Newton's 2nd law of motion and Newton's law of gravity.

It may come as somewhat of a surprise but even when aether-flow speeds are near the speed of light Newton's laws still apply. This is not a situation of relativistic effects —effects that involve length contraction and time dilation. The relativistic equations are not needed here. The reason is simple. Relativistic equations apply only to the speed of particles and bodies ***through space*** and not the speed of aether itself (and its comoving companions).

Here is the straight forward derivation.

From Newton's 2nd Law of Motion $F = ma$.

From Newton's Law of Gravity $F = -GMm/r^2$.

Then $F = ma = -GMm/r^2$,

where a is the acceleration of our test mass m, M is the mass of the Earth-like body, $M \gg m$, G is the Newtonian gravitational constant, and r is the radial distance of the test object. The minus sign indicates that the force F (likewise a) decreases in magnitude as r increases.

The acceleration is, of course, the rate of change of speed (or velocity if using vectors). With this substitution and the cancellation of m the equation becomes,

$$a = \frac{dv}{dt} = -\frac{GM}{r^2} \ , \tag{1-1}$$

$$\frac{dv}{dr}\frac{dr}{dt} = -\frac{GM}{r^2} \ ,$$

$$\int_{v\ \text{initial}}^{v\ \text{final}} v\,dv = -\int_{r\ \text{initial}}^{r\ \text{final}} GMr^{-2}\,dr \ . \tag{1-2}$$

As the test mass 'falls' the magnitude of its velocity continuously increases while the radial distance continuously decreases. The expression for the freefall speed from a *great distance* is simply the integration of the elemental changes in speed over the entire radial motion from far-off $r_{\text{initial}} = \text{infinity}$ to some distance of interest where $r_{\text{final}} = r$. Noting, in the following equation, that at $r' = \infty$, $v' = 0$ and at $r' = r$, $v' = v$:

$$\int_0^{v} v'\,dv' = -\int_{\infty}^{r} GM\left(r'\right)^{-2} dr' \ ,$$

$$v^2 = 2GM/r \ ,$$

$$v = \pm(2GM/r)^{1/2} .$$

Thus, $$v_{INFLOW} = (2GM/r)^{1/2} \tag{1-3}$$

where $r \geq R$, the radius of the gravitating body.

This gives the inflow speed of aether at *any* radial distance from an isolated (at rest in the surrounding aether) gravitating body.

By inspection it is easy to see that v_{INFLOW} is maximum at the **surface**.

Aether, of course, penetrates all mass. When calculating the inflow between the surface and the center of the body only the mass inside the smaller radius ($r < R$) is applied to the equation. Consequently, in the interior there is a linear decrease in speed from the surface (where it is maximum) to the center (where it is zero).

Plugging in the values for the Earth-body we find

$$v_{INFLOW} = [(2 \times 6.67{\times}10^{-11}\text{Nm}^2\text{kg}^{-2} \times 5.98{\times}10^{24}\text{kg}) /(6.37{\times}10^6\text{m})]^{1/2}$$

$$= 11{,}200 \text{ m/s} .$$

This is an impressive 11.2 kilometers per second. It is the actual speed, since aether is not subject to resistance of any kind (unlike the comoving test object which more than likely will burn up when it encounters the increasing air resistance).

Now for a simple reasonableness check. If a projectile were to be propelled with the same magnitude, as the one just calculated, but in the opposite direction then one would expect that the object would not fall back. In other words this speed will allow the surface-launched projectile to escape the gravitating body. And indeed this is the case,

$$v_{ESCAPE} = (2GM/R)^{1/2}$$

is the basic physics equation for the escape speed from position R. And, indeed, the speed required to escape the Earth is a nominal 11.2 km/s.

A word of caution. In our isolated Earth-planet

$$|v_{AETHER\ INFLOW}| = v_{ESCAPE\ SPEED} \ .$$

In gravitating systems, however, this is rarely the case. For the real Earth there are two additional major aether-flows (the Solar inflow and the Galactic inflow, not to mention the flow due to Earth's orbital motion) that stream through its region. However, the net volume of aether that flows into the Earth (and does not flow out) can still be calculated with equation (1-3). Technically eqn (1-3) gives the average flow speed (perpendicular) through a Gaussian surface concentric with the gravitating body.

For a variety of examples of aether inflow see the Table of Aether-Flow Components in the Appendix.

How does rotation affect the inflow speed? The most noteworthy difference is the change in the angle of inflow. Standard physics recognizes this as the well-known frame-dragging effect. The inflow becomes angled to the surface, which, in itself, means less aether volume penetrates the surface. However, the equatorial bulge that accompanies rotation, no doubt, increases the surface area so that the aether volume penetrating does remain constant. No matter how flattened the rotating structure becomes, the volume of aether inflow remains constant — subject only to changes in the density of the structure. (Of course, it is the component of the inflow vector that is perpendicular to the surface that must be used to measure the inflowing volume of aether.)

The Formulas for Velocity and Acceleration of Space Flow (relative to a gravitating body) summarized:

In the following, G is the gravitational constant and r is the radial distance from the center of the mass M to any position of interest external to M. For extended bodies, M is the total mass within the sphere of radius r.

The aether inflow speed for isolated/comoving bodies is

$$v_{\text{ACTUAL INFLOW}} = (2GM/r)^{1/2}\,, \qquad (1\text{-}3a)$$

and in general (in the presence of background aether flow)

$$v_{\text{AVERAGE INFLOW}} = (2GM/r)^{1/2}\,. \qquad (1\text{-}3b)$$

The basic rate of change of the space inflow at radial position r must therefore be

$$a_{\text{INFLOW}} = GM/r^2\,. \qquad (1\text{-}4)$$

In general, the rate of change of the space flow in any small region gives the measure of the direction and intensity of the effect known as gravitation.

The special case situation, expressed by equation (1-3a), allows us to calculate the rate of space contraction, which we will do next.

Once we have derived an expression for space contraction it should become evident that the aether velocity is not what determines gravity. Rather it is the *change* in aether velocity.

2. Rate of Aether-Space Contraction

When *space* contracts aether is being lost. The most meaningful way to 'measure' the loss is to compare the volume quantity of contracted aether with some standard volume. The conventional standard is the cubic meter of Euclidean-space volume. Before calculating the loss of aether, let us be clear on the difference between a volume of aether and volume of Euclidean space. The difference is made graphic in Figure 1.

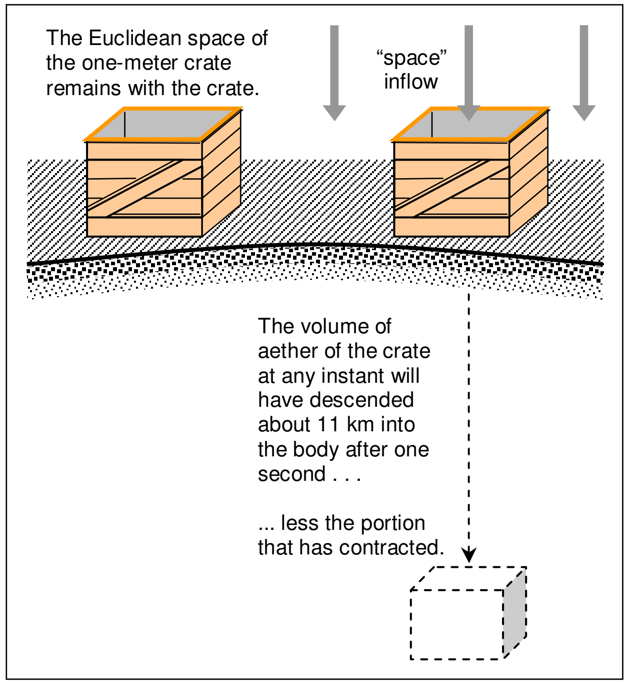


Figure 1. The difference between a volume of aether and Euclidean space. The Euclidean space is intrinsic to the crate; aether is a flowing *essence fluid*. (The example illustrated is for an isolated/comoving Earth-like body.)

We start by 'constructing' a thin-shell sphere to enclose a central gravitating mass body M as shown in Figure 2. Aether flows into the shell with speed v_2, undergoes a certain amount of contraction-dissipation, and then passes through the inner shell wall with speed v_1.

From eqn (1-3a) we know that

$$v_1 = C/r^{1/2} \;\text{ and }\; v_2 = C/(r + dr)^{1/2},\; \text{ where } C = (2GM)^{1/2}.$$

$$\Delta \text{ Vol. flowrate} = (\text{flowrate out}) - (\text{flowrate in})$$

$$= [v_1 \times \text{Area}_{\text{INNER}}] - [v_2 \times \text{Area}_{\text{OUTER}}]$$

$$d\text{Vol}_{\text{FLOW}} = [(C/r^{1/2})\, 4\pi r^2\,] - [(C/(r + dr)^{1/2})\, 4\pi(r + dr)^2\,]$$

$$= 4\pi C\, r^{3/2} - 4\pi C\, (r + dr)^{3/2}$$

$$= 4\pi C\, (r^{3/2} - (r + dr)^{3/2})$$

$$= 4\pi C\, (r^{3/2} - r^{3/2}\, (1 + dr/r)^{3/2})$$

$$= 4\pi C\, r^{3/2}\, (1 - (1 + dr/r)^{3/2}),$$ (since $dr/r << 1$, the binomial theorem approximation applies)

$$\cong 4\pi C\, r^{3/2}\, (1 - (1 + 3dr/2r)),$$

$$dV_{\text{FLOW}} = -\, 4\pi C(3/2)\, r^{1/2}\, dr\,,$$

$$= -\, 4\pi(2GM)^{1/2}\, (3/2)\, r^{1/2}\, dr\,, \qquad (2\text{-}1)$$

where the negative indicates a loss of aether volume.

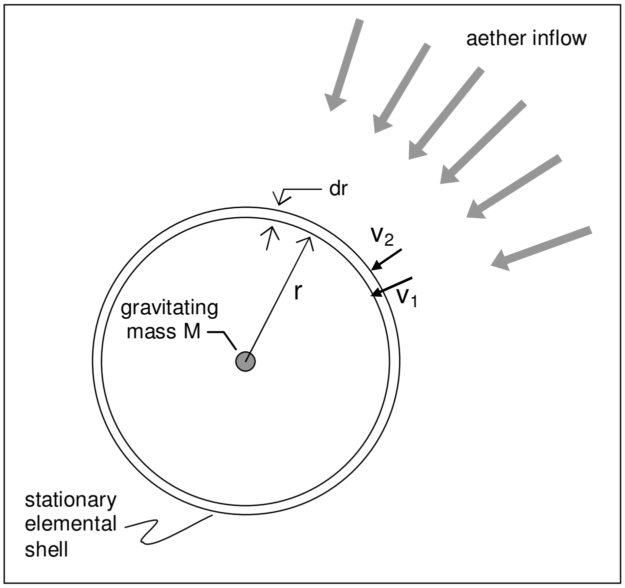


Figure 2. An imaginary spherical thin-shell (shown in cross-section) is 'positioned' concentric with a mass body *M*. The difference between the speed v_2 of aether entering the shell and the speed v_1 of aether leaving the shell is used to derive an expression for the volume contracted (dissipated).

Thus the volume contraction rate within the thin shell of radius *r* is

$$dV_{\text{TOT CON RATE}} = 6\pi(2GMr)^{1/2}\, dr\,. \qquad (2\text{-}2)$$

And the unit contraction rate at distance *r*, obtained by dividing (2-2) by the shell's Euclidean volume ($4\pi r^2\, dr$), is

$$U_{\text{UNIT CON RATE}} = 6\pi(2GMr)^{1/2}\, dr \,/\, (4\pi r^2\, dr)$$
$$= (3/2)\,(2GM)^{1/2}\, r^{-3/2} \qquad (2\text{-}3)$$

where *M* is the total mass within the limits of radius *r*. The units are m^3/s per m^3 and are interpreted as cubic meters of aether per second per cubic meter of Euclidean space; or simply as the fractional volume loss per second.

Earth Example

Let us consider the aether contraction for the physical Earth and specifically at the Earth's surface. In determining the contraction rate there are a number of factors to consider.

(1) The contraction rate due to the mass of the Earth itself is, from eqn (2-3):

$$U_{\text{EARTH SURFACE. EARTH MASS}} = (3/2)\,(2GM_E)^{1/2}\, R^{-3/2}$$

$$= (3/2)\,(2 \times 6.67{\times}10^{-11}\text{N}{\cdot}\text{m}^2\text{kg}^{-2} \times 5.98{\times}10^{24}\text{kg})^{1/2} \times (6.37{\times}10^{6}\text{m})^{-3/2}$$

$$\cong 2.64{\times}10^{-3}\ \text{m}^3\text{/s per Euclidean cubic meter; or}$$

$$\cong 2.64{\times}10^{3}\ \text{cm}^3\text{/s per Euclidean cubic meter; or}$$

$$\cong 0.264\ \%\ \text{per second.}$$

This means that 2,640 cubic cm of aether is dissipated every second within each cubic meter of Euclidean volume at the Earth's surface. And this dissipation occurs while aether races through the Euclidean volume —a simple physical cubic meter box— at 11.2 km per second. (Note: Although 11.2 km/s is properly the inflow speed, per eqn (1-3a), for an Earth-mass at rest in aether, it remains valid even when Earth is subjected to any number of external aether flow components. For the *actual* situation at Earth's surface 11.2 km/s, per eqn (1-3b), represents an average of the inflow component over the entire spherical surface.)

(2) Next we consider the dissipation due to the mass of the Sun. At the radial distance of Earth's orbit the Sun's contraction component is, likewise, from eqn (2-3):

$$U_{\text{EARTH ORBIT. SUN MASS}} = (3/2)\,(2GM_S)^{1/2}\, r^{-3/2}$$

$$= (3/2)\,(2 \times 6.67{\times}10^{-11}\text{N}{\cdot}\text{m}^2\text{kg}^{-2} \times 2.0{\times}10^{30}\text{kg})^{1/2} \times (1.50{\times}10^{11}\text{m})^{-3/2}$$

$$\cong 4.2{\times}10^{-7}\ \text{m}^3\text{/s per Euclidean cubic meter; or}$$

$$\cong 0.42\ \text{cm}^3\text{/s per Euclidean cubic meter.}$$

Being less than half a cubic cm per second, this component is comparatively negligible.

(3) Then there is the inflow due to the proportional mass of the Milky Way galaxy inside our radial distance from the galactic core. Although the inflow is an amazing 365 km/s, it is responsible for contracting (at the 23,000 LY = $2.2{\times}10^{20}$m radial distance of our solar system) aether at the negligible rate of

$$U_{\text{SOLAR ORBIT. GAL MASS}} = (3/2)\,(2GM_{\text{GAL WITHIN R}})^{1/2}\, R^{-3/2}$$

$$= (3/2)\,(2 \times 6.67{\times}10^{-11}\text{N}{\cdot}\text{m}^2\text{kg}^{-2} \times 1.1{\times}10^{11}{}_{\text{SM}} \times 2.0{\times}10^{30}\text{kg})^{1/2} \times (2.2{\times}10^{20}\text{m})^{-3/2}$$

$$\cong 2.5{\times}10^{-15}\ \text{m}^3\text{/s per Euclidean cubic meter; or}$$

$$\cong 2.5{\times}10^{-9}\ \text{cm}^3\text{/s per Euclidean cubic meter.}$$

(4) The Earth orbits the Sun with a tangential speed of 30 km/s. This means the Earth is subjected to a flow component of 30 km/s. However, since the magnitude of this speed is essentially constant, it contributes nothing whatsoever to aether contraction.

(5) Clearly the Earth is not subjected to any strong external gravitational effects (fields); thus the net contraction rate at the Earth's surface is, as calculated above, 2,640 cm^3/s per Euclidean cubic meter.

Rate of Contraction Within a Thick Shell

To determine the contraction rate within a thick shell concentric with a central gravitating mass body *M*, as shown in Figure 3, we divide the region into elemental thin-shells. Aether flows into a typical sub-shell with speed $v_{(r+dr)}$, undergoes a certain amount of contraction-dissipation, and then passes through the inner sub-shell wall with speed $v_{(r)}$.

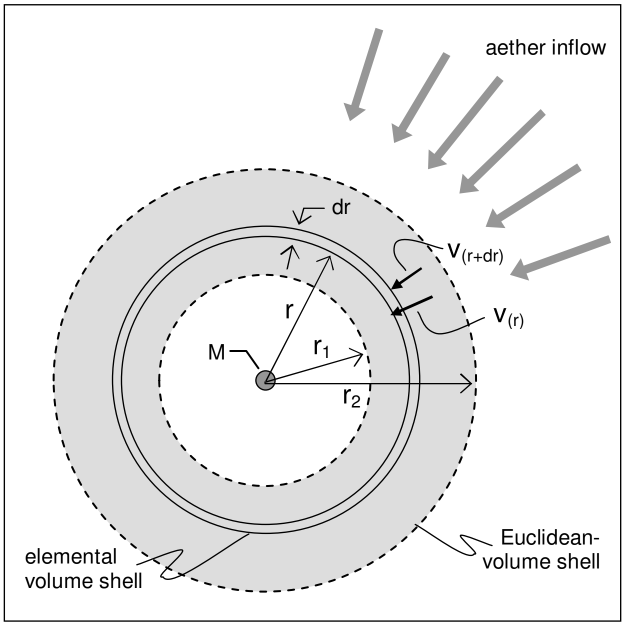


Figure 3. Calculating the volume flow of aether contraction within a constant-size shell concentric with central mass *M*.

From eqn (1-3a) we know that

$$v(r) = C/r^{1/2} \text{ and } v(r+dr) = C/(r+dr)^{1/2},$$
where $C = (2GM)^{1/2}$.

For the elemental Euclidean-volume shell:
Change in Vol. flowrate = (flowrate out) − (flowrate in)

$$= [v(r) \times Area_{INNER}] - [v(r+dr) \times Area_{OUTER}]$$

$$d(V_{FLOW}) = (C/r^{1/2})4\pi r^2 - (C/(r+dr)^{1/2}) \times 4\pi (r+dr)^2 \quad (2\text{-}4)$$

$$= 4\pi C\, r^{3/2} - 4\pi C\, (r+dr)^{3/2}$$

$$= 4\pi C\, (r^{3/2} - (r+dr)^{3/2})$$

$$= 4\pi C\, (r^{3/2} - r^{3/2}(1+dr/r)^{3/2})$$

$$= 4\pi C\, r^{3/2}(1-(1+dr/r)^{3/2}),$$ (since $dr/r \ll 1$, the binomial theorem approximation applies)

$$\cong 4\pi C\, r^{3/2}(1-(1+3dr/2r)),$$

$$dV_{FLOW} = -4\pi C(3/2)\, r^{1/2}\, dr\,. \quad (2\text{-}5)$$

Integrating the Euclidean volume of the thick shell from r_1 to r_2:

$$\int dV_{flow} = -4\pi C\int_{r_1}^{r_2} (3/2)(r')^{1/2}\, dr'$$

$$V_{FLOW} = -4\pi C\,[(r_2)^{3/2} - (r_1)^{3/2}]\,. \quad (2\text{-}6)$$

Thus for any concentric region, external to a central mass *M*, the volume rate of aether self-dissipation is:

$$V_{TOT\ CON\ RATE} = 4\pi\,(2GM)^{1/2}\,[(r_2)^{3/2} - (r_1)^{3/2}]\,, \quad (2\text{-}7)$$

where the units are interpreted as the number of **cubic meters** of aether lost **per second** within the entire Euclidean thick-shell (of radius r_1 to r_2).

Rate of Contraction Within a Limited Concentric Sphere

If we treat *M* as a point mass and set r_1 equal to zero, we can approximate the dissipation rate for the concentric sphere of radius $r = r_2$.

$$V_{SPERE\ CON\ RATE} \cong 4\pi\,(2GM)^{1/2}\,(r)^{3/2}. \quad (2\text{-}8)$$

The size of the sphere, which this equation applies to, is limited because in the DSSU the range of gravity is strictly limited; a consequence of the discrete cosmic gravity cells that constitute the DSSU.

Another important point. Although in deriving eqns (2-7) and (2-8) the mass body was assumed to be isolated, the equations are still valid when *M* is part of a gravitating system. In that case, *more* space will be contracted in the thick-shell or spherical region; however, the space-contraction attributable to *M* itself will remain unchanged. The equations still apply.

And finally, since it is the Gaussian flow that we are actually interested in and specifying in the equations, it does not matter in the least if mass *M* is traveling *through* the aether sea. (At relativistic speeds, according to some theories, there may be an increase in the value of *M* to take into account.)

3. Space Contraction and Gravity

The phenomenon of contractile gravitation is actually two distinct effects acting simultaneously. The first effect, called Primary gravity, involves the aether flow caused by a process of *absorption/assimilation* (of aether by matter); the accompanying effect, called Secondary gravity, involves the *contraction/dissipation* of aether. The distinction between the two gravities is of considerable importance in the continuing research of DSSU theory.

Primary Gravity

Recall (from DSSU Postulate #2), the direct absorption and assimilation of aether-space by matter is the ultimate source of gravity. We have called this *Primary gravity*. While the direct action occurs *in and on matter*, it induces a radially inward flow of aether. Primary gravity by itself, however, is a ‘force’ with surprisingly low intensity (as distance from source increases).

Let us investigate the fluid dynamics of the Primary gravity caused by a comoving body.

Mass serves as the ‘sink’ for the dynamic flow of aether. And *aether*, it is important to know, has a non-compressible nature (i.e., the density of aether is constant). Although it is not compressible, aether does have the ‘ability’ to contract. ... But now, let us imagine, for the moment, that aether has lost its ‘ability’ to contract. We imagine it to be a *non-contractile* fluid. We assume that it maintains all its discrete units during the spherically symmetrical flow towards a central mass body. Then, when the units actually enter the mass, they are absorbed, assimilated (and contracted) in the usual way. In other words, we conduct a thought experiment of aether inflow without the usual external contraction previously detailed.

Under these conditions we may justifiably apply the standard fluid-flow continuity equation to any concentric shells about the mass —including the spherical surface of the mass itself.

area of concentric outer sphere X *flow vel. at outer sphere* X *fluid density at outer sphere*

= *area of concentric inner sphere* X *flow vel. at inner sphere* X *fluid density at inner sphere*

Since aether density is constant (by definition), the two density terms cancel. For the inner concentric sphere we use the surface of the gravitating body; here the area is constant and is equal to $4\pi R^2$; and here the aether velocity magnitude is also constant and is equal to $v_{SURFACE}$. (See Figure 4.) With these substitutions, the equation allows us to determine the aether flow speed at any radial distance r (where $r > R$).

$$4\pi r^2 \times v_P = 4\pi R^2 \times v_{SUR} ,$$

$$v_P = (R^2 \times v_{SUR})/r^2 .$$

This can be further simplified. The non-contractile aether speed can then be expressed as:

$$v_P = \text{Constant}_1 / r^2 .$$

Gravity (its intensity), as usual, is the acceleration of aether. By taking the time derivative of the above expression, the acceleration, and hence the gravity intensity, of the *non-contractile* aether is

$$a = \frac{dv}{dt} = \frac{dC_1/r^2}{dr}\frac{dr}{dt}$$

$$a_P = (-2C_1/r^3)\,(C_1/r^2).$$

Combining all the constant terms into one constant, C_2:

$$a_P = C_2/r^5.$$

Thus the acceleration due to Primary gravity varies inversely with the ***fifth power*** of the radial distance. While normal Newtonian gravity is ruled by an *inverse-square law*, Primary gravity is ruled by an *inverse-fifth-power law.*

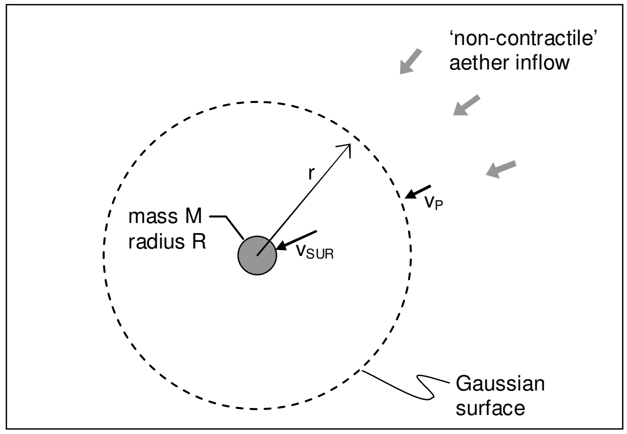


Figure 4. *Primary gravity effect.* Aether is imagined as being *non-contractile*. This allows the use of the standard fluid-flow equation and results in an expression for Primary gravity (for some radial distance *r*).

Clearly, Primary gravity is a comparatively weak effect. Its intensity, when compared to composite gravity, is weaker by three orders of magnitude!

Primary Gravity Analogy

The mechanism of Primary gravity may be easily demonstrated. Place a spherical intake nozzle into a large tank of water. (Think of the intake as a cluster of miniature shower heads arranged in spherical symmetry, but instead of spraying water outward they are sucking it in.) The accelerating flow of water and comoving particles towards, and into, the intake device clearly simulates the effect of Primary gravity.

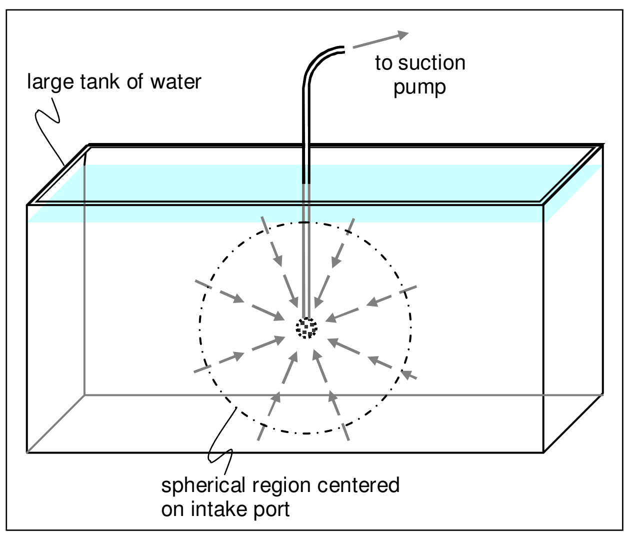


Figure 5. Simulation of the Primary gravity effect. Within a limited spherical region, water will accelerate towards the symmetrical intake port. The intensity of the effect, calculated to diminish as the inverse of the fifth power of radial distance, replicates the intensity of Primary gravity and primary aether acceleration.

The arrangement shown (Figure 5) imitates Primary gravity because water is non-contractile (no molecule of water ever 'disappears'), has low viscosity, and maintains a constant density. With the standard fluid flow equation it is easy to show that the water accelerates towards the intake according to the inverse 5th power rule.

There is, however, no arrangement that can serve to model composite gravity —Primary and Secondary gravity combined. A contractile fluid would be required but no physical contractile fluid exists —other than the quasi-physical aether fluid itself.

As an aside, with the above apparatus, one is also able to simulate non-Machian inertia. It is a straight forward matter of measuring the difference in the applied force required to accelerate the 'intake ball' when active (when absorbing water) and when inactive; the 'inactive' measure serves to establish a neutral value for comparison.

Secondary Gravity

The comparison between primary acceleration and the acceleration induced by contractile aether reveals the enormous power of *composite gravitation*. The comparison is between acceleration varying inversely with the ***fifth power*** on the one hand, and varying inversely with the ***second power*** on the other. Primary gravity varies with $1/r^5$; composite gravity varies with $1/r^2$.

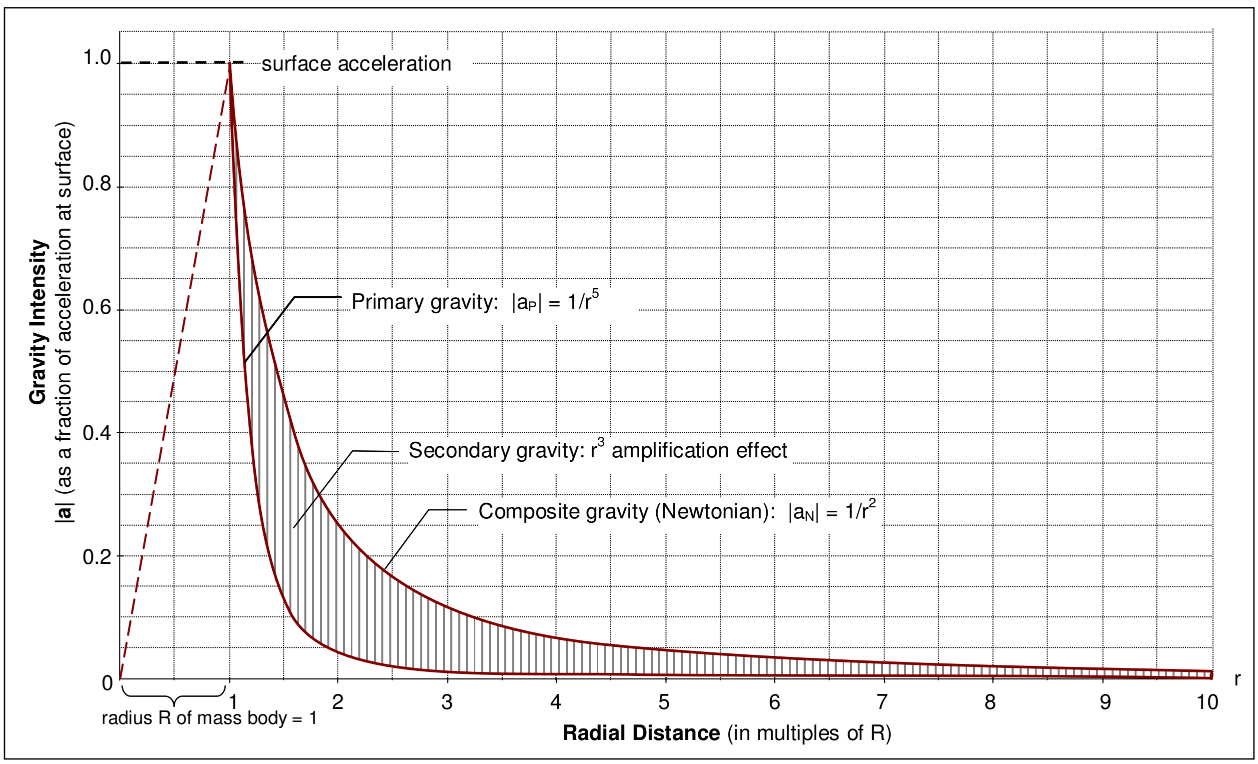
If the constants are ignored, the two accelerations differ by a significant factor of r^3. The conclusion is that aether must be a shrinking/contracting fluid (under convergent-flow conditions). Furthermore, the rate of contraction is prodigious.

It is this induced contraction/dissipation action called *Secondary gravity* that really allows matter to dominate the Universe. It is a magnifying effect that is responsible for contracting far more aether outside a gravitating body than is the Primary gravity acting inside the body.

Secondary gravity may be described mathematically as a *space contraction field* —a field that acts as a gravitation amplifier.

Given that aether is a constant-density, non-compressible, yet contractile, fluid, the action of the gravitation amplifier is as follows: The cause of gravity is the direct assimilation of aether. This produces a low intensity acceleration of surrounding aether inflow (this is true whether or not secondary contraction takes place). It is this acceleration which then induces aether in the gravitational field to contract. And contraction, in turn, amplifies the aether acceleration. Thus, initial aether-absorption by mass: leads to acceleration; leads to secondary contraction; leads to further acceleration.

Secondary gravity —the gravity amplifying effect— is shown as the shaded region in the graphical representation of the intensity of gravity (as a function of distance) in Graph 1.



Graph 1. In the graphical representation of the intensity of gravity (as a proportional function of distance) the *Secondary gravity* —the gravity amplifying effect— is shown as the shaded region. According to DSSU theory, aether contraction is the effect that amplifies Primary gravity from a weak inverse-5th-power law to a potent inverse-square law that rules the Universe. Although the reason is not discussed in the text, it should be noted that the accuracy of this graph is contingent upon the density of the mass having the maximum density at which matter can exist.

By the way, Einstein's General relativity theory also contains a gravity amplifying feature. The ability of geometric space to produce its own additional gravity is described by physicist/cosmologist Edward Harrison,

> *...the curvature of spacetime is itself a form of energy, which produces its own gravitational field, and is hence the source of further curvature. ...Thus curvature generates [additional gravitational] curvature.*[3]

In other words gravity involves a double distortion of local space.

4. Expansion of Aether

Where does *space* (our aether) expand? Keep in mind that *space* and *aether* are synonymous terms. DSSU theory tells us that *space* does not expand universally, rather it expands regionally. Specifically, it expands within the cosmic voids —large, and apparently empty, regions long familiar to astronomers and baffling to theorists.

How does space expand? Consider first how it does not expand: It does not expand by stretching, not by inflating the size of its discrete units, and certainly not by revealing some higher (normally hidden) dimension or dimensions.

There is nothing obtuse in how aether expands. It expands simply by the growth in *the number* of aether units. Expansion is a primary process (i.e., a causeless process, per Postulate #1) involving the spontaneous manifestation of new aether units.

Our purpose here is to determine the rate at which the medium expands.

First, it is essential to establish the size —the diameter— of a typical cosmic cell. This is done by measuring and comparing the angular size differences of 'standard candles' located on the near-side and the far-side of a cosmic cell (or void). The supergiant galaxies known as *cD* galaxies are the best choice to use as 'standard candles.' Another method is to measure and compare apparent brightness in relation to intrinsic brightness —again using favorably positioned *cD* galaxies. Still another method is to compare the *luminosity functions* of two galaxy clusters (from opposite nodes). This involves comparing the distributions of the numbers of galaxies of various apparent brightnesses of the two clusters; from the difference in magnitude it is easy to calculate the relative distances of the two clusters.[4] If the absolute distance to the near cluster is known, then the absolute distance to the far-side cluster can be calculated. The important thing is that the measured distance across the cosmic cell must be independent of the expansion redshift related to that distance.

Pending further investigation the tentative diameter of a typical cosmic cell is 300 million lightyears. The choice of 300 MLY represents a reasonable estimate based on our neighboring Virgo-Coma and Eridanus cells.

Second, we need the expansion redshift across the cosmic cell. This is obtained from the same standard candles mentioned above. Knowing both the diameter and the redshift difference across the cosmic cell makes it possible to determine the rate of space expansion.

The *cosmic redshift* is a stretching of the wavelengths of electromagnetic radiation, including visible light, emitted by distant objects, most notably, galaxies. A redshift measurement, an index symbolized by z, is a dimensionless number. It is simply a ratio. It is meaningful only if related to some other more useful quantity. When related to the speed of light it becomes monumentally significant.

And that is exactly what Edwin Hubble did when he proposed that z be multiplied be the speed of light, c, thereby transforming the dimensionless number into a velocity. Hubble pointed out that this procedure then allowed the redshift to be interpreted as a Doppler effect —meaning that galaxies are receding *through* cosmic space. The speed of recession (an intrinsic speed) then is c times z.[5]

Modern astronomers do somewhat the same thing. Common practice is, again, to multiply the redshift by the speed of light. But being aware that galaxies, for the most part, do not race *through* space, astronomers use a modified interpretation. Instead of cz being a recession velocity *through* space, it is now deemed to be a recession velocity ***with*** space —a movement with receding space.

Which brings us to our third step. For us, cz will not represent a recession velocity. The speed cz is interpreted as a pure space-expansion velocity (where z is limited to the redshift across a cosmic-cell void).

Recapping the three interpretations of the *cosmic redshift*: Doppler recession velocity of galaxies through space; Big Bang recession velocity of galaxies with space; and the DSSU interpretation of regional-space-expansion velocity with no cosmic recession of galaxies.

The DSSU method uses z as a measure of the fractional increase by which space has stretched or expanded (during the time interval it takes the light to traverse the cell). The redshift across the Virgo-Coma void induced by space expansion is approximately $z_{\text{dia}} = 0.0187$. Multiplying by the speed of light gives the space expansion velocity.

$$\text{Velocity}_{\text{EXPANSION}} = c\,z = 5{,}600 \text{ km/s} . \qquad (4\text{-}1)$$

The space at opposite ends of a void is moving apart at 5,600 kilometers each second (Figure 6). In each and every second 5,600 kilometers of newly expanded space is added to the distance across the void. However, the Virgo-Coma cell itself does not expand; a compensating amount of space contraction at the interfaces ensures equilibrium.

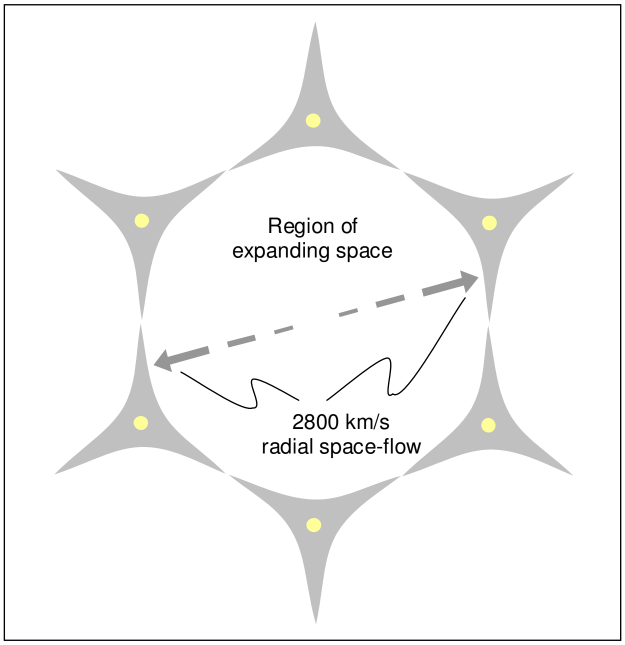


Figure 6. The velocity of space expansion across a non-expanding cosmic cell is 5600 km/s (as determined in the text) and corresponds to the difference of the two vector velocities shown above. (2800 km/s) – (–2800 km/s) = 5600 km/s.

The expansion rate of 5,600 km/s is not very useful unless we know over what distance this expansion is taking place. What we really want is a parameter that specifies the rate of space expansion per standard length (the standard length could be a parsec, a light year, or a million lightyears). Here is where the 300 million lightyears (MLY) cell diameter, noted above, is essential. It is used for our final step. By dividing the expansion velocity of eqn (4-1) by the diameter we obtain the space-expansion parameter, which we call H:

$$H = (5{,}600 \text{ km/s}) \div (300 \text{ MLY})$$

$$\cong 18.7 \text{ km/s} .$$

One should immediately notice that the DSSU space-expansion parameter falls well within the acceptable range of the Hubble parameter used in Big Bang cosmology. This is not surprising, since the same method of multiplying z by c was used. What is innovative and holds great promise is the interpretation —the cellular interpretation.

The question is: Which interpretation of the cosmic redshift is valid, universal recession velocity on the one hand or regional space expansion on the other? And let us be even more inclusive and also question the validity of redshift theories that refute both a recession-motion cause and a space-expansion cause.

Some physicists believe the cosmic redshift is caused not by the expansion of space itself and not by the Doppler recession of galaxies but rather by the presence of a “huge amount of transparent molecules of hydrogen in the universe” and the energy loss accompanied by repeated photon-and-hydrogen interactions. The effect, it is claimed, is constant and the energy loss increases in proportion to distance traveled.[6]

Others believe the cosmic redshift is caused by the thermalization of starlight by dust grains or needlelike, filamentary structures (made of materials such as carbon, silicates and iron) distributed in interstellar space. Light waves from distant sources are weakened (redshifted) as they are intercepted and re-transmitted by the deep space sub-millimeter particles.[7]

Returning to the question, is there a way to validate the DSSU interpretation? Is there some other method that avoids the direct use of the expansion redshift? It would be most pleasing to have an independent method to determine the rate of space expansion; a method supported by some previously unexplained phenomenon; a method through which we may gain new insight.

Indeed, there is such a method. It is independent of the expansion redshift.

5. Phenomenon of ‘Anomalous’ Redshifts Involves a Key Intrinsic Velocity

Let us consider the motions of galaxies at the *space-contracting* boundary between adjacent cosmic cells. A typical boundary interface will contain galaxies with a wide variety of intrinsic and comoving velocities. At flat interfaces galaxies arrive from two opposite directions, i.e., from the two adjacent cosmic cells. At boundary edges they arrive from the three directions of the three abutting cells. While *all* the galaxies display an *apparent* recession-velocity redshift, our knowledge of interface symmetry tells us that about one half of the galaxies are receding and half are approaching. The interface symmetry also suggests that one half are on the near side and the other half on the far side.

The velocity of *space flow* near the interface can be verified by measuring the maximum velocity of galaxies within the interface (and relative to the interface). Ideally one would like to find a pair of galaxies that are flying past each other (in opposite line-of-sight directions) at maximum speed. Keep in mind that it is only when it reaches the boundary edge that a galaxy will possess the accumulated speed it acquired (exponentially) during comovement with space prior to entering the interface.

We need two galaxies, practically touching each other; one racing towards us, the other racing away. Galaxies that match this description obviously have radically different redshifts and are known as an anomalous pair.

The hypothetical pair in Figure 7 represents a redshift ‘anomaly’ of 0.01866 (or, in terms of velocity, 5600 km/s). It is obtained by taking the absolute value of the difference of the two redshifts. A difference of this nature is described in textbooks as being an *anomalous velocity* or an *anomalous redshift*. Note the additional confusion over what is anomalous —the mysterious cause of the Doppler motion of the galaxies is underscored by the former term, while the broader cause of the redshift itself is questioned by the latter. Standard cosmology does not have a meaningful explanation.

Anomalies, however, are abundant. With a discrepancy of 5200 km/s "Stephan's Quintet, a cluster of galaxies (NGC 7317-20), gives evidence that some redshifts may not be directly related to distance. The galaxies are still believed to lie at the same distance, which can be estimated from various indicators." [8] Another group, NGC 2903, similarly has an anomaly of 6000 km/s.

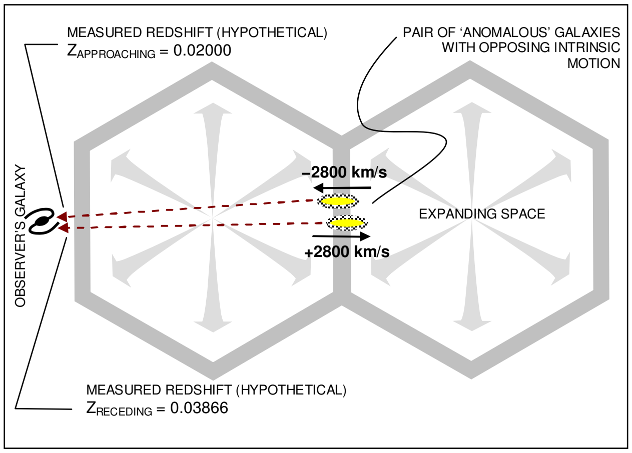


Figure 7. *Two galaxies can be in the same location yet display significantly different redshift values.* In DSSU cosmology these redshifts are a verification of cellular space expansion. In standard cosmology they are an unexplained *redshift anomaly* or *velocity anomaly*. By taking the difference between the two observed redshifts we are effectively removing all other possible causes of lightshifting *and ending up with a pure Doppler effect*. By taking the difference we obtain a number that codes the relative intrinsic motion of the two galaxies. (Not to scale)

When we evaluate the difference between the observed ***net*** redshifts we are effectively removing the space-expansion component (or effectively removing whatever one's theory attributes as the cause of the cosmic redshift). What remains is a pure Doppler redshift.

$$z_{\text{receding gal}} - z_{\text{approaching gal}} = z_{\text{Doppler}}$$

$$0.03866 - 0.02000 = 0.01866$$

And with a Doppler redshift we are fully justified in multiplying z by the speed of light to obtain the intrinsic relative velocity (as each galaxy would 'see' the other's motion):

Rel. intrinsic vel. $= c\, z_{\text{Doppler}}$
$= 5{,}600$ km/s (along the line of sight).

How, we may ask, can astronomers be reasonably sure that two galaxies (an anomalous pair) really are in approximately the same location, contrary to what the redshift says (under the conventional interpretation)? The redshift may signal that the galaxies are far apart, but there are other highly reliable methods for establishing distances —including measuring galaxy angular size and analyzing supernovae events. Distance can be established independent of the redshift method. Most conclusive, however, is the evidence of galaxy pair interaction, such as the presence of arms or bridges linking the pair —an unequivocal sign of proximity.

The scenario of two galaxies at the same location in the universe but displaying drastically different redshifts demands an explanation. The explanation depends on our choice of cosmology.

The new cosmology explanation is simply what is illustrated in Figure 7. The speed of each galaxy is originally acquired from the comovement ***with*** expanding space. Each galaxy originally drifted with the *space expanding from opposite directions* —from two adjacent cells. Once the galaxies penetrate the interface, this motion becomes intrinsic motion. The intrinsic motion causes a Doppler wave-shift which, along with the expansion redshift of intervening space, is then observed, from our home-galaxy vantage point, as the net redshift of the light emitted from each distant galaxy. A simple explanation but one that is completely alien to conventional cosmology.

Space expansion within and across the cosmic cell is the ultimate source of the large-scale motion at the interface. Measure the motion and you unravel the mystery of anomalous redshifts and anomalous galactic encounters.

Measure the motion and you have the key to determine the rate of space expansion.

With the new insight and two vital pieces of information, a space flow that rises to a nominal radial rate of 2,800 km/s and a corresponding nominal radius (for the void of a cosmic bubble) of 150 million lightyears, we can easily calculate a *space expansion parameter*.

6. Space Expansion Functions & Space Expansion Parameter

Space Expansion Index

Assume a uniformly expanding spherical region of space with radius *r*. All lengths in such a sphere increase by a fractional amount *i* during each time interval. A basic *compounding amount* formula can be used to approximate a function for the radius of expansion:

$$r(t) = r_0(1+i)^t\,, \qquad (6\text{-}1)$$

where, $r(t)$ is the function of radial expansion with respect to time; r is the radius, in lightyears (LY), from the center of expansion. In uniformly expanding space the center of expansion may be any arbitrary point, but for our purpose here we select the geometric center of the void. Time t is the number of time intervals of a million years (MY); r_0 is the length of the radius at time $t = 0$, and

i is the fractional increase in length occurring in each time interval.

The rate of expansion of the sphere (the speed with which r increases) is determined by taking derivatives[9] of both sides of eqn (6-1). Then:

$$\text{Rate of radial expansion} = v(t) = r_0(1+i)^t \, ln(1+i). \quad (6\text{-}2)$$

To simplify the calculations, r_0 , the initial radial length, is set to 1 lightyear. When expansion reaches equilibrium: the nominal radius will be 150×10^6 LY; while the speed of expansion v will equal approximately 2,800 km/s (from Fig. 6) and can be converted to an equivalent speed of 9,340 lightyears per million years. Then equations (6-1) and (6-2) become:

$$r(t) = (1\text{LY})(1+i)^t = 150\text{x}10^6\,\text{LY} , \quad (6\text{-}3)$$

$$v(t) = (1+i)^t \, ln(1+i)\ \text{LY/MY} = 9{,}340\ \text{LY/MY}, \quad (6\text{-}4)$$

representing two equations with two unknowns. Then, by substituting (6-3) into (6-4),

$$ln(1+i) = 9{,}340 \div 150\times10^6 = 6.226\times10^{-5},$$
$$(1+i) = e^{\ln(1+i)} = e^{0.000\,062\,26},$$
$$(1+i) = 1.00006226 ,$$
$$i = 6.226\times10^{-5} \quad \text{(per million years).} \quad (6\text{-}5)$$

The parameter i is the *space-expansion index*. It represents the fractional increase between any two points in uniformly expanding space in one time interval, which in this case was selected as one million years. The value 6.226×10^{-5} is the fraction by which, say, one kilometer of *space* 'stretches' in one million years (i.e., one t interval). It means that each kilometer of space expands by just over 6 centimeters in 1,000,000 years. This remarkably small expansion leads, in turn, to a staggeringly lengthy radial-expansion time, as we will see shortly.

Space Expansion Parameter

A useful expansion parameter may be calculated by first selecting the length that light can travel in one of our time intervals. For convenience, this would be a length of ***1 million lightyears*** (the distance a light pulse travels in the time of one million years).

We know that this distance (sometimes called a comoving coordinate distance) increases by a fractional amount i every million years. The increase can be expressed as,

$$\Delta\,\text{distance} = 1\text{MLY} \times i ,$$

then divide by our chosen time interval,

$$\Delta\,\text{distance} / \Delta t = (1\text{MLY} / 1\text{MY}) \times i .$$

The left side is simple the definition of average speed, and on the right side *1MLY÷1MY* is, by definition, the speed of light c, and can be replaced by 300,000 km/s. Thus,

$$\text{Speed of expansion} = c \times i .$$

Finally we divide both sides by the length of *1MLY* (alternately 1 mega-parsec favored by astronomers), which is the coordinate length that references the expansion:

$$v / 1\text{MLY} = (c\ i) / 1\text{MLY}.$$

The left side defines the expansion parameter. The right side is easily evaluated.

$$\text{Space expansion parameter} = (c\ i) / 1\text{MLY} \quad (6\text{-}6)$$
$$= 300{,}000\ \text{km/s} \times 0.00006226 / 1\text{MLY}$$

$$\text{Space expansion parameter} \cong 18.7\ \text{km/s per MLY}$$

We have, in effect, determined the value of the space expansion parameter —known as Hubble's 'constant' in conventional cosmology— by using the cellular structure of the Universe and the associated galaxy motions induced by aether dynamics.

The Exponential Equations for Space Expansion

Equation (6-1) above provides a simple, intuitive, approach to space expansion. The increment factor (1+ i) is applied repeatedly to the growing coordinate length in the same way that an interest factor is applied repeatedly to a growing monetary investment. The formal method is to use the expression for the *relative rate of change* of a co-ordinate length r with respect to time:

$$^{dr}/_{dt} \div r = v / r = k , \quad (6\text{-}7)$$

where k is constant when *space* is expanding uniformly. The expansion is described by the ratio of the rate of change of a length divided by that length. Note that the value of k depends *not* on the length units, but only on the time units chosen. Constant k is simply our *space expansion parameter* with its length units cancelled out. Let us, then, replace k with the *space expansion parameter* (which we symbolize as H) and write the *relative rate of change* equation as,

$$^{dr}/_{dt} \div r = v / r = H . \quad (6\text{-}8)$$

Now if we choose our units so that v is in km/s and r is in MLYs, then the expression could easily be mistaken for the *Hubble term* used in conventional cosmology. The identity confusion is but momentary; only until one realizes that 'their' *Hubble expansion* is applied to the *entire* visible universe, while our *space expansion* H is applied only within the confines of cosmic cells —the cosmic cells of a non-expanding universe.

We again note that radial velocity is about 2800 km/s when the radius (from void center) is 150 MLY, and calculate the *space expansion parameter* to be:

$$H = v/r = 2800 \div 150 \approx 18.67 \text{ km/s per MLY},$$

which, by using the conversion factors listed in the endnotes, is entirely equivalent to

$$H = v/r \cong 6.227\text{x}10^{-5}\ \text{MY}^{-1}.$$

(Compare with eqn (6-5))

For the space expansion postulate of DSSU theory, the expression (6-8) serves as the ratio of comoving velocity to radial distance in the void of the typical cosmic bubble. If we now integrate and then solve for r we obtain the exponential function for the radial position from the center of a cosmic void:

$$r(t) = r_0 e^{Ht}. \qquad (6\text{-}1a)$$

And this leads (using differential calculus) directly to the speed of radial expansion with respect to time,

$$v(t) = r_0 H e^{Ht}, \qquad (6\text{-}2a)$$

and also the acceleration of expansion,

$$a(t) = r_0 H^2 e^{Ht} = H^2\, r(t)\ , \qquad (6\text{-}9)$$

where r_0 is the radial position, from the void center, when $t = 0$. In working with these equations it is important to remember that the time units of H and t must be the same. (Important because the units of H and t must cancel so that the exponential growth function will have its necessary unitless exponent.) Also keep in mind these equations represent idealized space expansion. They neglect a certain amount of *space contraction* that takes place and increases with the radius, particularly near the interface.

Speed of Expansion Within a Cosmic Cell

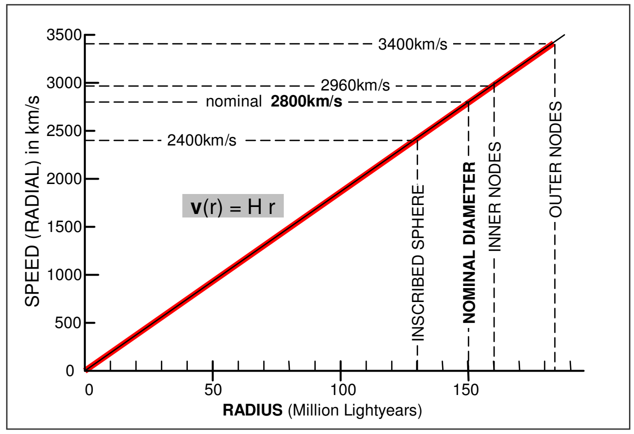
Let us assume that the center of the void is a sea of tranquility with virtually no bulk flow and an absence of structures (contrary to what is suggested in section 9). With nothing present (except for transient radiation), the expansion of space at the center is extremely slow. An imperceptible expansion near the core, however, becomes a ~2800 km/s blast of galaxies and debris at the interface.

Equations (6-1a) and (6-2a) may be combined to give,

$$v(t) = H\, r(t), \text{ or},$$

$$v(r) = H\, r. \qquad (6\text{-}10)$$

We may then graph the radial comoving speed as it increases with the radius from the void center. Since we want to be able to relate intuitively with the graph's scales, we will use the velocity-distance form of H (i.e., H = 18.7 km/s per MLY of length).



Graph 2. ***Speed of expansion as a function of radial position.*** The graph tells us, (1) the magnitude of the velocity of *flowing space* with respect to the motionless center of the void or to the 'fixed' interfaces surrounding the void; (2) the speed of *comoving* particles/objects/bodies with respect to the same references.

Equation (6-10) and its graph give the expansion speed at any point along any radius. As can be seen in Graph 2, expansion-versus-radius is a linear function. But note that the radius, r, itself is an exponential time-dependent function $r(t)$; therefore, expansion is also a non-linear time-dependent function. The simpler linear function clearly shows the predicted speeds at various interface locations based on the geometry of the close-packed dodecahedral shape. The nominal speed of 2800 km/s is found at the boundary edges; the minimum, 2400 km/s, at the planar faces; and the maximum, 3400 km/s, at the outer nodes.

Acceleration of Radial Flow and Tertiary Gravity

The acceleration of expansion (i.e., radial flow) in the void is the rate with which comoving speed increases. The acceleration is shared by all comoving particles and structures. Theoretically it is measurable in the motions of galaxies and star structures during their initial (freefall) approach to the interface. As an example, the acceleration of a comoving galaxy at initial approach to the boundary edge (where r is 150×10^6 LY) using equation (6-9) is,

$$a = (6.227\times10^{-5})^2\,(150\times10^6) = 0.5816\ ^{\text{LY}}/_{\text{MY}^2}$$

$$\cong 5.53\times10^{-12}\ \text{m/s}^2$$

$$\cong 0.055 \text{ angstrom units/s}^2$$

Note that the radial acceleration, like the velocity, is linearly dependent on the radial position.

The significance of this acceleration, which is the third type of aether acceleration encountered, is profound.

Since the acceleration of aether is the essence of our definition of gravity, then the radial, or diverging, accelerating flow must be encompassed by the DSSU gravity theory. It cannot be otherwise. Simply because the flow is diverging does not place this phenomenon outside of gravity theory. (In contrast, Lambda-expansion[10] in conventional cosmology is a separate phenomenon independent of gravity.) The expansion-flow acceleration here described is but another face of gravity —another phenomenon of an all-inclusive theory of gravity.

We call this third gravitational effect ***cosmic gravity*** or ***Tertiary gravity*** —a third mechanism by which aether and contained objects are accelerated towards major centers of mass concentrations.

7. Time Duration of Radial Expansion

For the *time* calculation we take the natural log of both sides of equation (6-1a) and solve for *t*:

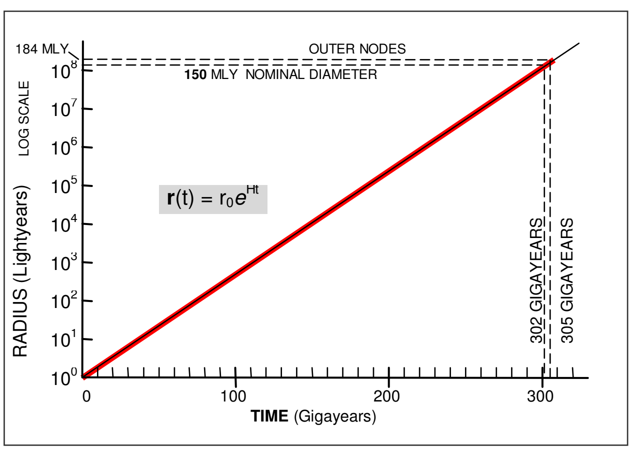
$$ln\,r = ln\,r_0 + ln\,e^{Ht}\,,$$
$$Ht = ln\,r - ln\,r_0\,,$$
$$t = (1/H)\,ln(r/r_0)\,. \qquad (7\text{-}1)$$

Using r equal to $150{\times}10^6$ LY and r_0 equal to 1.0 LY we find the time for radial expansion to the nominal boundary to be:

$$t = (0.00006227)^{-1}\text{MY}\ ln(150{,}000{,}000 / 1)\,,$$
$$t \cong 302 \text{ Gigayears.}$$

Graph 3 shows the radial distance, with respect to time, of a point starting at one lightyear from the geometric center of the cosmic cell and comoving with expanding space.

The starting position within the void is most important in determining the time for expansion to reach the interface. For instance, by decreasing the starting radial length to only one kilometer, the time is increased to 782 Gigayears. In fact, the closer we choose the starting point to the center of expansion, the closer the approach to infinity the total expansion time becomes.



Graph 3. ***Radial expansion versus time***. This graph gives the time it takes for a comoving point in expanding/flowing space to reach position *r* when starting from 1.0 MLY from the void center (represented by the origin). Alternately, the curve represents the radial position of a comoving test object (moving with the *expansion space flow*) with respect to time.

Time Interval for Comoving Along Radius.

Equation (7-1) leads to the time interval expression for comovement with expanding space along a cosmic bubble radius:

$$\Delta t = t_2 - t_1$$
$$\Delta t = (1/H)\,[ln\,(r_2/r_0) - ln\,(r_1/r_0)]$$
$$\Delta t = (1/H)\,ln\,(r_2/r_1)\,, \qquad (7\text{-}2)$$

where t represents intervals of million years, r_1 is the shorter radius and r_2 is the destination radius in lightyears; and the space expansion parameter H equals 0.00006227 MY^{-1}.

The time interval, for example, of expansion or comoving translation from r_1=*150 MLY* to r_2=*160 MLY* (the sphere of the inner nodes) is

$$\Delta t = (1/H)\,ln\,(r_2/r_1)\,,$$
$$= (1/0.00006227\ \text{MY}^{-1})\,ln\,(160/150)\,,$$
$$\cong 1.0 \text{ Gigayears.}$$

Similarly, the time interval of expansion or comovement from r_1=*150 MLY* to r_3=*184 MLY* (the sphere of the outer nodes) is 3.3 Gigayears.

8. Volume of Aether Produced and Transferred to Interface

The nominal volume of space expanding into the interface regions of a cosmic cell is given by:

$$V(t) = (\text{area of sphere}){\times}(\text{radial velocity}){\times}(\text{time})\,,$$
$$= (4\pi R^2){\times}(9{,}340\ \text{LY/MY}){\times}(\text{time})\,,$$
$$= 2.64{\times}10^{21}(\text{LY}^3/\text{MY}){\times}(\text{time}), \qquad (8\text{-}1)$$

where the radius R is $150{\times}10^6$ LY, and *time* is measured in million years.

If the nominal volume of a cosmic cell is $14{\times}10^{24}$ LY^3, then the length of time for an equivalent volume of a cosmic cell to become contracted at the interface is found by solving eqn (8-1) for t:

$$14{\times}10^{24}\ \text{LY}^3 = 2.64{\times}10^{21}(\text{LY}^3/\text{MY}){\times}(\text{time})$$
$$t \cong 5{,}300 \text{ MY.}$$

The interface absorbs (by means of *space contraction*) the equivalent of one cosmic bubble of volume in 5.3 Gigayears.

In effect, a cosmic bubble duplicates its own total volume of *aether* every 5,300 million years.

9. Is The Core of the Void a Nursery for Galaxies?

It has been shown (using equation (7-1)) that it takes about 300 Gigayears (GY) of comoving expansion to convey a point, or test particle, starting one lightyear from the center of a void and ending at the interface 150,000,000 lightyears from the center of the void. How long does it take to reach the halfway point at 75,000,000 lightyears? Remarkably, it takes 290 GY for expansion to reach one half the radius of a full-size cosmic bubble. This leaves only 10 GY in which to expand the balance of the distance to the interface; and is achieved by a relentless increase in both the speed and acceleration of the outward space flow (caused by expansion). Obviously comoving expansion takes a very long time, both in relative and absolute terms. The prolonged slow expansion and almost negligible *space flow* in the central portion of a void, leads to an interesting possibility.

Part of the DSSU theory of galaxy formation is described as follows: As *space* expands in three spatial dimensions and flows radially outward from the cosmic bubble's central void, *space* accumulates matter by a formation process in which primitive matter emerges from the aether, from the fundamental fluctuators that constitute aether. The primitive matter grows and evolves —manifesting as conventional energy and mass particles. The important point here is that matter accumulation within the void depends primarily on time and consequently on radial position.

Now if we divide the total *expansion-flow* time of 300 GY (Graph 3) into two equal time periods along the full nominal radius: then 150 GY is spent along the first million lightyears of length (actually considerably less than one million lightyears, only 11,400 LY, using equation (6-1a)); and 150 GY along the much longer 149 million lightyears, of the latter portion of the radius. In descriptive terms, it is as if *space* sits leisurely at the core of the void for 150 Gigayears and then spends another 150 Gigayears expanding completely across the void (to the interface boundary). This is a disproportionate consequence of the 'miracle' of compounding or exponential growth!

Back to the galaxy formation process. A vital quantity for determining the rate of galaxy formation is missing. What is the rate of matter formation and accumulation per unit of volume? Equivalently one may ask, how long does it take for a galaxy to form from pure vacuum energy and its derivatives? It could not possibly be a short time span —otherwise the voids would not be voids and would be filled with proto-galaxies and mature galaxies. It would have to be as long as possible. A reasonable assumption is that the time span of formation is not more than 150 GY. By the time a region of matter and energy accumulation reaches the interface it will have evolved into a full grown elliptical. This result is predictable and observable (only the evolution time is contentious but seems reasonable).

If we accept this conservative time frame for the formation of galaxies in expanding and flowing space, and we recognize that the same time span (about 150 GY) and the same rate of *space* expansion occurs in the central core (approx. one MLY radius) of the void, we can reasonably surmise that galaxies also form, and even mature, in this region. It is possible that galaxy formation is great enough to sustain a small cluster of galaxies. The result would be a void core-region where *expansion space-flow* is actually radially inward. The geometric center of each void may actually be a region of net space-contraction. Without knowing the rate of matter formation per unit of volume, the size and degree of contraction remains speculative.

Full grown galaxies arriving at the interface is an observable fact; the existence of galaxies in the center of a cosmic-bubble void is an interesting idea and actually has been reported but not verified.

Verification requires the inclusion of the following properties applied to a small group of galaxies: All must be spherical, or almost spherical. No galaxy rotation (a consequence of the fact that expansion *space-flow* is negligibly small). All members must have practically identical redshifts. The redshift distance must correspond to the center of a void. Significantly, there should be no intrinsic velocity and as a result the redshift would provide a pure measure of depth position.

There is also the crucial question of stability: Would the galaxies or proto-galaxies of this contracting region be stable in their location, or would they, one by one, drift into the outbound flow and slid down the hill of space-expansion upon which they are balanced? Or maybe this entire contracting region is unstable in its location. It would seem that any such pocket of accumulation is unstable, something like balancing a marble on top of a balloon. The core may act as a temporary nucleus, lose its balance, and drift away; while a new nucleus begins to grow and replace the former. In either case, the void core simply serves as a nursery for nascent galaxies.

10. Conclusions and Closing Comments

The foregoing discussion is much more than the presentation of an aether theory. If there is one concept that unifies the present paper on the flow-, expansion-, and contraction of aether, it is the phenomenon of gravitation.

The common theme in the discussion of space flow, expansion, and contraction is that they are all aspects of gravitation.

Although the *space contraction Postulate* of the DSSU is designated as the *gravity Postulate* both space expansion *and* contraction are participants in the mechanism of gravity. Together they produce a unified gravity consisting of primary, secondary and tertiary effects (as described in the text).

What this means is that our two *Space Postulates* (one associated with the usual contractile gravity the other associated with the divergent Lambda effect), applied to their designated regional domains, constitute the key elements of *a theory of unified gravity*.

What we experience locally as *the acceleration due to gravity* is the acceleration of space-flow itself. We define a contractile gravity field this way: *The intensity of the gravitational effect at a particular location is a measure of the local space-flow acceleration with respect to the gravitating body.*[11] And what about a unified gravity field? The intensity of gravity at a particular location in a unified gravity field (which necessarily is of cosmic proportion) is a measure of the bulk space-flow acceleration, *whether diverging or converging*, and which ultimately converges on the nodal mass concentration at the very center.

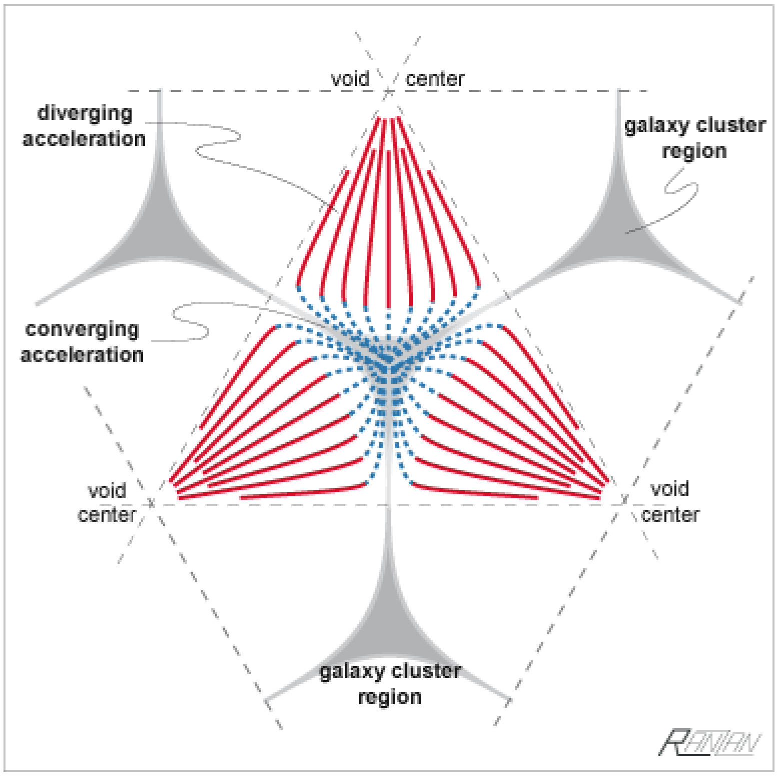


Figure 8. *Unified gravitation cell is an aether acceleration field.* The contractile gravity region (blue lines) and the Lambda regions (red lines) are configured into a *unified* gravity region. The schematic trefoil-shaped field corresponds to the hexagonal cellular structure of a flat plane. In the real Universe of dodekahedral bubble universes the unified gravity cells are shaped as tetrahedra and octahedra.

Thus, the two *Space Postulates* —along with matter/energy supplied by the *Matter-formation Postulate*— constitute a theory of unified gravity. Aspects of the theory, immediately apparent and made obvious in Figure 8, are the range limit and non-sphericity of gravity.

We may safely conclude that since gravity fields have limits and those limits lack spherical symmetry, Newton's constant *G* cannot be a true constant of Nature. It cannot be applied to the truly cosmic scale.

While individual unified gravity fields are strictly limited in range, the number of such fields has no limit whatsoever. It is implicit in the cellular nature of the Universe. And as so often happens in DSSU explorations, we gain new insight into old ideas. A case in point: Physicists tell us that,

> *... that there is no 'pure' inertial motion* [i.e. unaccelerated]*; all motion is accelerated and space cannot be conceived to exist without a gravitational field ...* [12]

Or in Einstein's words "the gravitational field cannot be done away with." [13]

The image in Figure 8 makes it clear why it is so. Place a test object anywhere in the unified gravity field and it will accelerate (along the trajectories shown). Place a test object anywhere in the universe,[14] for that matter, and it will accelerate *since every region is part of a gravitational field.*

Acceleration, $a_{\text{AETHER FLOW}}$, is the all-important measure of gravity —the very intensity of gravity. Specifically, acceleration is simply the time-rate-of-change of the aether flow speed (or velocity when expressed in vector form). The direction of flow is referenced to a 'local' mass structure or to the Euclidean structure of the Cellular Universe (as was done with the acceleration of aether in the void). Using the Newtonian Laws and classical physics we can interpret expressions for both acceleration and velocity of aether.

DSSU Theory, the Broader Appeal

In a world experiencing a new dark age; a world in which over 90% of the population professes belief in the supernatural; a world in which the international body formed many years ago with the express purpose of preventing wars has been subverted towards instigating wars of aggression; a world in which the educated elite have constructed a creationist mythoreligious worldview of which they confess is highly unnatural to the point of being *preposterous*;[15] in a world where individuals are still, in this twenty-first century, persecuted and jailed for the beliefs, opinions and truths they express; ... one's intellectual spirit finds in the physics of DSSU theory the rational and unifying rules so woefully absent in the world of human affairs. □

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Appendix

A1. Selected Values and Conversions:

Speed of light ≅ 3.00×10^{8} meters/sec
$G_N = 6.673\times10^{-11}$ N·m²/kg²
1 year = 3.156×10^{7} seconds
1 lightyear = 9.461×10^{12} km
1 km/s = 3.3353 LY/MY, speed
1 cubic lightyear = 8.47×10^{47} cubic meters
H ≅ 18.67 km/s per MLY ≅ 0.00006227 MY^{-1}

A2. Calculating the Expansion Rate Using Volume Method

Volume Rate of Space Expansion. We use the standard exponential growth rate (or *unrestricted* growth rate) equation for the ***rate of space expansion***:

$$dV/dt = +3k\,V\,. \tag{A1}$$

The growth rate depends on the volume present and on a proportionality constant, *3k*, which we are free to designate as *3H* (*H* being the space expansion 'constant'). The "3" reflects the fact that space expands in three spatial dimensions. The positive sign simply indicates that the volume *V* is increasing with time.

Total Volume Expansion. The expression for volume expansion is obtained by rearranging the terms of (A1) and then integrating:

$$dV/V = 3H\,dt,$$
$$\int 1/V\,dV = 3H \int dt,$$
$$\ln V = 3H\,t + C.$$

The integration constant *C* is determined from the fact that $V=V_0$ when $t=0$ (i.e., the initial volume is V_0). Then $C = \ln V_0$, and

$$\ln V = 3H\,t + \ln V_0\,.$$

The volume expansion (at time *t*) then is:

$$V(t) = V_0\, e^{3Ht}\,. \tag{A2}$$

When applying this equation one must be careful to select the appropriate initial volume V_0. For the *volume expansion equation* to agree with the *radial expansion equation* (below), an equivalent starting volume or radius must be used. This means that if r_0 is 1 lightyear then V_0 must be $^4/_3\pi$ cubic lightyears (the volume of a sphere of 1 lightyear radius).

Radial Expansion Rate. To determine the *radial expansion rate* (the expansion velocity) we need only apply the chain rule to (A1) and express the volume in terms of *r*:

$$^{dV}/_{dt} = {}^{dV}/_{dr}\ {}^{dr}/_{dt} = +3HV.$$

Substituting for the volume of a sphere $V = {}^4/_3\,\pi r^3$, and differentiating with respect to *r*, so that $^{dV}/_{dr} = {}^4/_3\,\pi 3r^2$, then:

$$^4/_3\,\pi 3r^2\ {}^{dr}/_{dt} = 3H({}^4/_3\,\pi r^3)\,,$$
$$^{dr}/_{dt} = Hr\,.$$

Thus our final expression here, for the rate of change of the radius (resulting from the volume expansion), is basically the same as (6-8) in the main text:

$$^{dr}/_{dt} = v(r) = Hr\,. \tag{A3}$$

Space Expansion Parameter. Since we have earlier deduced that radial expansion speed is about 2800 km/s when the radius is 150 MLY, we can immediately find the value of the ***space expansion parameter H*** by simply substituting the two known values into (A3):

$$H = v / r = 2800\text{ km/s} \div 150\text{ MLY}$$
$$\approx 18.7\text{ km/s per MLY}, \tag{A4}$$

or equivalently,

$$H \approx 0.00006227\,/\text{MY}\,.$$

Time Equation. From (A2) we can also obtain the *time equation*. Take the natural log of both sides of (A2) and solve for the time parameter:

$$\ln V = \ln V_0 + \ln e^{3Ht}$$
$$3Ht = \ln(V / V_0)$$
$$t = (1 / 3H)\ \ln(V / V_0) = (1 / 3H)\ \ln(r^3 / r_0^3)$$
$$t = (1 / H)\ \ln(r / r_0)\,. \tag{A5}$$

A3. Table of Aether-Flow Components

Selected Aether-Flow Components					
SOURCE	**Radial Location** (from source)	**Mass** (within radial location)	**Aether-Flow speed** eqn (1-3)	**Aether-Flow acceleration** eqn (1-4)	**Aether Contraction** $U_{CON.\,RATE}$ per eq (2-3)
Earth (acting as aether sink)	@ surface $R_E = 6.37\times10^{6}$m	5.98×10^{24} kg	11.2 km/s	9.83 m/s²	2.64×10^{-3} m³/s per Euclidean m³
Sun (as aether sink)	@ surface $R_S = 6.96\times10^{8}$m	1.99×10^{30} kg	6.18×10^{5} m/s = 618 km/s	274 m/s²	1.33×10^{-3} m³/s "
Sun (as aether sink)	@ Earth orbit $R_{E.ORBIT} = 1.50\times10^{11}$m	2.00×10^{30} kg	4.22×10^{4} m/s = 42.2 km/s	0.00593 m/s²	4.2×10^{-3} m³/s "
Milky Way Galaxy (as aether sink)	@ Solar System orbit $R_{GAL\ INNER\ RADIUS} = 2.2\times10^{20}$m	$1.1\times10^{11}{}_{SM}$ x $(2.0\times10^{30}$kg)	3.65×10^{5} m/s = 365 km/s	3.03×10^{-10} m/s²	2.49×10^{-15} m³/s "
Earth's orbital motion	N/A	N/A	$v_{TANGENT}$= 30km/s	N/A	N/A

Table Notes:

The significance of the *Aether-Flow speed* is that this is the speed that must be taken into account when calculating relativistic effects (length contraction and time dilation).

The significance of the *Aether-Flow acceleration* is that this is the measure of the intensity of gravity.

The significance of the *Aether Contraction* is that this is the measure of the self-dissipation of aether.

A4. Useful Resources

- Reginald T. Cahill, *Absolute Motion and Quantum Gravity*, (2002) (www.scieng.flinders.edu.au/cpes/people/cahill_r/processphysics.html)
- R. T. Cahill, *The Michelson and Morley 1887 Experiment and the Discovery of Absolute Motion* (Progress in Physics, October, 2005 Vol. 3)
- The vector version of the equations for the dynamic flow of aether may be found here: R. T. Cahill, *Dynamical 3-Space: Alternative Explanation of the 'Dark Matter Ring'* (arXiv:0705.2846v1 [physics.gen-ph] 20 May 2007)
- R. T.Cahill, *Space and Gravitation.* **Magister Botanicus**, Vol.2, pp.13-22, (January 2004)

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[3] E.R. Harrison, *Cosmology, the Science of the Universe* (Cambridge University Press, 1981) p170

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[5] E.P. Hubble, *The Realm of the Nebulae* (Yale University Press, 1936) p121

[6] Paul Marmet,. *Discovery of H2, in Space Explains Dark Matter and Redshift* Published in 21st CENTURY Science & Technology, Spring 2000, Pages 5-7 (http://www.newtonphysics.on.ca/hydrogen/index.htm)

[7] David Layzer, *Constructing the Universe,* Scientific American Library (W.H. Freeman & Co., New York, 1984) p267-8

[8] William K. Hartmann, *Astronomy: the Cosmic Journey*, 1991 Ed. (Wadsworth Publishing Co) p558

[9] Using the exponential rule: $d/dx\, b^u = b^u\, ln\, b\, du/dx$.

[10] Lambda-expansion is the space expansion associated with Einstein's *cosmological constant* of positive value.

[11] Reginald T. Cahill, *Space and Gravitation.* **Magister Botanicus**, Vol.2, pp.13-22, January 2004

[12] Correa & Correa (2006) *The Gravitational Aether, Part II* (Akronos Publishing @ Aetherometry.com, Canada) p10 (http://aetherometry.com/cgi-bin/accept_free.cgi/AS3-II.9.pdf?file=AS3-II.9.pdf&action=askprevious)

[13] Ibid., p12

[14] Except at Lagrangian points: For instance, at the very center of a void there is no gravitational acceleration.

[15] Sean M. Carroll, *The Cosmological Constant* (astro-ph/0004075 EFI-2000-13 Available at http://relativity.livingreviews.org/Articles/lrr-2001-1) (Physicist Sean Carroll's website: http://preposterousuniverse.com/)