DSSU, THE NON-EXPANDING UNIVERSE: STRUCTURE, REDSHIFT, DISTANCE

(A new interpretation of the cosmic redshift and the distance it encodes)

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The universe has succeeded with a beautifully elegant trick.
It is eternally evolving yet forever remaining the same. —Dr. Johan Masreliez[1]

1 FORMATION OF CELL STRUCTURE

The *DSSU* (the *Dynamic Steady State Universe*) is a universe[2] in which *space* expands but the universe as a whole *does not*. It is surprisingly easy to demonstrate in an analogous way that a universe consisting mostly (even overwhelmingly) of expanding space —where *space* is defined as a quantum foam of fluctuating energy entities— is itself NOT expanding.

Space is the fluid of the Universe; ordinary liquid is the fluid in the following two-dimensional analogy.

Consider a large shallow pan of water, or oil, gently and evenly heated from beneath and similarly cooled from above. A steady fluid flow is set in motion, as the warm liquid rises, cools at the top, and sinks again in what is known as a convection motion. Sprinkling some powder or fine sawdust over the liquid surface reveals the flow pattern. Significantly, the convection currents will *not* cause the floating particles to drift radially towards the perimeter of the pan as one might imagine as in Fig. 1. If conditions are favorable (viscosity, thermal conductivity,
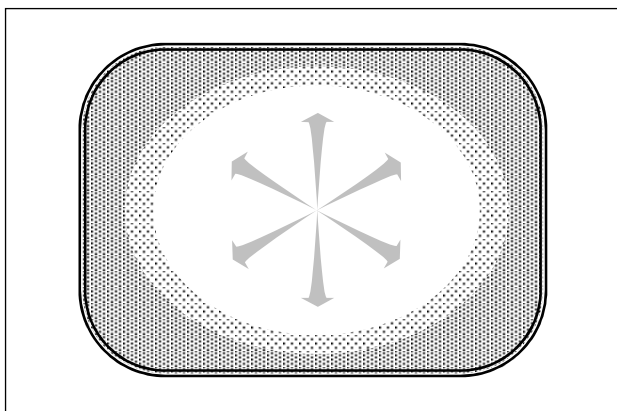
thermal-expansion coefficient, minimal inhomogeneity) what will actually be observed is a striking pattern (Fig. 2) consisting of mostly hexagons —much like a bee colony's honeycomb —but also incorporating various irregular-polygon flaws.[3] [4]
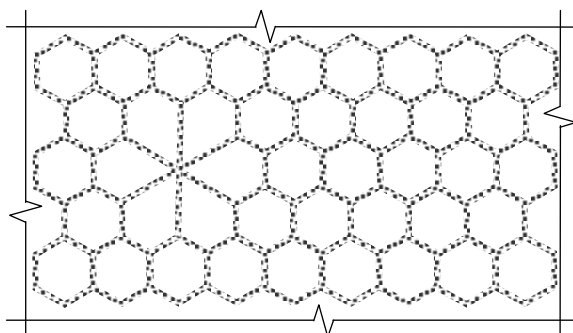
Fig. 2. Convection cells, viewed from above, reveal the flow pattern of a liquid being evenly heated from below. The lines in this schematic represent the surface locations where floating particles aggregate. Notice the change in the regularity of the pattern when just one cell collapses (or simply failed to form at the outset).

The insight gained from this simple lab experiment is that a dynamic process —a convection flow in a heated liquid— can produce a more or less static pattern (an array of hexagons). Clearly a dynamic process can produce a static pattern on a two dimensional surface.[5]

A similar dynamic process occurs in the surface layer of the Sun. The scale is much larger; the cells are typically 800 to 1200 kilometers across. Also, the pattern is much less regular as solar magnetic fields act to disturb and complicate the cell pattern (Fig. 3). The main point of interest is that the surface radial flow of fluid on top of the cells is limited by the cell boundaries (whether of a regular shape or not). Furthermore, the cell boundaries act as sinks for the surface flow.
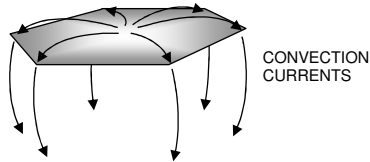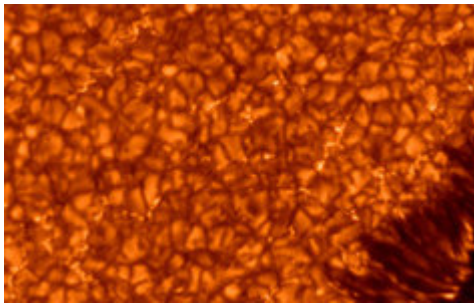
Fig. 1. Convection flow pattern that one might wrongly expect to find on the surface of a liquid being evenly heated from below.

Fig. 3.   Convection cells of the Sun's surface layer (photo, top). The cells are typically 800 to 1200 kilometers across. The line drawing shows how the radial surface flow drains through the cell boundary.

Now before applying this insight to the next higher dimension we need to clarify what is meant by *the dynamics of the fluid* constituting our Universe. Whatever one chooses to name it —space, aether, quantum foam, or essence-of-the-universe— the quantum foam *fluid* can do three things. It can **expand**, it can **contract**, it can **flow**. In make this assertion I am not stating anything new; astrophysics permits all three as model components. Einstein's theory of general relativity, for instance, requires that space expand or contract but forbids it to remain static. What *is* new, however, is their concurrent usage.

Above all, we want to avoid the type of mistake presented in Fig. 1 where global cell growth turned out to be wrong. We clearly understand that *space expansion*, if extrapolated without limit, leads to the expansion of the entire universe! Unrestricted space expansion will lead the unwary to the unrealistic Big Bang scenario (Fig. 4)!
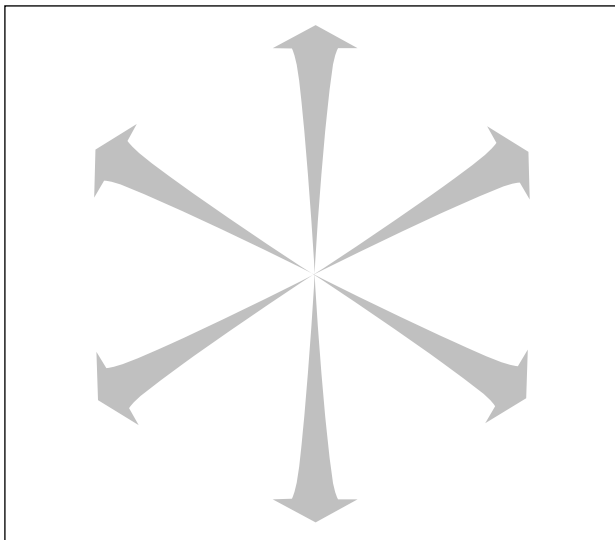

Fig. 4.   In the Big Bang scenario *space* expands **and** the whole universe expands.

A THOUGHT EXPERIMENT.   Consider a large portion of a universe filled with expanding space and containing nothing else (at least for the moment). We ask the simple question, *Will such a universe grow in size?* If we postulate that the universe already extends to infinity the question becomes meaningless. More specifically then, *Will a finite portion of the universe grow in size?*

To find the answer we sprinkle the representative portion of the universe with luminous 'sawdust' of galaxies. Recall the lab example, a dynamic mechanism prevented the sawdust on the surface of the liquid from migrating to the perimeter of the pan. Similarly, a dynamic action prevents galaxies from drifting (the proper term is *comoving*) into the dim distance of a universe-wide expansion.

The sawdust on the liquid surface followed the thermal convection currents; the movement of galaxies is determined by the dynamics of space. In both cases we witness the formation of cells whose outline is discernable as a web of particle debris —the sawdust in two dimensions, the galaxies in three dimensions.

In the liquid example the *void* of the cell is sustained by the upwelling of heated water from below and the cell interface marks the boundary where cooled water sinks, leaving the sawdust debris behind to display the pattern of the motion. In the expanding-space universe the *void* of the cell is sustained by the upwelling of new space (i.e., space expands) and the cell interface marks the boundary where space sinks out of existence (i.e., space contracts), leaving the flotsam of galaxies behind to highlight the 3-dimensional tapestry woven by the aforementioned three dynamics of space.

The shape of the bubble-cells so formed, at least under ideal conditions, is the rhombic dodecahedron or the trapezoidal-rhombic dodecahedron or both (for a mathematical proof see *The DSSU Manuscript*, chapter 1, The Large Scale Structure of the DSSU). They are known as closest packed polyhedra. No doubt there are imperfect and irregular shapes mixed together with the more regular ones.

And here our thought experiment ends for it is just such cells —with their void-like space-expanding centers and galaxy clustering boundaries— that form the largest scale structure of the DSSU (Fig. 5). The network of structures is not speculation. It is beyond hypothetical. The cellular structure is real.

2   THE LARGEST SCALE STRUCTURE OF THE UNIVERSE FORMS A STATIC PATTERN

THE REAL WORLD.   Our Universe is observed to be cellular. Our Universe is structured as Voronoi cells.

Now the Voronoi cell is a polyhedron. Astronomers have recently discovered that the large-scale distribution of matter in the universe resembles a network of such polyhedra. Most galactic clusters seem to be located on the boundaries of neighboring
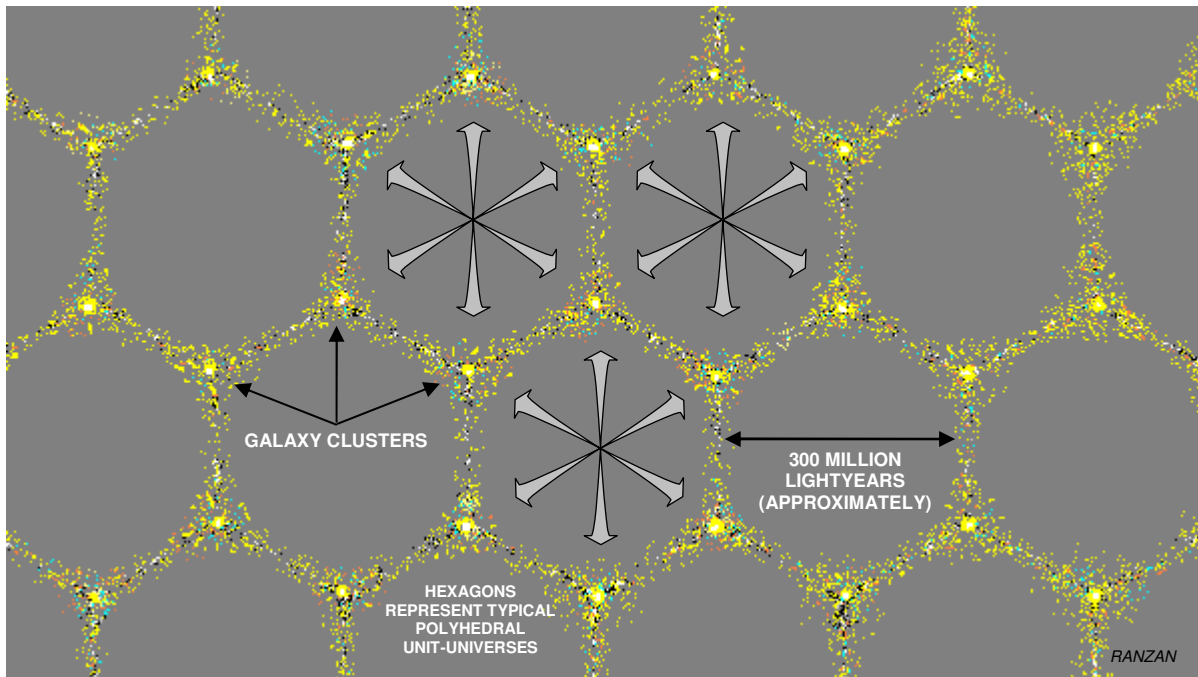
Fig. 5. In the *Dynamic Steady State* cellular universe ***space expands*** but ***the universe does not***. Dynamic processes produce a static polyhedral pattern. The 'sawdust' of galaxies drift radially in regions that are strictly limited courtesy of a universe that is in exquisite and perpetual balance —the quantity of space expanding equals the quantity of space contracting.

Voronoi cells. This pattern has been called the Voronoi cell model of the universe... —Ian Stewart[6]

And in the words of one of these astronomers describing the real world: As is predicted in "the Voronoi model, centers of voids are located randomly, and clusters [of galaxies] are placed as far from void centers as possible. ... During dynamical evolution matter flows away from the low-density regions and forms filaments and clusters of galaxies."[7]

Space expansion acts as a cosmological constant —a repulsion force that tries to maximize the distance between centers of expansion. Each cell has a center of expansion, acting as a center of anti-gravity, from which matter is conveyed outward. The outward motion ends at the space contracting boundary. The Voronoi boundaries become the highly interactive *interface* between bubble universes. As the space inside the cells expands, star clusters and galaxies and other comoving bodies become concentrated along the common Voronoi boundaries.

The bubble interior would be a void, but the bubble wall would be the site of vigorous activity. —Jeremiah P. Ostriker[8]

The paradigm discovery is credited to the Estonian astronomer, Jaan Einasto of Tartu Observatory, who at the 1977 International Astronomical Union meeting presented his analysis of the distribution of the several hundred galaxies for which data was then available. Einasto had found that the Universe has a cellular structure; the large scale organization of galaxies has a net-like cellular pattern with interconnected bridges of galaxies surrounding empty regions.

After many more years of dedicated research Einasto in the year 2003 stated, "observational evidence suggests that rich superclusters and voids form a quasi-regular network of scale ~100-130h^{-1}Mpc;" and "voids between superclusters have mean diameters about 100h^{-1}Mpc." It appears the "Cellular large-scale structure may be the end of the fractal structure of the Universe." [9] In other words, the observations suggest that there are no bigger structures than the Voronoi polyhedral cells.

With the universe being structured as a cellular array numerous phenomena take on new interpretations. Many mysteries may now be readily resolved. One of the more profound consequences is the apparent cancellation of Lambda (the famous cosmological constant) over vast cosmic distances. And one of the more self evident consequences is a mechanism for the cause of galaxy rotation. This paper, however, will focus on how the cellular universe resolves the *cosmology crisis of 1998.* But first it is necessary to describe the *redshift* and its essential connection to the determination of distance.

3 REDSHIFT AND THE MEASUREMENT OF DISTANCE

Now that we have established the basic structure of the DSSU we turn our attention to the determination of distance. Specifically we will look at the various formulations by which redshift has been (and is being) used to measure the cosmic distance to galaxies, to supernovae, and even to the source of microwave background radiation.

DEFINITIONS. **Redshift** is defined as the elongation (the shift) of an emitted electromagnetic wave, towards a longer wavelength, expressed as a fraction of the original wavelength itself. **Redshifting** is simply a stretching of the wavelengths of light or other electromagnetic radiation beamed forth by an astronomical object. A **wavelength** (λ) is the distance between successive crests of a wave. A redshift can occur in all kinds of radiation, from the very shortest gamma rays and X-rays, through to the increasingly longer ultraviolet rays, visible light, infrared rays, and finally to the short and long radio waves.

If the original wavelength is known from its chemical fingerprint, or otherwise deduced, then and only then can the degree of redshift be determined and actually serve as a measure of velocity (under the Doppler interpretation) and of distance (under the expanding-space interpretation).

Astronomers use the relative displacement of specific spectral lines[10] (the chemical fingerprints) in the light from astronomical sources when compared with a laboratory standard here on Earth to determine a redshift value. In practice it is symbolized by z, a unitless index, and is measured as the ratio of the change in the length of a wave and its original length:

$$Redshift = \frac{observed\ wavelength - emitted\ wavelength}{emitted\ wavelength}$$

$$z = (\lambda_o - \lambda) / \lambda \qquad \text{(by definition)}$$

The redshift is probably the single most important measurement extracted from astronomical objects, particularly from whole galaxies. The *redshift* of the light from galaxies in one way or another relates to the *distance* of those galaxies. This is essentially true regardless of one's theory of the universe (be it static, steady state, universal expansion, or cellular). The challenge in astrophysics has always been to find the correct relationship —one that agrees with other distance measurement methods independent of redshift.

BIG BANG EQUATION 1. THE BASIC HUBBLE LAW. Omitting all the fascinating details that invariably surround paradigm discoveries we directly focus at the heart of Edwin Hubble's pioneering achievement. The first redshift-distance relation, known as the basic Hubble law,

$$\text{distance,}\ \ r = z / h\,, \qquad (1)$$

with h as the constant of proportionality, made its appearance in 1929. It was usually interpreted as a Doppler effect, whereby the spectral shift is the result of galaxies themselves moving through static spacetime. To make the interpretation explicit the numerator, unitless z, was multiplied by the speed of light c (and to be consistent the denominator, h in (1), was also multiplied by c and henceforth became the capitalized Hubble's constant H). Equation (1) became,

$$\text{distance,}\ \ r = cz\,/\,ch = v\,/\,H\,, \qquad (1a)$$

where $v = cz$ is the speed of the receding (redshifted) galaxy and c is the speed of light. As long as z was small there was no problem; historically this was the case up until the 1960s. Then, z measurements were being recorded that pushed the recession speed (the $v = cz$) uncomfortably close to the speed of light. Galaxies, however, simply cannot race *through* space at such high speeds. The classical Doppler formula had reached its limit. Hence a relativistic interpretation of z was needed; instead of having $z = v/c$ Einstein's special relativity restriction was applied to the motion of the galaxies and astronomers began using

$$z = [(c+v)/(c-v)]^{1/2} - 1\,. \qquad (2a)$$

This formulation of the redshift index led to the recession speed expression (found by solving the previous equation for v),

$$v = c\,\frac{(z+1)^2 - 1}{(z+1)^2 + 1}\,, \qquad (2b)$$

and when applied to eqn. (1a), then gives the relativistic Hubble's law: [11]

BIG BANG EQUATION 2
Relativistic Hubble's Law

$$\text{Distance} = \frac{v}{H} = \frac{c}{H}\,\frac{(z+1)^2 - 1}{(z+1)^2 + 1} \qquad (2c)$$

Unfortunately this equation also has its limitations. Although the equation works reasonably well for redshifts up to about $z = 0.5$, or 38.5% of the speed of light, the equation still represents a Doppler interpretation. In any universe with expanding space, and this includes the Big Bang (BB) universe, it is the *space expansion* interpretation that ultimately determines the validity of any distance formulation.

The BB model uses a *universal space expansion* interpretation. The expansion redshift is, of course, due to the expansion of space. Comoving galaxies, stationary *in* expanding space, receive radiation from each other which is redshifted. The radiation propagates through the expanding space, and during the journey all wavelengths are continually stretched. This redshift is determined by the amount of expansion according to the *expansion redshift law*

$$z = (R_0\,/\,R) - 1\,, \qquad (3a)$$

where R is the value of the *scaling factor* at the time of emission and R_0 is the value at the time of reception. (Simply think of R as the distance to the galaxy at the moment when the light was emitted and R_0 as the distance when the light is finally received.) Once the expansion

redshift of a distant galaxy has been determined, the ratio R_0/R tells us how much the BB universe has expanded during the time in which the light from the galaxy has been traveling towards us. For instance a redshift of $z = 1.5$ means that the universe has grown by 50 percent.[12]

By treating R and R_0 as emission distance and reception distance, a simple distance-redshift equation follows.

$$R_0 = R\,(z + 1) \tag{3b}$$

But, since no one knows the scaling factor of the past — the R in the equation— or its rate of change, this equation is of no use to astronomers. The problem is that no one has ever found a way to measure R. Even more worrying is the fact that its actual existence has never been specifically verified. It might simply be a mathematical construct.[13] [14]

The scaling factor problem underscores an annoying complication inherent in universal BB expansion: the dual distance complication. It is important to realize that in standard cosmology there are actually two distances associated with a remote galaxy. Proponents of BB methodology, and those trying to decipher it, must always distinguish between the *emission distance* (the distance from us that a galaxy was located when the light being measured was originally being emitted) and the *reception distance* (the distance of the same galaxy at the present time). The galaxy has supposedly, according to BB theory, receded while the emitted light traveled towards Earth.

To surmount the problem of the scaling factor BB theorists have adopted the model first proposed by Albert Einstein and Willem deSitter in 1931. With its simplifying assumptions the basic Einstein-deSitter universe (being the simplest of all known universes with a curvature constant $k = 0$, a cosmological constant $\Lambda = 0$, a deceleration term $q = \frac{1}{2}$, flat expanding space, and classed as unbounded and forever expanding) formulates extragalactic distance as:

BIG BANG EQUATION 3
Basic Einstein-deSitter *reception distance*

$$\text{Distance} = \frac{c}{H_0} \times 2\Big(1 - \frac{1}{\sqrt{1+z}}\Big) \tag{3c}$$

During the last decade of the 20th century the gauging of very distant objects using measuring techniques independent of redshift made it increasingly obvious that the simple Einstein-deSitter equation also breaks down. The data from distant supernovae indicated that these objects are actually located farther than theory predicted (and precipitated the *crisis of 1998*). Once again the distance-redshift formula was revised. The Friedmann model, in which a density parameter omega (Ω) plays a key role, was adopted. In effect, it is like having an *adjustable* Einstein-deSitter curve. In the Einstein-

deSitter the density ratio Ω does not appear because its value is equal to 1 and does not change (one of that model's simplifying assumptions). In the Friedmann the value of Ω_0 is subject to interpretation of matter density data. Basically, it is a variable factor that permits professionals to adjust the rate of expansion of their BB universe.

The formula currently popular among astronomers for determining proper comoving (comoving with expanding space) distance:

BIG BANG EQUATION 4
The **Friedmann** (k = 0) reception-distance eqn.

$$\text{Distance} = \frac{2c}{H_0\,\Omega_0^{\,2}\,(1+z)}\,\{\Omega_0\,z + (\Omega_0 - 2)\,[(\Omega_0\,z + 1)^{1/2} - 1]\} \tag{4}$$

Mattig (1959)

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which, when the *total energy density* Ω_0 is set equal to 1.0, simplifies to become the basic Einstein-deSitter equation (3c).

It is interesting to note that physicist and expansion expert Anrei Linde, uncomfortable with the criticality of $\Omega = 1$, anticipated the need for an adjustable density parameter when in 1995 he promoted the idea of "Inflation with Variable Omega."[15]

Functionally the 'adjustable' **Friedmann** equation cannot fail. By adjusting the value of Ω_0 the distance can always be made to agree with the supernovae findings — specifically the Type 1A Supernovae data. That, however, is also the problem; different regions of the BB universe require different Ω density values. A major ongoing effort in astrophysics is to come to some agreement on its appropriate value. If left unresolved, it would mean that the BB violates *the cosmological principle* which holds that the universe is homogeneous and isotropic; that is, uniform in all places and in all directions.

In this brief overview we have seen that ever since the redshift has been related to cosmic distance the usefulness of each formulation was limited. Moreover, none could ever be applied to an infinite universe.

Redshift serves as a measure of expansion — specifically the expansion of quantum space. It does not, it cannot, serve as a measure of the expansion of the entire universe. To claim that it does is to indulge in unwarranted extrapolation. Such an assertion of universe-wide expansion reveals the fatal flaw of all expansion-of-the-universe models. Unfortunately this is the interpretation which is presented as the officially sanctioned version in journals, texts, and popular media.

In contrast, DSSU theory refrains from speculation and makes no such extrapolation. It recognizes that when *general relativity* says, and rightly so, that space expands it does **not** follow that the entire universe expands.

4 DSSU COSMIC REDSHIFT EXPRESSION

Interestingly, each of the four formulations for distance expressed above uses the speed of light. Since the cosmic redshift is caused by the expansion of space and NOT by the movement of galaxies some professionals have argued that the speed of light is irrelevant.

... redshift does not really have anything to do with velocities at all in cosmology. The redshift is a...dimensionless number which...tells us the relative distance between galaxies when the light was emitted compared with that distance now [with the inclusion of the intervening expanded space]. *It is a great pity that Hubble multiplied z by c. I hope we will eventually get rid of the c.* —M. S. Longair, 1995 [16]

Fig. 6. Determining the redshift across a unit-universe. The difference in the *z* values between M87 and NGC4874 is 0.01974; the difference between M87 and NGC3842 is 0.01671. The average difference is 0.01823. The redshift across a typical unit-universe is symbolized by z_{UU} and assigned the empirical value 0.01823. (Drawing not to scale; galaxy size is greatly exaggerated.)

DSSU theory may well be the first to achieve this sought after formulation. Our cellular universe does not need the speed of light *c* as part of its unique and simple distance equation. It does, however, need a new expression for *z*, the cosmic redshift.

In BB cosmology *z* is determined, at least theoretically, by the ratio of scaling factors; in the new cosmology *z* is determined by the cellular structure. Once we have a theory-specific expression for *z* then, and only then, will we be in a position to derive a distance equation and comply with the earlier statement that the cosmic redshift, in some way, relates to the distance of the light source.

THE DSSU COSMIC REDSHIFT EXPRESSION. Recall the DSSU is structured into cells each filled with expanding space; the cells themselves, however, do not expand. As a first step in developing a cellular-specific redshift expression we need to measure the redshift caused by the expansion of space within a typical cell and caused during the time of the light's transit across the cell. Basically we seek the redshift across the diameter of a single cell. This is easily done. We select stationary galaxies on opposite sides (near side and far side) of a 'nearby' cell. Most useful are the non-rotating supergiant galaxies, the ones that astronomers label *cD* in recognition of their unmistakable size and unmistakable brightness and cluster dominating stature. In DSSU cosmology they are the *nodal galaxies* which reign supreme at the various vertices of each polyhedral cell. A true nodal galaxy does not move. Not ever. For the near-side, the nodal galaxy M87, the core galaxy of the Virgo Cluster, provides an obvious choice. On the far side NGC4874 (in Coma cluster A1656) as well as NGC3842
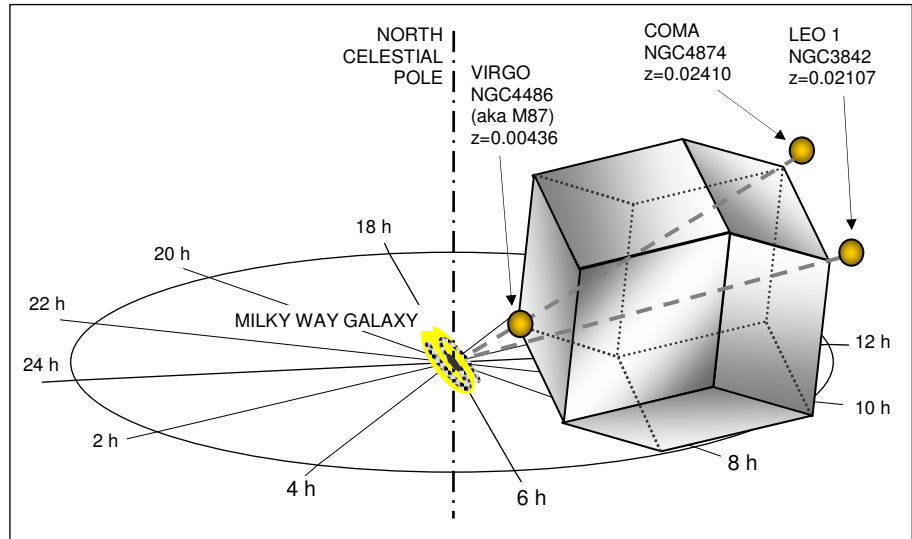
(in Leo 1 cluster A1367) are easily recognized as nodal supergiants. The region between Virgo and Coma-Leo is the space expanding void. The redshift reading of the near galaxy is subtracted from the far; then averaged. Figure 6 shows the numbers.[17] The nominal redshift across a single polyhedral cell turns out to be $z_{UU} = 0.01823$ where the subscript means 'across one **unit-universe**.'

Note carefully, knowing the redshift z_{UU} across the cell does not give us any meaningful distance information. The only thing we can say for certain is that intervening space has expanded by 100 *z* percent or about 1.8 percent since the time the light was originally emitted from the far-side galaxies. This is the message provided by the 1.8 percent increase in the wavelength. The percentage amount of the increase is independent of the transit time, independent of the original wavelength, and even independent of the way the space expands (whether slowly, quickly, or in a series of jerks)! Between the time of emission and the time of reception, both the wavelength and the intervening space in the void have expanded by a certain percentage or by a factor $\Delta\lambda/\lambda$ (which happens to be $z_{UU} = 0.01823$ for each identical size cell). Without some additional information we do not know how far the light wave has traveled; and we do not know how much time the transit has taken. But we do know that the size of the unit-universe (u-u) has *not* changed. This invariant property is inherent in the DSSU and reflects the static aspect of the model.[18]

The development of an appropriate redshift formula uses *the basic fact that each and every u-u induces a similar proportional elongation in the wavelength.* The elongations are successive; they are compounded. When the light wave travels through a series of unit-universes, we find that with each passage through a u-u the new

wavelength is given by the previous wavelength *plus* its proportional change. Since the proportional change (using idealized conditions) is always z_{UU}, then we simply use the common factor $(1+z_{UU})$ to obtain the new wavelength. Fig. 7 shows each u-u providing another factor $(1+z_{UU})$ to the growing wavelength. After passing through N number of unit-universes, the light wave that is finally observed has N common factors —giving us the observed wavelength (λ_0).

Next we use the definition of the redshift, $z = (\lambda_0 - \lambda)/\lambda$, and substitute $\lambda_0 = \lambda(1+z_{UU})^N$ to obtain the cosmic redshift equation (for the DSSU) in its basic form,
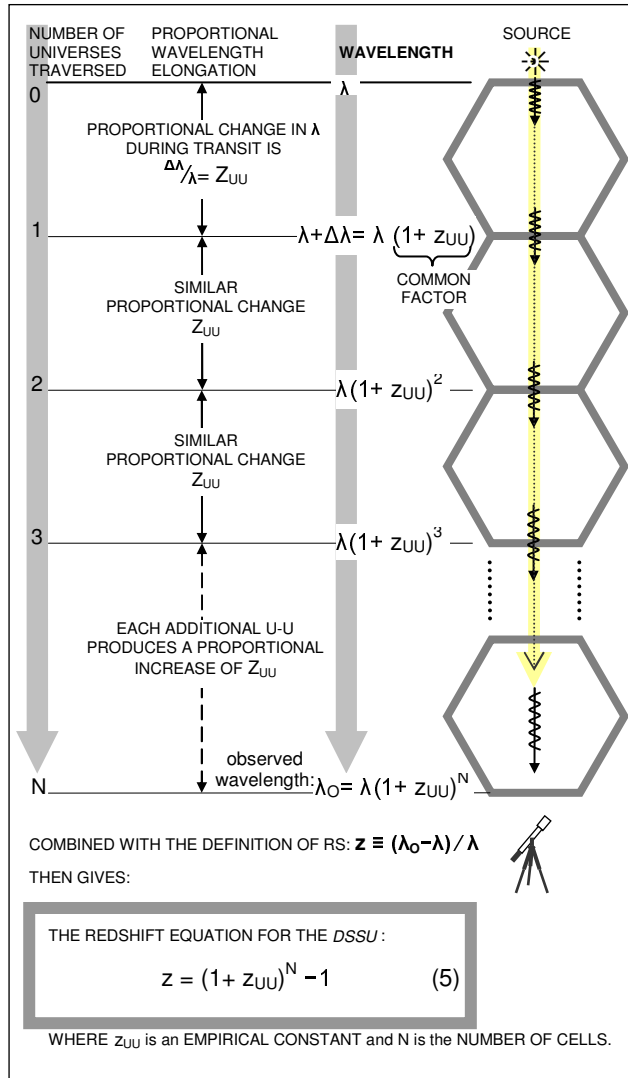
$$z = (1+z_{UU})^N - 1. \qquad (5)$$

Fig. 7. *Cosmic-Redshift equation for the DSSU* is unique for a universe with space that is expanding within a static structure. Each unit-universe (u-u) contributes a redshift component to a quantum of radiation. Each u-u in succession stretches the wave it receives by the factor z_{UU} before passing it on to the next u-u. The final detected redshift z is the *compounding of the repeated stretching effect.*

Although, in the diagram, the light path is shown crossing each u-u symmetrically, a non-symmetrical oblique angle through 3-dimensional cells will not alter the validity of the equation. A light path may at times pass through a long axis and at other times through a very small portion of a cell. This suggests that the N parameter should be considered not as the actual number of units traversed but rather as the *equivalent* u-u number. Also, any minor instability of the u-u size, as well as the non-uniformity of expansion within, is not important. Over multiple voids (cells) the effects tend to average out.

The non-expanding interface regions surrounding the voids *do* introduce a blueshift component; but a judicious choice of a value for z_{UU} should include the blueshift and thus z_{UU} will represent the *net* redshift across a u-u.

5   DSSU AND THE MEASUREMENT OF DISTANCE

By isolating the distance term, N, in (5) we form an equation of distance solely in terms of redshift. The distance according to the number of cells between us and the light source is:

$$N = \ln(1+z) \div \ln(1+z_{UU}) . \qquad (6)$$

N is the natural log of $(1+z)$ divided by natural log of $(1+z_{UU})$. This makes for an interesting, and simple, measure of distance, but not very useful for comparing with conventional distance scales and other universe models.

Basically we need to calibrate the new metric. We need the diameter of our representative cell. And it would be convenient to have it expressed in the ever popular unit, the lightyear (the distance that a pulse of light travels during the time of one Earth year).

But how do we measure such an enormous distance? Geometric methods such as trigonometric parallax, the gold standard for astronomical distances, are completely useless. The distance scale we are involved with is beyond astronomical —we are exploring the cosmic realm where distances are scaled in hundreds of millions of lightyears. The scale is far beyond the interplanetary, the interstellar, and even the intergalactic —the scale is that of the intergalaxy-clusteral. It is a grand scale that involves distances that we cannot fully comprehend —but we pretend, and we imagine, and more. We honor the awesome immensity of the cosmic cells by naming them unit-universes (and in the future individual ones will no doubt be named after the voids they encompass).

The standard method is to use the familiar Hubble's law. Since the redshift factor ($z_{UU} = 0.018$) is well within the accuracy range of the basic Hubble equation (1a) we could simply multiply c times z_{UU} and divide by the space expansion parameter H. We select $H = 18.2$ and hope we have selected a reasonably accurate value. Thus with

c = 300,000 km/s; z_{UU} = 0.01823; and
H = 18.2 km s^{-1} MLY^{-1};

$$\text{Diameter}_{UU} = cz_{UU} / H_{18.2}$$

$$= 300 \text{ million lightyears.}$$

This initial estimate must be supported by some other method. The use of so called standard candles promises to be the most rewarding. The class of nodal galaxies described earlier whose members are the cells location beacons could also serve as distance markers. The known intrinsic luminosity of these supergiants is compared to their apparent brightness; application of the inverse-square law then gives the distance. In addition to brightness, astronomers could also compare the known actual size with the angle that the galaxy subtends when viewed through a telescope.

There are other celestial objects that function somewhat like standard candles. Type 1A supernovae serve as probably the most accurate and rival the nodal galaxies as the most distant.
The overriding advantage of the standard candle method is that the distance so derived is independent of the speed of light, the redshift index, and the H-constant expansion.

We note that a rhombic dodecahedron, with a nominal diameter of 300MLY, has an inscribed sphere with a diameter of 260MLY and a circumscribed sphere with a diameter of 338MLY. Clearly, deciding on how to assign a functional diameter to a seemingly random orientated polyhedron is more intuitive than mechanical. Pending a more accurate measure, let us accept the nominal value of 300MLY as the tentative diameter of the unit-universe. Then

$$\text{Distance}_{COSMIC} = \text{No. of Cells} \times \text{Diameter}_{UU}$$

$$\text{Distance}_{COSMIC} = N \times 300\text{MLY}$$

And the expression for N is given by equation (6).
As a general principle we state,

The Cellular Universe Redshift-Distance Law:

$$\text{Distance} = \frac{\ln(1+z)}{\ln(1+z_{UU})} \times \text{DIA}_{UU} . \qquad (7)$$

And more specifically we state,

The DSSU Cosmic Distance Equation:

$$\text{Distance} = \frac{\ln(1+z)}{\ln(1+z_{UU})} \times 300\text{MLY} \qquad (8)$$

where z_{UU} = 0.01823

Before plotting the new equation and making a graphic comparison with the BB model, it is important that we clarify the dual-distance complication which can easily confuse the unwary.
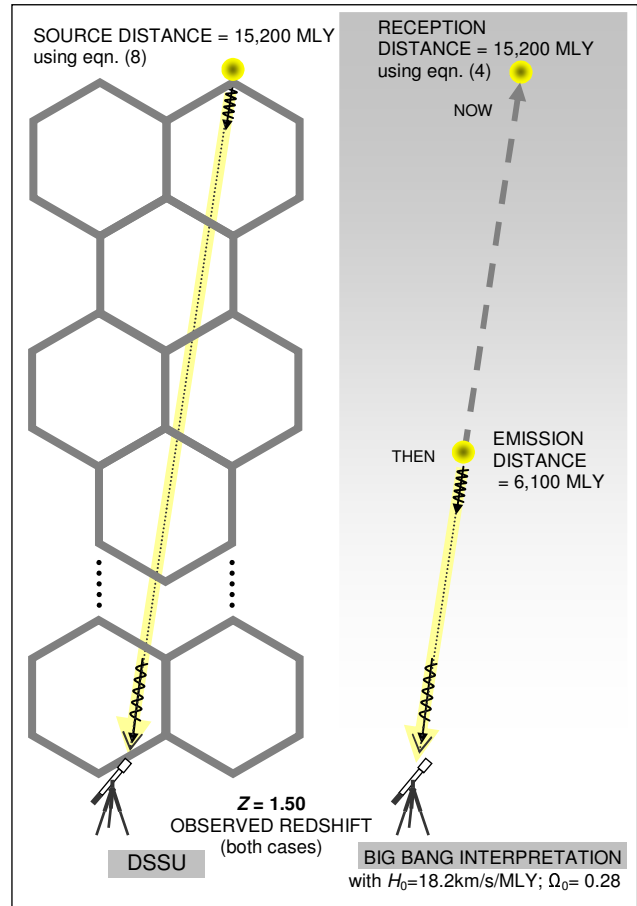

Fig. 8. *Cosmic distance in DSSU is comparable to the reception distance* of the Big Bang model. With universe-wide expansion (at right) the light from a supergiant galaxy would travel 6,100 Million lightyears (MLY) towards the Milky Way galaxy while the supergiant itself comoves with the exploding universe to end-up at 15,200MLY from the observation point. DSSU distance *does not* change with time; big-bang distance *does*. And, for a given redshift, *only at the moment of reception will the two agree.* Not to scale.

In our *Dynamic Steady State Universe* the distance to any high-z galaxy is fixed —its location at the moment the light was emitted long ago is the same as its location at the moment the light is received *now*. As explained earlier such is not the case in the BB model. A reasonable question to ask, is DSSU cosmic distance comparable to BB's *emission* distance or its *reception* distance? —or neither? Prior to the crisis of 1998 which forced the inclusion of a substantial corrective factor the answer would probably have been *neither*. The time of emission was in the distant past when the BB universe was supposedly smaller (so the galaxy was closer); the reception distance relates to some farther location to which the galaxy has drifted (with universal expansion) during the time the light traveled in the other direction to reach our Milky Way galaxy. Simple enough ... but how does the DSSU fixed-distance relate? The example in Fig. 8 with numeric exactness clearly shows that DSSU distance is comparable to BB's *reception distance*.

The emission distance, used in the figure, was calculated by simply taking a fraction $1/(1+z)$ of the reception distance.[19]

The cause of the confusion should become instantly clear. The initial ray of light in one case traveled through 15,200 million lightyears of expanding space and in the other through only 6,100 million lightyears of similarly expanding space —and amazingly underwent the same degree of spectral shifting! (Needless to say the corresponding theories cannot both be right; one must be invalid.)
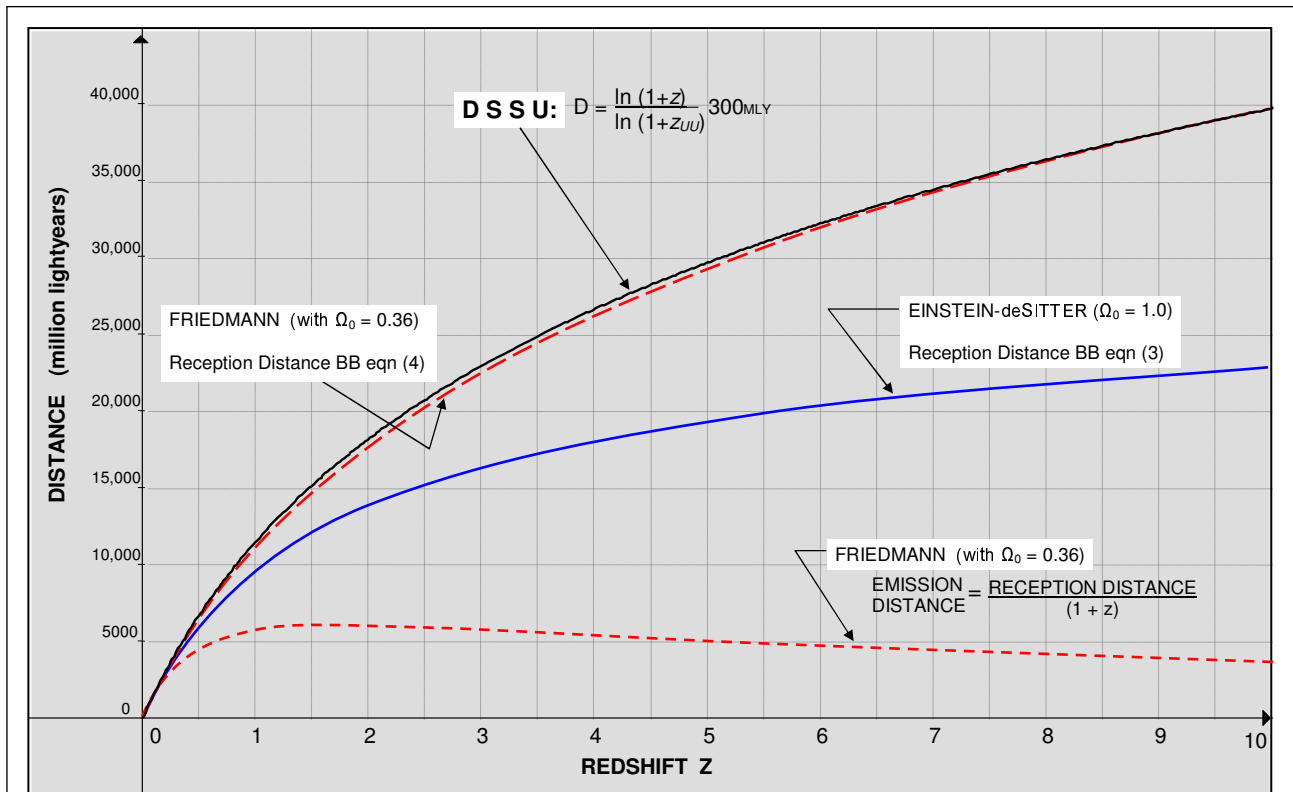
6 A GRAPHIC COMPARISON

Now let us compare the curves of the key distance expressions. As previously explained we expect reasonable agreement between the *DSSU* curve and the *Friedmann reception-distance* curve, provided appropriate values of Ω are used. True enough, this is the case and is shown in Graph 1 for redshifts up to $z = 10$ when $\Omega = 0.36$.

The basic Einstein-deSitter curve, which uses $\Omega = 1.0$, plots the equation that was popular prior to 1998. The conclusive findings of that year made it untenable.

At the bottom of the graph is the emission-distance curve. It is the one rising then declining towards the right, reflecting the BB premise that the universe in the past was smaller. It means that the greater the redshift that is imprinted in the light ray, the further in the past it originated —and the smaller was the size of the universe then. If the emission curve could be extended far enough (towards increasing z) the emission distance becomes infinitely small —leading to a mathematical fantasy world called a *singularity*. Strange as it may seem this is serious stuff in BB cosmology. It is another unscientific extrapolation (this one into the distant past) and I suspect it has led more than a few cosmologists to explore alternate theories.

So much for a general comparison. Let us now look at the redshift range for which reliable distance data is available.

Since the intensity and rate of decay of Type 1A Supernovae are well known, these stellar explosions serve as highly accurate distance measurements —in fact they are the most reliable *standard candles* applicable to high z distances known. The method has been applied by several high-redshift teams and they all conclude that i) Ω cannot be equal to unity, ii) that a cosmological constant (Lambda force) or other form of 'dark energy' is present

DSSU: $D = \dfrac{\ln(1+z)}{\ln(1+z_{UU})} \, 300_{MLY}$

FRIEDMANN (with $\Omega_0 = 0.36$)

Reception Distance BB eqn (4)

EINSTEIN-deSITTER ($\Omega_0 = 1.0$)

Reception Distance BB eqn (3)

FRIEDMANN (with $\Omega_0 = 0.36$)

$\dfrac{\text{EMISSION}}{\text{DISTANCE}} = \dfrac{\text{RECEPTION DISTANCE}}{(1+z)}$

DISTANCE (million lightyears)

REDSHIFT Z

Graph 1. *Key Redshift-Distance equations compared* for redshifts between 0 and 10. Within the redshift domain spanned by this graph, agreement between DSSU (top solid curve) and the zero-curvature Friedmann (top red-dashed curve) is remarkable.

The parameters used in the equations are: the redshift across one unit-universe $z_{UU} = 0.01823$, the Hubble term $H = 18.2$ km/s MLY^{-1}, the density ratio, Ω_0, as shown.

in the universe, and iii) that we (that is, *they*) do not understand the fundamental force driving the universe.

[One such] investigation concludes that an unexplained energy is the principal component of the Universe. ... If this inference is correct, it points to a major gap in current understanding of the fundamental physics of gravity.[20]

But most important for our graphical comparison is that they all agree that the most plausible values for the density parameter is $\Omega_0 \approx 0.3 \pm 0.05$ ($\Omega_M \approx 0.3 \pm 0.05$ and $\Omega_\Lambda \approx 0.7 \pm 0.05$) in a more or less flat universe.[21]

A typical conclusion is that of the Supernova Cosmology Project.[22] Their findings suggest that for a best-fit curve for a flat universe $\Omega_M = 0.25$ and $\Omega_\Lambda = 0.75$.

The team of Richard Ellis, and Mark Sullivan found "These data [on type 1a supernovae (SNe1a)] strongly exclude the hitherto popular Einstein de Sitter cosmology ($\Omega = 1$, $\Lambda = 0$). ... the SNe1a results suggest a significant non-zero cosmological constant ($\Omega = 0.28$, $\Lambda = 0.72$)."[23]

And another group, the High-z Supernova Search Team, reported[24] a best fit with $\Omega_M = 0.28 \pm 0.05$.

We, however, draw but one simple conclusion. The findings support the validity of the DSSU; the SNe1A data bracket the DSSU curve. See Graph 2.

The graph speaks for itself. It shows why researchers had to select Ω_0 in the range 0.25 to 0.35; they sought

agreement with the reality that the DSSU curve represents. A range of 0.15 to 0.25 would have placed objects too far (i.e., mainly above the DSSU curve); a range of 0.35 to 0.45 would have placed objects too near (i.e., substantially below the DSSU curve).
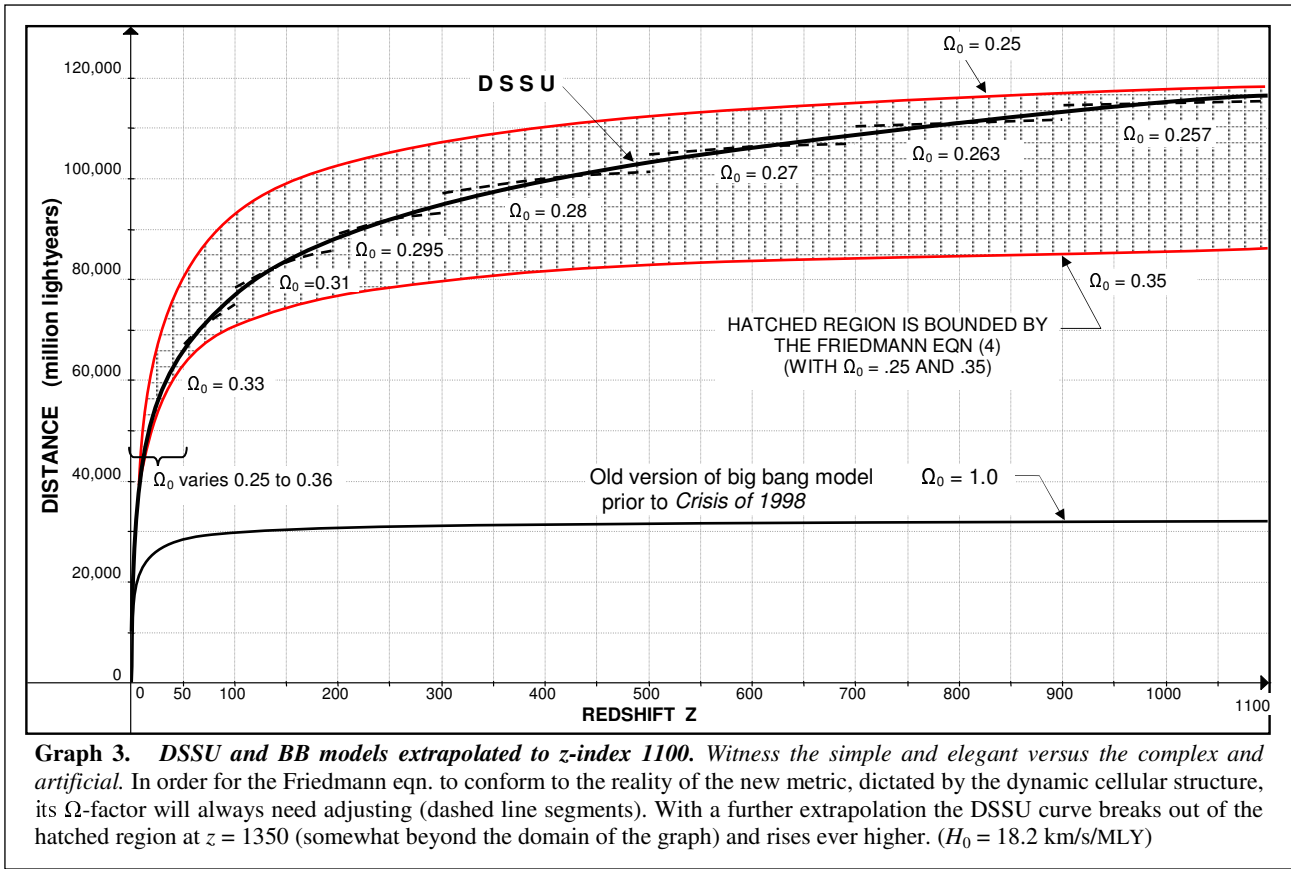
Also, although it hardly needs mentioning, the DSSU (in concordance with observational evidence) is not a curved universe. The early teams of high-z explorers expected to measure the degree of curvature of the universe and found no such curvature. (In fact they were so surprised that they refused to believe their own results pending repeated efforts.)

Ironically the supernova evidence clearly failed to support the standard BB model, as represented by the Einstein-deSitter curve in Graph 1, but did provide validation for a modified BB ***as well as a rival steady state model.*** The graphs clearly demonstrate that one does not necessarily need an *expanding* universe to achieve observational agreement —a *static cellular* universe with expanding space works just as well.

RS-DISTANCE EXTRAPOLATION.   Let us see what DSSU theory predicts. The curve, whose simple equation has served us well, will now be extended —out to a staggering *z* index of 1100. The DSSU predicts the drift of the redundant density parameter. To match the extrapolated DSSU curve, the BB reception-distance curve becomes segmented as it struggles with an
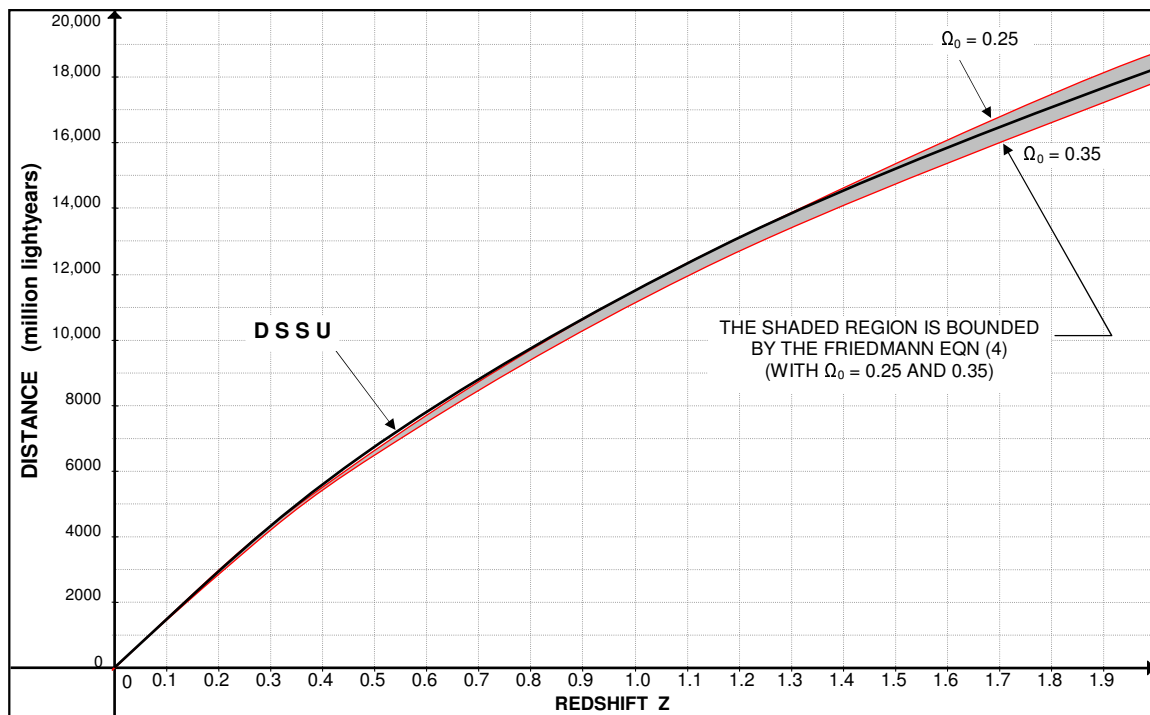
Graph 2. *Supernovae data support DSSU.* The shaded region corresponds to the averaged redshift-and-distance coordinates of numerous supernovae events that have been measured. The DSSU curve (solid black line) lies mainly within the shaded portion. The fact that the DSSU model fits the data demonstrates that one does not necessarily need an expanding universe to achieve observational agreement —a *static cellular* universe with expanding space works just as well. Note, the most distant supernovae ever measured has *z* = 1.7 and most are between 0.3 and 1.5

Graph 3. *DSSU and BB models extrapolated to z-index 1100. Witness the simple and elegant versus the complex and artificial.* In order for the Friedmann eqn. to conform to the reality of the new metric, dictated by the dynamic cellular structure, its Ω-factor will always need adjusting (dashed line segments). With a further extrapolation the DSSU curve breaks out of the hatched region at $z = 1350$ (somewhat beyond the domain of the graph) and rises ever higher. ($H_0 = 18.2$ km/s/MLY)

inconsistent density parameter. Graph 3 shows the Friedmann curve split into segments of the Ω values that become necessary as astronomers push ever deeper into the high-z region of the cellular universe.

The reader may be wondering: Why bother to extend the graph to include $z = 1100$? which corresponds to an almost unimaginable distance of 116 billion lightyears!? ... Well it seems that at z 1100 is where the BB universe ends (at least as far as distance is concerned). Furthermore, it is there, that the BB universe reveals its beginning —where BB proponents allegedly have found the wall of fire of the Cosmic Microwave Background radiation (CMB), the bright phase of the primordial fireball.[25]

In the DSSU model, z 1100 simply means the light source is, according to equation (6), about 388 unit-universes away.

In the search for ultimate reality mankind ventures (and necessarily so) in two opposite directions —the scale of the large, the cosmic realm, and the scale of the small, the sub-atomic realm. And the closer we come to unraveling the ultimate truths the simpler things (entities and processes) become. Continuing with this reasoning, the ultimate truth of the small and the ultimate truth of the large must be so unequivocally simple that when confronted by them we would readily admit, 'nothing could be simpler.' At the same time, all else lies between these truths and belongs to the realm of complexity.

On the cosmic scale a cellular steady-state structure is as simple as it gets. No sustainable 3-dimensional structure is simpler; no continuous process (the balanced space expansion and space contraction) is simpler. Occam's famous razor, as a metaphorical judge of objective reality, favors the simple and elegant cellular Universe and repudiates the complex and artificial BB universe.

7 SUMMARY AND REFLECTIONS

Our universe is far simpler than the model which BB cosmology attempts to construct. The BB uses universe-wide expansion; the DSSU does not. The BB uses parameters (for density and deceleration) that vary with time and/or distance; the DSSU does not.

The commonality of the two cosmologies lies in the fact that they both use the quintessential concept of space expansion (hence, they both need a space expansion term and sure enough both use *H*). And there agreement ends. BB models make a totally unrealistic extrapolation of the observed expansion of space: an extrapolation into the expansion of the entire universe! The DSSU does not. Instead, this simple and elegant cosmology ***confines and limits*** space expansion to the void regions. Herein lies the explanation of why the voids are empty. It then adds the steady-state condition that whatever expands must elsewhere contract. And, behold, theory and observation come together in remarkable agreement. DSSU theory

and the redshift-and-distance Supernovae data agree — *without using any additional parameters!*

THE NEW METRIC. In the new cosmology our understanding of cosmic distance is greatly simplified since the distances to galaxies *do not change*. The distance of a source is the same *now* as the distance at the time when the light was first emitted. A source at 50 giga lightyears will not change position; it will always be at 50 giga lightyears —limited only by its own temporal lifespan. Another advantage, one that should not be underestimated, is that the gauging of cosmic distances is *not* dependent on the Hubble term! and *not* dependent on the speed of light! The unit-universe itself can be considered as the Greater Universe's own natural metric. The Universe presents us with a 3-dimensional non-rectilinear grid which can serve as a natural scale —an immense advantage.

Many leading scientists over the centuries, including Isaac Newton and Albert Einstein believed that the universe is unchanging, neither contracting nor expanding. It now turns out that on this fundamentally important point they were right after all! With the 21st century advent of the DSSU theory it is possible to validate the view that the Universe does *not* expand — *only space itself expands*. While the concept may sound paradoxical, it actually has a simple explanation. Space expands within the Voronoi cells and simultaneously contracts at the Voronoi boundaries. The size of the cells does not change and neither does the greater universe. Whether we like it or not the Universe *is* a Steady State universe.

Nevertheless, considerable research effort is being expended in fine tuning the BB model —in keeping up appearances. A situation reminiscent of an earlier time, of an earlier cosmology. Not unlike the persistent efforts of long ago devoted to the problematic (not to mention, fundamentally wrong) geo-centric model, the present age amidst assurances of infallibility endures its own Ptolemaic tinkering only on a grander scale.

... [W]hile work continues on determining the precise rate at which the universe expands, the fact that it does *expand is today as well established as, say, the fact that biological species arose through the process outlined in Darwin's theory of evolution.* —Timothy Ferris[26]

It has come to this: cosmologists and astrophysicists are searching for a cosmic philosopher's stone —a magic combination of a growing collection of adjustable parameters that will bestow perfection to their vision of the expanding universe. But these professionals see predominantly what they are trained to see, and seek what they are trained to seek. None among them dares to question, let alone deny, the validity of the premise.

Darwin's theory is both well established and *valid* — and unassailable. But universe-wide expansion, the foundation idea supporting BB cosmology, is merely well established —and *lacks validity*. It is telling that the efforts in "keeping up appearances" are becoming ever more complex.

Meanwhile, awareness grows and an inferior model, albeit well-established, cannot be sustained indefinitely. If one turns to the lessons taught by History one finds that there exists only one way to overthrow fallacious orthodoxy. ... Revolution.　　☐

NOTES AND REFERENCES────────────────────

[1] Quote by Dr. Johan Masreliez, www.estfound.org/philosophical.htm

[2] In compliance with conventional usage 'universe' refers to a model or theory of the Universe, while 'Universe' refers to the particular universe we live in and are a part of.

[3] The first intensive experiments on the effects caused by heating a layer of fluid were conducted by Bénard, a French physicist, in 1900. Bénard experimented on only very thin layers (a millimeter or less) that had a free surface and observed hexagonal cells when the convection developed. Later experiments on thermal convection in thicker layers (with or without a free surface) obtained convective cells of many forms, not just hexagonal. —*Astronomy 202: Astrophysical Gas Dynamics.* Dr. James R. Graham, Astronomy Department, UC, Berkeley [http://grus.berkeley.edu/~jrg/ay202/node132.html]

[4] While Fig. 2 shows the result of a carefully controlled experiment, the result of a less stringent 'kitchen' experiment, using a silicone liquid sprinkled with aluminum powder, and often used in lab-lecture demonstrations, may be viewed by going to http://www.physics.brown.edu/physics/demopages/Demo/astro/demo/8a1070.htm .

[5] In some lab experiments the liquid is sandwiched between two glass plates maintained at different temperatures. "Often the [convection] flow pattern acquires a striking regularity. ... remarkably similar patterns are associated with convective motions in the sun." —Wolfson, Richard and Pasachoff, Jay M. *Physics, Extended with Modern Physics* (1990 Scott, Foreman and Co.) p419

[6] Stewart, Ian *Scientific American* May 1998 p103

[7] Einasto, J. *Large Scale Structure. Elsevier Preprint*, Sept.30, 2002 p14 & 17; arXiv:astro-ph/0011332 v1 17Nov2000.

[8] Ostriker, Jeremiah P. & Steinhardt, Paul J. *The Quintessential Universe. Scientific American*, Special Ed. Cosmos, Dec 2002 p48

[9] Einasto, J. *The Structure of the Universe on 100MPC Scales. World Scientific* 13Feb2003; arXiv:astro-ph/0011334 v1 17Nov2000.

[10] A **bright spectral line** indicates a particularly abundant emission wavelength; a **dark spectral line** indicates an absence of a specific wavelength due to its absorption at or near the source.

[11] Harrison, E. R. 1981. *Cosmology, The Science of the Universe*. (Cambridge University Press) p235

[12] Ibid., p235-6

[13] Gentry, R. V. 2001. arXiv:physics/0102092 28 Feb. Part 1 p5

[14] Gentry, R. V. 2001. arXiv:physics/0102096 28 Feb. Part 5 p2

[15] Anrei Linde, *Inflation with Variable Omega*, plenary talk given at the Snowmass Workshop on Particle Astrophysics and Cosmology, 1995 (in *Proceedings*, edited by E. Kolb and R. Peccei).

[16] Longair, M. S. 1995 *The Physics of Background Radiation*. (In Binggeli, B. and Buser, R. (editors) *The Deep Universe*. Springer, Berlin) p369

[17] The galaxy redshifts (heliocentric) are provided by *the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.* http://nedwww.ipac.caltech.edu/forms/z.html

[18] The description assumes a normal regular cellular arrangement. The possibility that a cell may collapse and result in a structural flaw as shown in Fig. 2 must also be considered. As a point of interest the so named "Great Attractor" might just be the mega-mass concentration associated with a collapsed cell.

[19] Harrison, E. R. 1981. *Cosmology, The Science of the Universe*. p247

[20] John L. Tonry et al. *Cosmological Results from High-z Supernovae* (arXiv:astro-ph/0305008 v1 1 May 2000)

[21] The theoretical or 'observed' omega, Ω_0 , is subdivided into *mass density* Ω_M (which is further divided into baryonic or normal mass Ω_B, and dark matter Ω_D) and the energy density Ω_Λ contributed by the famous cosmological constant. They are related as follows:

$$\Omega_0 = \Omega_M / (\Omega_M + \Omega_\Lambda),$$

and it is easy to see that if $(\Omega_M + \Omega_\Lambda) = 1$ then $\Omega_0 = \Omega_M$

[22] R. A. Knop et al. (2003) *New Constraints on Ω_M, Ω_Λ, and w from an Independent Set of Eleven High-Redshift Supernovae Observed with HST* (arXiv:astro-ph/0309368 v1 12 Sep 2003)

[23] Richard Ellis, and Mark Sullivan *Verifying the use of Supernovae as Probes of the Cosmic Expansion* (arXiv:astro-ph/0011369v1 20Nov2000)

[24] John L. Tonry et al. *Cosmological Results from High-z Supernovae* (arXiv:astro-ph/0305008 v1 1 May 2003)

[25] According to BB cosmology the *cosmic microwave background radiation* originates at a "redshift [index of] 1100 where the imprint on the CMB is formed." —John L. Tonry et al. *Cosmological Results from High-z Supernovae* (arXiv:astro-ph/0305008 v1 1 May 2003)

[26] Timothy Ferris *The Whole Shebang* (1997, Simon & Schuster, NY) p66