THE COSMIC BACKGROUND RADIATION IN THE DSSU[1]

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There are many reasons why people believe weird things, but certainly one of the most persasive is that most people have never heard a good explanation for the weird things they read and hear about. Short of a good explanation, they accept the bad explanation that is typically proffered. –Michael Schermer [2]

... [M]any problems in science cannot be conceptualized correctly unless one escapes the intellectual straitjacket of prevailing scientific mythologies. –Frank Sulloway [3]

KEYWORDS: Cosmology, Dynamic Steady State Universe, DSSU, Cosmic background radiation, CMBR, Cellular universe, Non-expanding universe, Aether, Photon extinction, Blackbody radiation, Small scale anisotropy.

A long time ago, two and a half millennia before the present, the Greek philosopher Aristotle placed the Earth at the center of the universe. Five centuries ago Copernicus placed the Sun at the center of the universe. Almost a century ago (in 1918) Harlow Shapley placed the Milky Way galaxy at the center of the universe. The Milky Way's special status did not last long. A most strange thing happened. Cosmology became infected by creationism. Inspired and guided by the Priest-Physicist Georges Lemaître, the theorists of the twentieth century placed a singularity at the 'center' of the universe.[4]

That Singularity, for whatever reason, (maybe realizing its own physical impossibility), blew itself apart. We all know the story —the official creation story. There was a super-hot, super-fast, super-inflationary, expansion; and, in less than the blink of an eye, the universe was born. Then, to mark the end of the 'beginning', there occurred a spectacle of fireworks, a blaze of glorious light, a momentous release of ubiquitary radiation —destined to become, 15 to 20 billion years later, the cosmic microwave radiation.

The intellectual descendents of Aristotle, Copernicus, Shapley, and Lemaître promote it as "the fading glow of the big bang" and "the remnant radiation from the primordial fireball" and "the best evidence of the expanding-universe hypothesis."

Can this really be what professional astronomers/cosmologists see? Harvard Professor David Layzer cautions us that specialists, for the most part, see what they are trained to look for.[5] They have been carefully taught the expanding universe model; and methodically trained to look for its supporting evidence. For them, all observations, all aspects of their theories, must be interpreted in the context of Lemaître's legacy.[6]

They see what their training allows them to see. The term "cellular universe" is not in their vocabulary; the "Dynamic Steady State Universe" is a banned topic. And so, from their restricted perspective much of the following discussion presents a view that is entirely off the screen.

Nevertheless, the basic definition of our subject is unchanged. The *Cosmic Microwave Background Radiation* (also CMBR, CBR and the "3 K blackbody radiation") is a nearly uniform flux of microwave radiation coming from all directions of the Cosmos; with an intensity corresponding approximately to a blackbody curve.

However, the extended definitions differ.

In conventional cosmology it is photon radiation left over from the primordial hot Big Bang which has cooled by expansion to a temperature slightly less than 3 degrees above absolute zero.

In the *new cosmology* the CBR is the radiation received from distant galaxies (emitting light at a peak intensity temperature of about 5800 K) after being redshifted by a z-factor of 3800 during a journey of 133,000 MLY.

Technically, and irrespective of any causal theory, the CBR is thermal radiation (i.e., photons) approximating the emission spectrum of a blackbody (any body or region in thermal equilibrium) at a temperature of 2.725 K; this emission spectrum includes a wide range of frequencies but the greatest intensity occurs in the microwave-range frequency of 160.2 gigahertz, corresponding to a wavelength of 1.9 millimeter.[7] [8] It is the peak intensity frequency that defines the temperature assigned to the radiation.

CBR Quick Facts

Cosmic Microwave Background Radiation (also CMBR, CBR and the "3 K blackbody radiation"): A nearly uniform flux of microwave radiation of wavelength 0.05 cm to 100 cm coming from all directions of the Cosmos; with an intensity corresponding approximately to a blackbody curve.

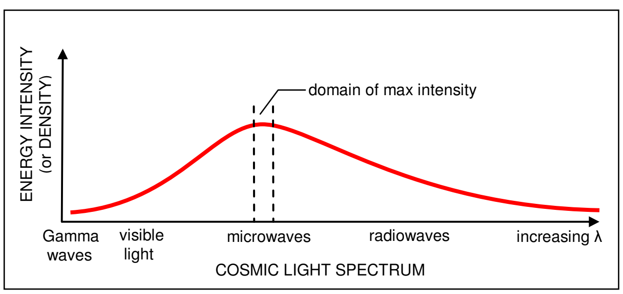
(1) In BB cosmology: Photon radiation left over from the primordial hot Big Bang which has cooled by expansion to a temperature slightly less than 3 degrees above absolute zero.
(2) In the *new cosmology*: the radiation received from distant galaxies (emitting light at a peak intensity temperature of about 5800 K) after being redshifted by a *z*-factor of about 3800 during a journey of 133,000 MLY.

Source of CBR is the light emitted by extremely distant hydrogen atoms.
80% of all radiating objects in the Universe are main-sequence stars. Stars, of course, burn hydrogen.

Arno Penzias and Robert Wilson, in 1978, received the Nobel Prize for discovering the CBR.

Penzias and Wilson had mixed feelings about the BB hypothesis. Wilson once recalled, "I very much liked the steady-state universe. Philosophically, I still sort of like it." — *Encyclopedia of Cosmology*, Norriss S. Hetherington, Editor. 1993. p103

So much for the definitions, now let's put things into perspective. It is important to realize that the CBR actually refers to a bath of radiation consisting of photons with a wide range of wavelengths.[9] How wide a range? *The Encyclopedia of Cosmology* gives a range of "wavelengths roughly between 0.05 cm and 100 cm."[10] (See Graph 1.)



Graph 1. ***Cosmic light spectrum.*** The curve represents the distribution of photons that astronomers have detected. The *cosmic microwave radiation* is the region having wavelengths between 0.05 cm and 100 cm.

Within the microwave portion of the spectrum lies the peak intensity. Within the microwave portion we find the *peak wavelength* —the wavelength that dominates the distribution curve of a sampling of all the photons arriving from all extragalactic sources in our Universe.

Now before detailing the source of the peak radiation I wish to outline the essentials of a scientific explanation of the CBR. It must include the following: (1) The nature of the source. (2) The distance of the source. (3) The reason for the flux. *Why is there a preferred radiation of greatest abundance? Why should there be one particular wavelength of radiation (the microwave CBR) of the entire electromagnetic spectrum that is the most abundant of all radiation permeating the entire universe?* And finally, (4) an explanation for the fact that it appears to be almost exactly the same in all directions while at the same time revealing small intensity variations, the so called *patchy anisotropy*.

1. Nature of the Source

The cosmic background radiation, as often described, originated from a hot hydrogen plasma that cooled just enough for stable hydrogen atoms to form and permit the transmission of photons which had been a part of the same plasma.[11] But this is just the very same action occurring in-and-on every star in the Universe. It is a continuous and unextraordinary occurrence. Take, for example, our nearest star, the Sun. The photons in the hydrogen plasma of the interior gradually and randomly make their way to the much cooler surface and then fly off unencumbered as starlight. Now, consider the Big Bang (BB) universe in its primordial stage. It is described as a cosmic ball of hydrogen plasma, which is really nothing more than a supergiant star —a universe-size 'star' that cooled. In BB cosmology the source of the CBR is an expanding-star that cooled as it expanded; it is said that it expanded and cooled until it became transparent.[12] Analogously, if our Sun similarly expanded, then theoretically, we would be able to see the light within its expanded-and-diluted interior.

Of course, the BB hypothesis is just a pseudo-science myth but the point, in plain language, is this: The source of the CBR is ordinary, everyday, generic-brand, starlight. This is unequivocally so for the Dynamic Steady State Universe (DSSU) with its infinity of stars; and it is so for the BB universe with its primordial single star. ... Stretch the starlight by a factor of 3800 (technically called a redshift factor) and the source starlight of wavelength 5.0×10^{-4} millimeters becomes the observed CBR of 1.9 mm.

Take ordinary sunlight[13] (which has an intensity peak, at 5.0×10^{-7} meters, in the yellow portion of the light spectrum), stretch it by a factor of 3800, and you end up with microwave radiation identical to CMBR.

> *When we observe the cosmic background radiation, we see ... what started out like sunlight now reaches Earth as short-wavelength radio waves.* –Physicist Joel R. Primack[14]

2. Distance of the Source

We can easily calculate the distance of the source. The peak-intensity wavelength of the source starlight —whether from the mythical "fireball" or ordinary Sun-like stars— is 5.0×10^{-7} meters which we symbolize as λ_S. When astronomers detect this radiation they measure a corresponding peak-intensity wavelength of 1.9×10^{-3} m (the 2.73 K CMBR) which we symbolize as λ_o.

Applying the definition of redshift,

$$z = \frac{\Delta\lambda}{\lambda} = \frac{\lambda_o - \lambda_S}{\lambda_S} ,$$

we readily find the redshift index to be

$$z = \frac{1.9\times10^{-3}\,\text{m} - 5.0\times10^{-7}\,\text{m}}{5.0\times10^{-7}\,\text{m}} \approx 3800 .$$

And the z-index can be translated into distance by using a formula appropriate to the cosmological model.

For the BB expansion hypothesis the distance would be 55.3 giga-lightyears.[15] This represents the distance[16] of the source *now* (at this moment in time) if the source (the super-size star) had survived intact, which of course it didn't. The source itself is long gone —having expanded, it is said, to become the visible BB universe.

For the Cellular Universe the distance is obtained with the DSSU redshift-distance law[17]:

$$D(z) = \text{Cell Dia.} \times \frac{\ln(1+z)}{\ln(1+z_{cc})} .$$

$$D(3800) \approx 300\text{MLY} \times \frac{\ln(3800)}{\ln(1.0187)} \approx 133{,}000\text{MLY} ,$$

$$\cong 444 \text{ cosmic cells} .$$

That is, the CBR originates ***133 giga-lightyears*** beyond our galaxy. This astounding distance is equivalent to ***444 cosmic cells*** (also called *dodecahedral cells or units*) lined up in a row.

3. Why the CMBR is the Most Abundant of all Radiation

Ordinary starlight is the source. Stars similar to our Sun are classified as typical "main sequence" stars. In fact, over 80 per cent of all stars are classified as main sequence stars. Hence these most abundant of stars represent, by far, the most abundant source of electromagnetic radiation in the Universe.

Quite naturally, if main-sequence-stars starlight (the source radiation) is the most abundant, then whatever this radiation transforms into, *that* transformed radiation must display a corresponding high abundance. If starlight is the most abundant source of radiation, then the transformed manifestation will also be identifiably "most abundant." From our vantage point in the universe, the visible source-frequency radiation (sunlight and starlight) is most abundant *locally*. A single source dominates our Solar System, a multitude of stellar sources dominate our galaxy. However, the low-frequency radiation (the background radiation) is most abundant *non-locally* (it dominates the Cosmos).

Of course, none of this explains why the observed peak is at wavelength 1.9×10^{-3} m and not at some other length. We'll come to that in a moment.

3-1 Microwave Radiation is the Most Abundant

The underlying fact is that the CMBR is the most abundant of all radiation. Legendary astronomer George Abell tells us,

> *... in intergalactic space [and therefore in the universe in general], that radio background is by far and away the most intense radiation around.*[18]

And astrophysicist David Layzer quantifies the abundance:

> *[T]he number density of microwave photons in interstellar space is roughly a thousand times as great as the number density of starlight photons.*[19]

3-2 Sheet Light-Source Physics

As a first step in explaining the photon count (the abundance) we need to understand why the usual inverse-square law that diminishes intensity with distance does not apply and will not enter our abundance equation. We need to review the nature of sheet emitters.

Consider a plane of light sources —an "infinite" sheet of point emitters of photons. For now, think of an endless ceiling of closely spaced incandescent bulbs.

An important fact of physics is that, barring any intervening reaction, the intensity of the radiation does *not* change with distance from the sheet source. This means that if the emission rate of the sheet-source is held

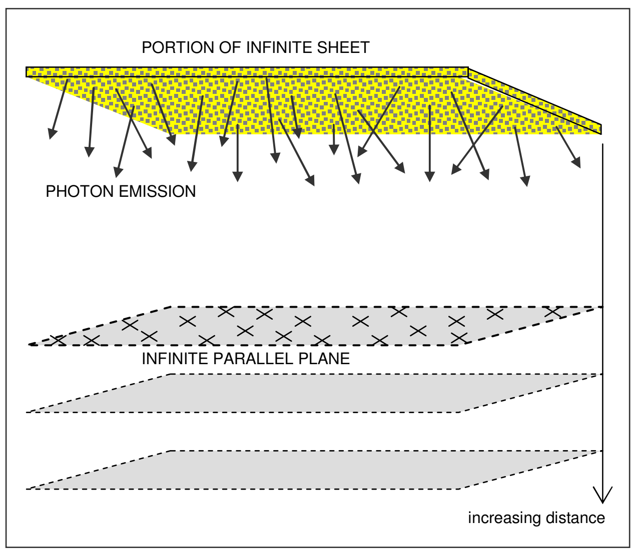


Figure 1. Given an infinitely-large sheet of light sources the intensity of the light does not diminish with distance. Each and every photon leaving the lower boundary of the sheet (yellow) will encounter the parallel plane —regardless of the plane's distance from the source sheet. *The inverse square law of diminishing flux does not apply*. If the emission rate is, say, 20 photons per square meter (per second) then the flux through the plane will also be 20 photons per square meter.

constant then the measured flux remains constant regardless of where, near or far, one chooses to measure the flux. (See Figure 1.)

(In other words, by confining the discussion to sheet sources, we will have no need for the usual inverse-square law in the diminishment of the flux. Although, as we shall see, there are other factors that do have an effect.)

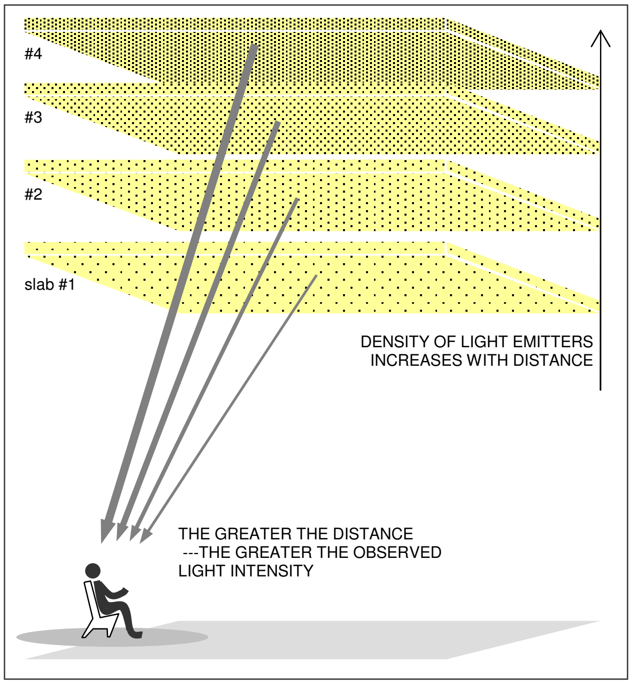


Figure 2. In a hypothetical experiment, the number of light emitters increases with distance (each extended slab of light simply has more light sources installed per unit area). Hence, assuming only one slab is radiating at any one time, the observer would see the slabs glowing brighter with increasing distance. (However, if all the source sheets are radiating simultaneously there would be no way for the observer to identify the slab with the greatest radiation intensity.)

Now taking this one step further. Let us stack several sheet-sources (as in Figure 2). But they are not identical; each sheet is to have a greater density of photon emitters. The greater the distance of the sheet, the greater will be the density we assign to it.

Based on the invariance of intensity with distance (as discussed above) each sheet will provide an observer with a different flux (or intensity); thus, the more distant the sheet, the stronger will be the flux.

There's just one problem. There is no way to identify the components of the measured flux with their source sheets. We are assuming the point emitters are all similar; all radiate the same colour, and the same temperature. (This "problem" is resolved shortly when we step up to the cosmic scale.)

3-3 Cosmic-Scale Sheets and Shells

Keeping in mind the principle that there is no inverse-square-law diminishment of photon flux with variation of the distance of a sheet light-source, we now move up to the cosmic scale.

When a sheet emitter is located at an astronomical distance there are two effects to consider.

First, because of intervening space dynamics (e.g., space expansion), the photons' wavelength is stretched (redshifted). This is good. It is the key to identifying the sheet's distance (since the redshift and the distance are uniquely related).

Second, even though the sheet source is emitting a narrow range of wavelengths (the sunlight portion of the spectrum discussed earlier), the observed wavelength will increase without limit depending on the angle, and therefore the distance, of the photon's path. See Fig. 3a. This is bad. It spoils our desire to have the uniformity of emission agree with the uniformity of reception.

What we will do is surround our location in the universe with a multitude of sheet sources, each sheet having the

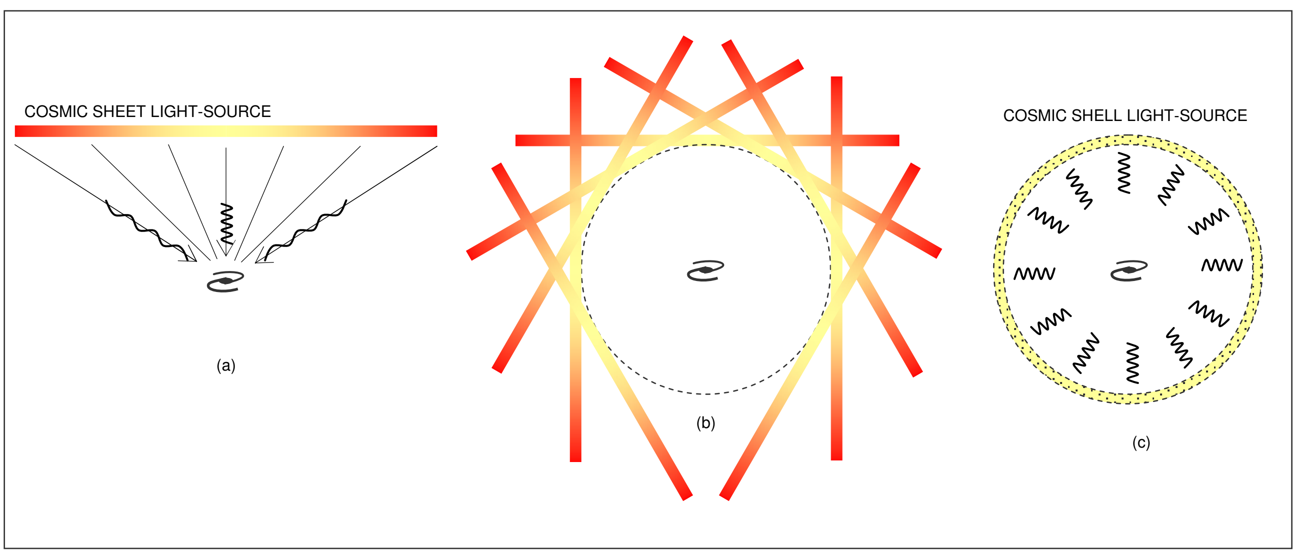


Figure 3. A cosmic-scale slab of starlight (shown in edge view) presents distant observers with a wide range of redshifted starlight (a) and represents a problem in the sense that wavelength cannot be used to identify one source-plane from another. However, if we consider a multitude of sheet sources (b) we end up with a spherical shell (c); the starlight from this arrangement will display a consistent redshift range.

same perpendicular distance (Fig. 3b). In fact, we will discard the extended portions of the sheets and retain only the portion within a constant radial distance. We end up with a spherical sheet —a shell of light emitters (Fig. 3c). With this configuration all the photons received at our central location will have approximately the same wavelength.

Thus the wavelength problem has been solved. And shells can be identified by wavelength —by the amount of redshift of the wavelength.

Now let us quantify the sources. Consider concentric shells, each having the same thickness but of ever greater radius (as in Figure 4). We want to know how many photons are emitted from each shell. Or, equivalently, we want to know how many radiating sources are present in each identifiable shell.

Earlier, with the planar source example (in Fig. 2), the intensity was increased by increasing the *spacing density* of the emitters. However, with the concentric shells the observed intensity increases as a consequence of an ever larger number of sources accompanying the ever larger shell volume.

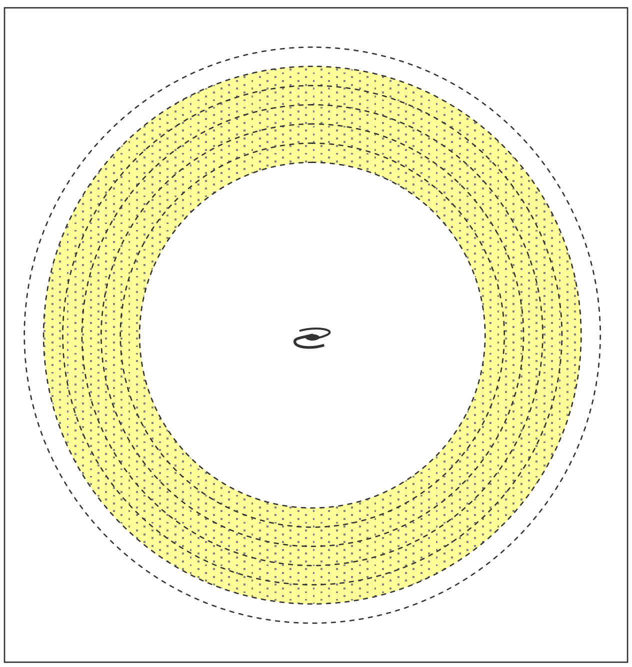


Figure 4. In a universe of uniform density, each larger shell has a greater number of light sources (stars) —simply by virtue of greater shell volume.

From each larger shell we would, in the absence of some other mechanism, receive ever more photons. And since our universe is infinite in extent with limitless stars, the number of concentric source-shells is actually infinite. Furthermore, the DSSU has no visibility horizon. The potential number of photons received would be infinite and reminiscent of Olbers' paradox.

There is, however, a limiting factor in the form of an extinction mechanism. Before getting into photon extinction we must quantify the photon source.

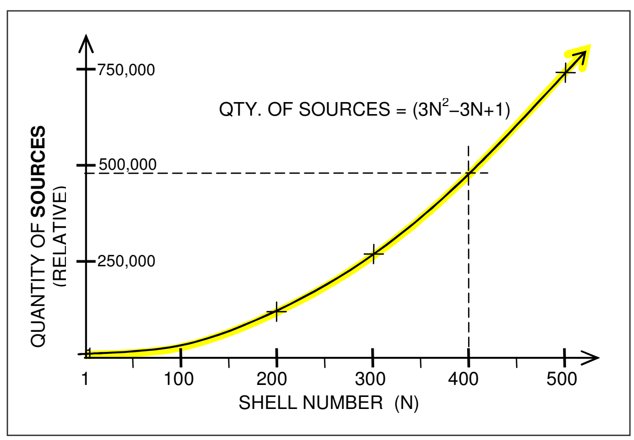
3-4 Number of Sources in Each Shell

We have divided the universe into concentric spherical shells thereby constructing sort of an onion-like universe. A few of the shells are illustrated in Figure 4. Each shell has a thickness, for convenience, of 300 million lightyears —a thickness corresponding to the nominal diameter of a typical dodecahedral-unit. Each shell contains vast numbers of photon sources —stars converting hydrogen into helium and emitting yellow light.

The DSSU is homogenously cellular (voids and galaxy clusters are more or less evenly distributed); thus the relative number of sources per "onion-layer" cosmic shell depends solely on the shell's volume. The volume of the first shell (actually a sphere) is $V_1 = (4/3)\pi R^3$. Again, we have chosen the shell thickness to be equal to the size of one dodecahedral-unit. Thus for the first shell radius R=1 and $V_1 = (4/3)\pi$. The volume of the second shell, by simple calculation, is $V_1(2^3 - 1^3)$. The volume of the third shell is $V_1(3^3 - 2^3)$; and so on. The volume of the N^{th} shell is $V_1(3N^2 - 3N + 1)$. The volume of any shell is simply the volume of the first shell, V_1, multiplied by the factor $(3N^2 - 3N + 1)$, where N is the number of the shell.

Similarly, the number of sources in a particular shell is equal to the number of sources, S_1, in the first shell times the factor $(3N^2 - 3N + 1)$. Thus, the number of sources in the N^{th} shell is $S_1(3N^2 - 3N + 1)$.

But only the factor $(3N^2 - 3N + 1)$ itself is needed to plot the relative number of sources corresponding to ever larger shells. Graph 2 shows the relative number-of-sources versus shell-number for 500 concentric shells. The actual number of sources could be obtained by, first of all, estimating a star-count for the "first shell" and then multiplying this count times the *relative source quantity* (given by the graph) for the particular shell number that is of interest. (The numbers are surely stupendous.) The actual source-count, however, is of little importance —the relative source-count is what really interests us.

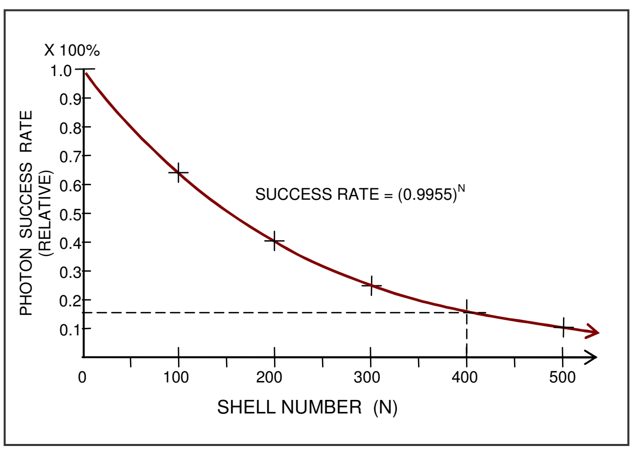


Graph 2. Function of relative number of typical light sources (stars) with respect to their corresponding originating shell. For example, the 400^{th} shell contains, within its thickness (between its inner and outer layers), 479,000 relative sources. Note that in the absence of a constraining factor the curve rises to the right without limit.

The graph above shows the relative photon count increasing without limit. In the real world this does not occur. In the real world photons are subject to *extinction* —the second phenomenon that affects a photon and ultimately the measurable flux. A photon, as it travels through successive cosmic shells (the onion layers of our analogy), may become captured and not make it across the thickness of one or another of those shells.

3-5 Photon Extinction

A photon, as it travels through the universe, passes through one dodecahedral-unit after another. This naturally involves crossing the interface regions that separate voids. A photon may have a chance encounter with or without subsequently being re-emitted. For instance, it may be captured by a planet, a star, or a pseudo black hole. If it is captured and then re-emitted ***it loses its relationship with its original onion-layer shell —it effectively becomes a new photon***. ***If it is not re-emitted then it becomes permanently lost.*** Photons falling into "black holes," for example, are permanently lost. Another way of expressing the loss is by saying that the shells are imperfect black-body layers each having emissivity of 0.9955 —compared to a perfect black-body which has its emissivity equal to 1. Every time a photon travels through a shell (or through, or across, a single dodecahedral-unit) there exists a certain probability that it will not pass through. The estimate of the probability of such a loss is about 4 or 5 per thousand. Out of every 1000 photons an average of 4.5 are lost during passage between consecutive shells. This 0.45% loss translates into an ***extinction factor*** of 0.0045. It is this, and only this, factor that diminishes the photon-count from a cosmic source-shell.



Graph 3. Curve gives the success rate of photons reaching the observation zone (at the center of concentricity). Each and every penetration of a shell reduces the photons' chance of reaching the next shell. For example, of the photons transmitted inward by the 400^{th} shell, only 16.4% will be detectable at the center.

Now considering the perspective from the receiving end. From our vantage point —from our home galaxy— each more distant cosmic shell radiates vastly more photons, but to reach us they need to pass through an ever greater number of inner shells. During the transit through each shell-thickness, 0.45% are lost, and ***99.55% pass through***. Of the photons originating within the first shell, a decimal fraction of 0.9955, theoretically, passes through. Of the photons originating within the second shell, a fraction of $(0.9955)^2$ makes it through; and so on, according to the rule of probability. Thus, for the photons originating from the N^{th} shell and heading in our direction, a fraction of $(0.9955)^N$ succeeds in entering our Milky Way. It is easy to see that a large N-value makes for a low success rate. This tendency is illustrated in Graph 3. Only about one-sixth of the photons originating in the N_{400} shell actually make it to our local dodecahedral cell.[20]

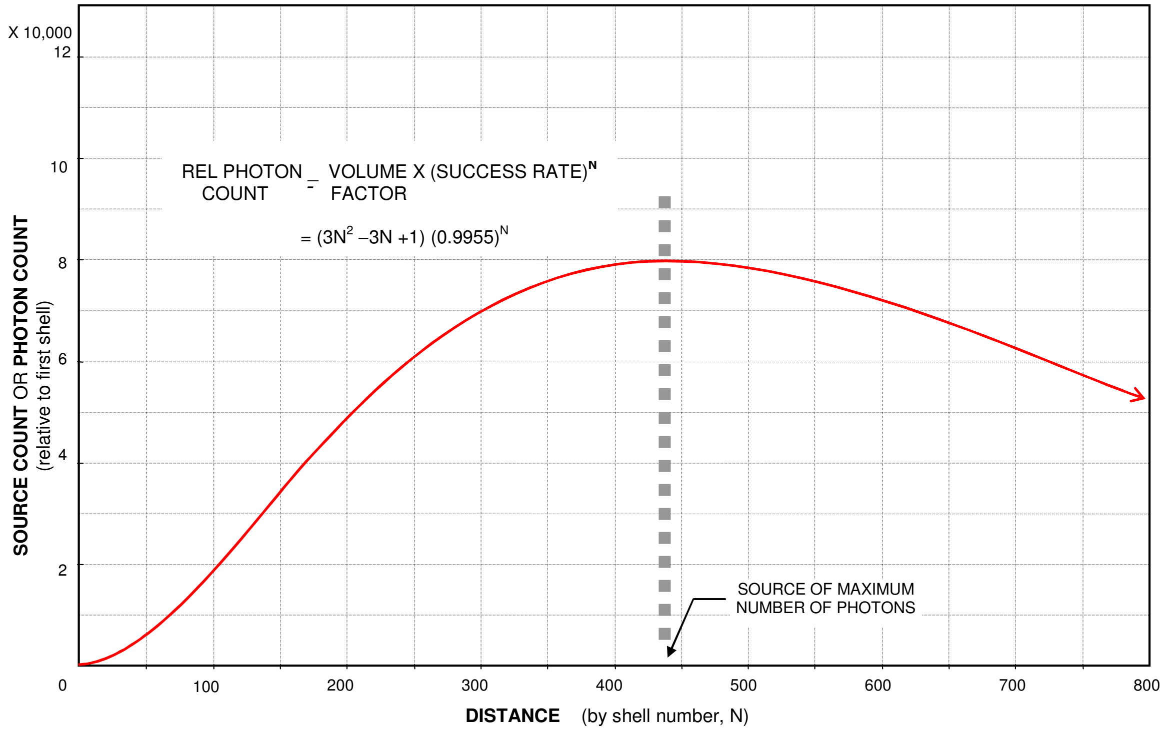
3-6 Intensity Variation

So here is the situation: the deeper our Earth detectors (e.g., COBE, Boomerang, NASA's WMAP, and ESA's Planck Satellite) peer into deep space, the ***more*** photons we expect to 'see' (because there really are more sources), and simultaneously, the ***fewer*** photons we expect to 'see' (because of the in-transit loss imposed by the extinction factor). We will now combine the two opposing tendencies and express the relative photon-count arriving at the center of all the concentric shells. The above analysis allows us to state, with respect to shell N,

$$\underset{(Relative)}{\textit{Photon-Count}} = \underset{Factor}{\textit{Volume}} \times (\textit{Success Rate})^N .$$

Notice that the *Volume Factor* diverges to **infinity** and the *Success Rate* term converges on **zero**. When the two are combined into a single function the result is unequivocal. The relationship is plotted in Graph 4. Significantly, there is a clear peak in the intensity curve. Furthermore, this peak occurs for the distance that agrees with our CBR source-distance. (This is not surprising since it was the distance calculated in Section 2 that demanded the particular choice of the value of the extinction factor.) *The peak intensity corresponds to the region at or near the* 444^{th} *shell —a mind-boggling distance of 133 billion lightyears.*

On the one hand, the number of photons emitted by consecutively larger shells increases *geometrically* in proportion to each shell's volume (which increases as the square of the radius). On the other hand, the number of photons that Earth detectors can pick-up diminishes with the distance in accordance with a probability factor that changes *exponentially*. In a competition between geometric growth and exponential change, it is the exponential change —in this case a decrease— that always wins in the end. Thus, as the distance to the emission source increases to infinity, the probability of being detected approaches zero. The curve in Graph 4, if extended off the page, moves closer and closer to the horizontal axis and tends towards zero.



Graph 4. ***Theoretical relative photon-count of the radiation received from incremental distances by Earth detectors***. For example, a space borne detector with a surface area of one square meter will receive twice as many photons from the 300th shell as from the 150th shell. Or for a truly dramatic comparison: for every ***one*** photon from the local shell impacting the detector there would be about ***78,000 photons*** from the 400th shell striking the detector. This extreme example assumes (unrealistically) that the local shell is an ideal shell with all the sources spread evenly over its outer "surface." If it were not for the interference from local point sources, including particularly the Milky Way, these comparisons would be valid for any and all directions.

This also happens to be one of the two arguments in the resolution of Olbers' paradox in the framework of the DSSU.[21]

Let me emphasize the main point here. It is not so much the absolute intensity of the photon flux (measuring the absolute intensity is the responsibility of astronomers and is-what-it-is independent of one's theory), nor is it the relative intensity (which at best is only an approximate prediction). The point of greatest consequence is the very existence of a maximum intensity, both in the observations and in the derivation from theory, and its correspondence to a specific-and-unchanging distance.

The consequences are profound. The explanation of the CBR does not, in any way, require an expanding universe![22] Why demand that the universe perform the metaphysical trick of expanding itself to account for the CBR? Why indeed, when a steady state universe can account for the CBR quite naturally —without hidden props, without supernatural processes.

4. The Patchy Anisotropy

There are two kinds of anisotropy associated with the CBR's distribution on the Celestial sphere.

1. The large scale anisotropy or dipole. This refers to the observation that the CBR is more intense (and has a higher temperature) from a certain direction than it is from the symmetrically opposite direction (where it has a lower temperature). The pattern of radiation is hotter on one side of the Celestial sphere and colder on the other.

Stating the dipole in yet another way: the CBR is redder (has a higher redshift) in one direction of the heavens, and bluer (has a lower redshift) in the opposite direction.

The difference in the two directions (regardless of how expressed) is caused by the motion of the Solar System with respect to the distant sources of the CBR and hence with respect to the Euclidean cellular structure of the Universe —the non-expanding universe. Our motion[23] (a motion that includes the individual motions of the Earth, the Solar System, the Milky Way galaxy, and the Local Group) introduces a Doppler-shifting of the CBR.

When the aforementioned motion is taken into account the CBR, in general, is isotropic and it appears to be almost exactly the same in all directions. But not quite.

2. The small scale anisotropy: is the miniscule variations in the temperature of the radiation **—**the so called ripples in space— coming from different parts of the sky.[24]

The standard explanation maintains that when the universe was a ball of hot hydrogen gas, roughly 300,000 lightyears in radius, there were small random variations in density usually described as *thermal fluctuations* (somewhat like the fluctuations now detectable on the

Sun's surface). When this hot ball expanded to become the full-blown BB universe, the thermal fluctuations likewise expanded so that they now match the observed size of the small-scale anisotropy.

Considerable importance is placed on the patchy nature of the observed microwave background. How important is it? Most cosmologists consider this characteristic of the anisotropy to be the best evidence for the Big Bang model of the universe; while other cosmologists may not be as eager to declare it to be the "best evidence" they still believe it is evidence of the Big Bang. No model other than the Big Bang, they often remind us and themselves, has been able to explain these fluctuations. The interpretation and the claim to exclusivity of the evidence should come as no surprise.

Let me put their interpretation into perspective. Every observation, every hypothesis, every theory is interpreted in terms of the expanding universe. No wonder the evidence points repeatedly to a big bang; overwhelmingly most cosmologists have never looked at anything other than expanding universe models. What the experts fail to tell us is that they simply do not look at other models. I repeat, with emphasis, *they simply do not look at other models —other than whole-universe expansion.* When there is only one type of model on the table, what choice does one have? The only choice is with various sub-models defined by their differing modes of expansion. Hence, the astrophysical journals are filled with seemingly endless variations on a common theme —a theme that has been played to obsession for most of the twentieth century and now into the twenty-first. Pages and Papers filled with such things as the quantum expansion mode, the inflation mode, the linear mode, the acceleration mode and the latest, the "jerk" mode (no, I'm not making this up; technically, the "jerk parameter" is the time derivative of the accelerating expansion). Cosmologists see what they were taught to see and interpret the CBR accordingly.

The universe designers have been focusing on a single mathematical (and metaphorical) expanding box —an unrealistic expanding-box world. Evidently, it has never occurred to them that the universe is a multitude of "boxes." With a total lack of peripheral vision, they have completely overlooked and thus never considered the steady-state Cellular Universe and have never tasted the explanatory power of the naturally structured universe.

Let us then consider the simple interpretation, the *natural* interpretation, the one missing from the conventional table, missing from the textbooks.

Contrary to what was assumed in the discussion of radiating cosmic shells (the spherical sheet sources) ***the sources are not evenly distributed***. The network of concentric shells is conceptually superimposed, not onto a homogenous mixture of stars or galaxies, but onto the universe's cellular structure which represents a realistic distribution of material. For the most part, it is an orderly distribution of galaxy clusters.

The source shell of the CBR is not a uniform source. The shell has holes in it. For obvious reasons they are called voids. If we magnify a region of the source shell Figure 5 we can see the voids; we can see that the source emission (the starlight) comes from the dense regions, the galaxy clusters, surrounding them. The source emission comes from the ***nodes*** of the cellular structure.

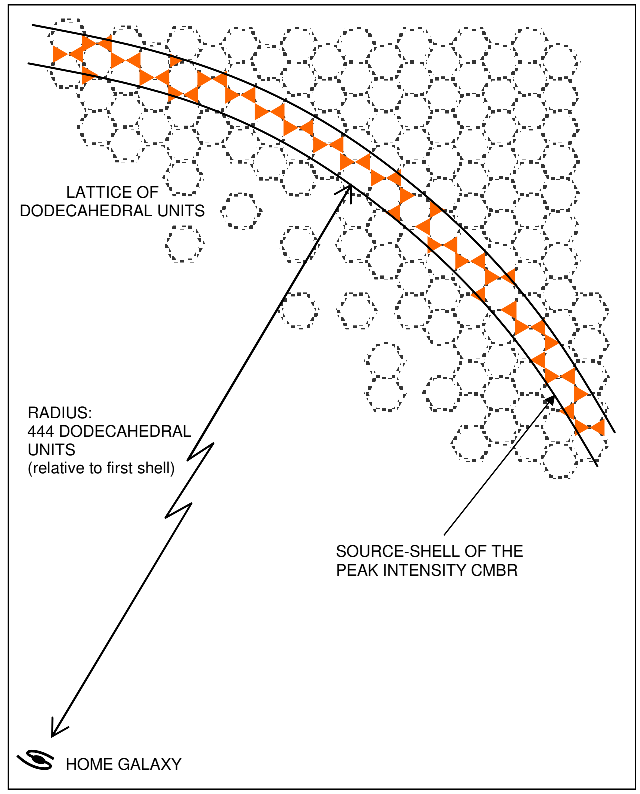
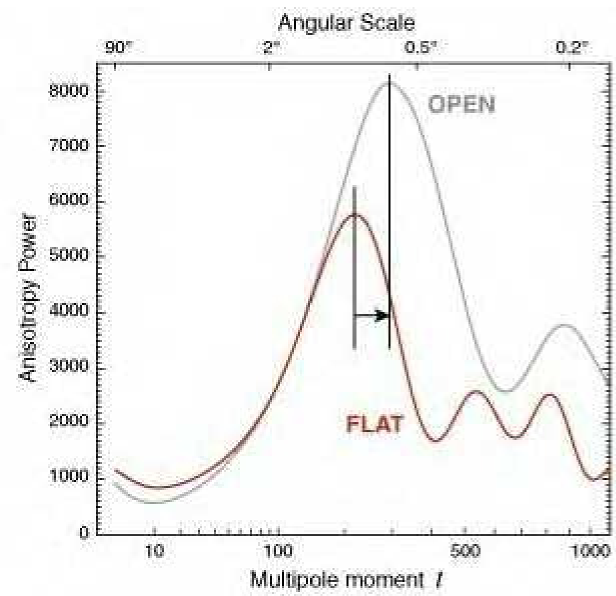


Figure 5. Patchy anisotropy is directly related to the density variation —the distribution of galaxy clusters. The peak-intensity source-shell has a cellular structure (like the rest of the universe) with hot spots of galaxy clustering (orange triangles) and cold pockets of relative emptiness (the cosmic voids). While the schematic image shown here is a section view, the image produced by astronomers of the patchy anisotropy is of the same "shell of cells" but viewed from the inside. (If this cross-section of the *Z3800* cosmic sphere had been shown to scale, it would have required a radius of about 444 of the small hexagons used here to represent the cosmic cells.)

The main purpose of the CBR missions undertaken by the world's major space agencies is to measure the very small differences in radiation intensity coming from different directions of the heavens. The method involves the use of high orbit instruments; measuring the radiation intensity for a multitude of points on the celestial sphere; and carefully removing point sources like stars, galaxies, and even galaxy clusters (clusters that are so distant that they appear as fuzzy points) lest they distort the small-scale structure of the CMB power spectrum.[25] As mentioned earlier, astro-scientists are deeply impressed by the *cellular pattern* that the data reveal. Their term for the pattern is "the patchy anisotropy"; science writers call it the "spotty glow" and "ripples in space."

Now the angle subtended by these cells (the "patches" of the patchy anisotropy) is quite small. The WMAP mission has reported an angle of 0.2°. It is the smallest angle so far detected between hot spots and is derived from a mathematical analysis known as a spatial power spectrum.[26] (See Graph 5; also the reader may find a more detailed explanation at the WMAP website.[27])



Graph 5. The spatial power spectrum of the cosmic microwave background radiation temperature anisotropy in terms of the angular scale (or multipole moment). Notice the intensity peak associated with a subtending angle of 0.2 degrees. The "open" and "flat" labels refer to two possible evolutionary paths speculated for the BB model. (Image source: NASA WMAP Mission)

There is nothing, I repeat, nothing in BB theory that predicts this or any other subtending angle!

What does DSSU theory predict? Let us do the simple calculation. And I do mean simple. Thanks to the quasi-static nature of the large-scale universe we can use Euclidean geometry.

A typical cosmic cell has a nominal diameter of 300 MLY —a diameter that refers to the dodecahedral cell's inscribed sphere. A cosmic cell may also be measured across its nodes. The 'diameter' across major nodes for the same cell will be 368 MLY (technically the circumscribing sphere diameter).[28] The question is *what angle θ does this diameter subtend? When the cell is embedded in the source shell?*

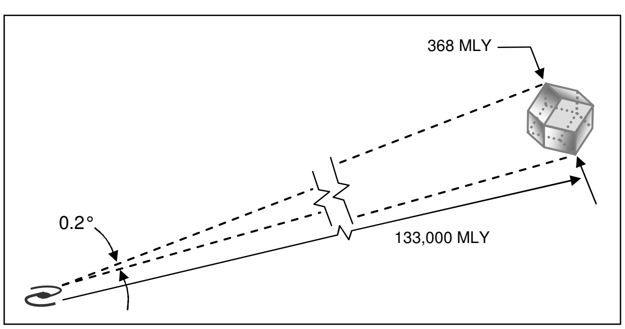


Figure 6. A circumscribed dodecahedral-unit subtends an angle of 0.2° when located at the same distance as the source of the peak CBR.

From elementary planar geometry of a circle,

(angle subtended) × (radial distance) = arc length.

And substituting the previously calculated values,

$$\theta \times 133{,}000\ \text{MLY} = 368\ \text{MLY}$$
$$\theta = 0.00276\ \text{radians} \cong 0.2°$$

From the DSSU perspective this is the angle between two major clusters on opposite sides of a void 133 billion lightyears away.

Thus the DSSU predicts that there will be a strong correlation between hot spots and the subtending angle of 0.2°.

5. Blackbody Radiation

The CBR is often referred to as *blackbody radiation*. Blackbody radiation is defined as the emission of radiant energy which would take place from a *blackbody* at a fixed temperature; it has a spectral energy distribution described by Planck's equation; it is represented by a curve that specifies how the intensity of the radiation varies with wavelength.

In BB cosmology the CBR is called blackbody radiation because the measured intensity of the radiation varies with wavelength in a way resembling the spectrum one expects for a *blackbody*. Measurements at a range of frequencies show that the spectrum has a thermal, blackbody spectrum.

In the DSSU we consider the CBR as *blackbody radiation* because the cosmic source-shell (the source of the CBR) behaves as an approximate *blackbody radiator*.

The key requirement for a blackbody spectrum — and a blackbody radiator— is the existence of thermodynamic equilibrium. The photon emission rate must be constant and the frequency distribution (histogram) of the wavelengths of the emission must also be constant; that is, the graph profile must remain stable. Stated another way, the temperature of a blackbody does not change.

In the BB model, with its assumption that the whole universe is expanding, it is difficult to see how thermal equilibrium can ever be achieved.

In DSSU theory, each and every concentric shell (not just the CBR source-shell) is in thermal equilibrium. The net emission rate remains constant. Not only is the net photon emission in a state of equilibrium, according to DSSU postulates, it is in a state of perpetual equilibrium.

When the blackbody thermal emission (basic starlight) is observed at the center of the emitting spherical shell as CBR, all the wavelengths will have stretched proportionally, but the spectral pattern (the blackbody spectrum) is preserved.

What about the photons that do not originate in a particular shell but simply pass through? Photons that simply pass through are considered absorbed on entry and emitted on leaving even though no interaction takes place.

Finally, in DSSU theory the CBR source-shell exists in thermodynamic equilibrium with the rest of the universe (the infinite universe). Because all the processes of the universe are steady state processes, the thermal energy (and any other kind of energy) entering the shell is constant; likewise the thermal energy leaving the shell is constant. However, the two need not be equal to each other (1st law of thermodynamics does not apply to the cosmic realm; therefore no physical laws are violated).[29] The really important condition is that the thermal emission of the source-shell be constant.

6. The Natural Versus the Unnatural

The existence of a cosmic background radiation, its approximation of a blackbody spectrum, and its patchy anisotropy are predictions of DSSU theory.

The same claim is made for the BB hypothesis.

Both DSSU and BB make the same claim but based on radically different assumptions. The DSSU cosmology assumes only the value of an empirical constant (the photon *extinction factor*). It should be pointed out that the cellularity of the Universe is not being used as an assumption, rather, it is present as an observational fact.

The DSSU assumes a natural process of photon capture (quantified by the *extinction factor*); while BB cosmology assumes an unscientific "fireball" creation event.

One explanation is based solidly on natural cellular structure sustained, in part, by expanding space; the other is based on the unscientific extrapolation of the space-expansion process into an unnatural expansion of the whole universe!

The explanation for CBR is utterly simple and self-evident —at least in the natural universe that the DSSU represents. One can't help but wonder why professional theorists pursue explanation in what may aptly be described as esoteric speculations. Maybe it is the nature of specialization (or over-specialization) that leads them to pass over the simple and to search for the complex-and-mysterious answers — "answers" requiring special esoteric interpretation. Or maybe it's those years and years of tunnel-vision indoctrination whereby "the universe appears to be expanding" becomes "the universe *is* expanding" and everything and every phenomenon must be interpreted under strict conformity to the BB commandment. Or else.

In any case the simple solution is staring them in the face.

Let us briefly look at some of the other CBR speculations that astrophysicists have put forward at one time or another.

Early on, in the 1960s, it was argued by some proponents of the historic steady-state theory that the microwave background was the result of *scattered starlight* from distant galaxies.[30] This was a reasonable assessment but unfortunately the advocates mistakenly believed the distant galaxies were receding and did not fully grasp the enormity of the distance involved. The *scattered starlight* hypothesis, with its explicit photon interaction with atoms or dust particles,[31] differs markedly from the DSSU argument. The *scattering* of starlight is simply not necessary. **In the DSSU the CBR is the *original* starlight from distant galaxies, with no *en route* interaction.**

Various kinds of "local source models" were advocated by Denis Sciama, Thomas Gold, Jayant Narlikar, and others. According to their reasoning, the background radiation might be the integrated result of a large number of extragalactic radio sources. Relatively local microwave emitters were postulates but were essentially unobservable and unidentifiable. Therefore, most astronomers found the model methodologically unacceptable.[32]

> *Even less convincing was the explanation suggested by Paul Dirac in 1973. In his cosmological theory, photons were continuously created, and he simply postulated that the present existence of a blackbody radiation was the accidental result of the fact that we just happen to live in an era in which the gradual blackening of radiation has taken the form of a Plank distribution [intensity curve].* –Helge Kragh, cosmology historian[33]

Then there are models that consider the *microwave background* to be *thermalized starlight*. The thermalization of starlight into microwave radiation simply means this: An incident starlight photon hits a dust particle in interstellar or intergalactic space and is re-emitted as a bunch of weaker photons (photons of longer wavelength). The process may repeat until the re-emitted photons have the low energy of micro-wavelength photons.

For many years Fred Hoyle argued that the CBR may be the result of starlight being *thermalized* by its interaction with interstellar needle-shaped grains of iron.[34] His thermalization-of-starlight hypothesis centers on a continuous process in a steady-state expanding universe.

There is also a thermalized-starlight hypothesis for an evolving universe (evolving and expanding universe). Harvard professor David Layzer, realizing that the observable universe is just not dense enough and not dusty enough for the thermalization hypothesis to work, postulated that the starlight thermalization occurred in the evolutionary past when the cosmos was denser and dustier. According to the model he champions, conditions were favorable in the observable past at redshift distance of $z = 100$. During that epoch, supposedly long before the galaxies began to form, there existed an early generation of stars, 10 to 15 times more massive than the Sun, which must have produced the radiation background. And where did the dust grains come from? It seems they came from the same stars. David Layzer claims, "The dust grains that

Table 1. CMBR Explanation		
Characteristic	DSSU Cosmology	BB Cosmology
Nature of source	Ordinary starlight	Starlight from a hypothetical "fireball" featured in a mythical primordial genesis
Distance of source	Real distance of 133 billion lightyears	Temporal "distance" of 15-20 gigayears
The flux: CBR-source photons are the most abundant photons in the Universe	The most abundant radiating objects in the universe are ordinary stars. Naturally, the most abundant photons will be starlight.	The great abundance is necessarily the product of the greatest thermal explosion in the entire history of the BB universe. (Theorists call it the cosmic event of decoupling between matter and energy)
The flux: appears to be almost the same in all directions	Because the sources lie in a spherical and concentric shell	Because the visible universe is spherical
The patchy anisotropy	The consequence of the cellular structure of the universe	The consequence of the chaotic inhomogeneity of that same hypothetical "fireball"
The temperature (and the thermal spectrum that defines it)	Forever remains the same	Decreases as the BB universe expands and evolves

thermalized the background radiation must have condensed from gas ejected by the early stars during the explosive phase of their evolution."[35] A detailed description of the thermalization hypothesis may be found in Layzer's book, *Constructing the Universe,* in which he "constructs" a BB universe but sensibly rejects the primordial fireball.

As I warned earlier, save for one exception, all explanations are tied to the obligatory expanding universe —making them unnatural speculations.

7. Summary & Comments

The Milky Way is at the center of the conceptual concentric cosmic shells described earlier. One of those shells is special. One of those shells is the nominal source of what astronomers measure as CMBR.

> *Microwave photons arriving at any given moment began their journeys at approximately the same time and distance from the earth. So their starting points form a sphere, ... with the earth at the center.* –Scientific American[36]

And most importantly, in the Cellular Universe, *that* sphere (or shell) is not expanding. Moreover, the emitters on that sphere (or in the shell) are *not receding*.

Table 1, above, gives a summary of the explanation of the CMBR and its characteristics. It gives a point by point comparison between two cosmologies and should leave no doubt as to which is the natural-and-plausible and which is the artificial and improbable.

A comment on the CMBR anisotropy: Physicists tell us that temperature anisotropies in the microwave background indicate *structural density perturbations*. On that point there is agreement. But on the question of *what structure is perturbed?* there is strong disagreement. The structure, in the DSSU, refers simply to the nodes and interfaces and voids of the ubiquitous cellular structure; in the opposing view, the structure is that of the fireball.

Physicists further tell us that the anisotropies (the density variations) are traces of an evolutionary past. It is a purely speculative assertion applicable to BB cosmology. In the DSSU the density variations are perpetual —as perpetual as the cellular structure and the Universe itself.

A comment on the temperature of the background radiation: The CBR temperature is directly affected by the evolving or non-evolving nature of the universe. In the evolving big bang scenario the CBR changes with time. The CBR temperature decreases as the universe expands and undergoes density dilution. However, in the stable DSSU, the CBR and the temperature it represents never changes. The perpetual equilibrium of processes (spelled out in the four Postulates) sustains the source of cosmic starlight.

A comment on model prediction: Does DSSU theory predict the CBR temperature of 2.7 K? If the opacity/transparency of the typical cosmic cell were known, then the answer would be yes. (Where the opacity/transparency is with respect to photon radiation.) The model clearly predicts that there will be a temperature displaying a dominant intensity (without giving its actual value). It also predicts isotropy and angular variation of the temperature. The observed temperature depends on three values: the average emission temperature of stars (assumed to be about 5800 K); the amount of redshift induced by each cosmic cell traversed; and the photon extinction factor. (The extinction factor is not an arbitrary parameter. It actually encodes the opacity/transparency of the individual cosmic cells.)

As for the big bang cosmology, we should be reminded that it does *not* predict the value of the CBR temperature; it is assumed as a given quantity.[37]

Throughout the ages men have postulated a center for the universe. Sometimes an object was chosen for the place of honour —the Earth, the Sun, the Galaxy, the Fireball, the Primordial Atom; sometimes an event —a strange singularity, a creation event, a quantum fluctuation.

What Aristotle, Copernicus, and Shapley had no way of seeing and what the cosmologists of the 20th century should have recognized, but failed to do so, is that the universe has no center simply because the Universe is cellular —an infinite array of Euclidean cells consisting of dynamical *space*.

And so, they failed to see the true nature of the CBR. The misinterpretation of the Cosmic Background Radiation was instrumental in the failure of 20th century cosmology. □

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NOTES AND REFERENCES

[1] "DSSU" is the acronym for *the Dynamic Steady State Universe*. For the details of DSSU theory see C. Ranzan, *The Dynamic Steady State Universe.* **Physics Essays** Vol.**27**, No.2, pp.286-315 (2014) doi: http://dx.doi.org/10.4006/0836-1398-27.2.286 (Local copy: www.CellularUniverse.org/Th8PE-DSSU-Ranzan(2014).pdf)

[2] Michael Schermer. 2005. *Science Friction, Where the Known Meets the Unknown* (Times Books, Henry Holt and Co. N.Y.) p63

[3] As in ibid., p259

[4] The singularity, of course, doesn't really "mark" or locate the center of the universe; the singularity is supposed to ***be*** the universe; supposed to be the *whole* universe. Somehow this qualification does not reduce the strangeness of the creationists' universe. Not surprisingly, theorists came up with modified expanding-universe models that do manage to avoid *that* infinitely-dense primordial singularity. Nevertheless, it is very hard to shake off the notion that something is not quite right —something to do with the connection to reality. What is surprising (and strange), is the fact that cosmologists of the twentieth century completely overlooked the simplest and most natural way to avoid both center and singularity!

[5] David Layzer. 1991. *Cosmogenesis, the Growth of Order in the Universe* (Oxford University Press, New York) p240

[6] The consequences of non-conformance and independent thinking on this fundamental issue are serious. For an in-depth discussion see Juan Miguel Campanario & Brian Marten, *Challenging Dominant Physics Paradigms*, Journal of Scientific Exploration, Vol.**18**, No.3, pp.421-438, 2004 (http://www.uah.es/otrosweb/jmc) (http://www.uow.edu.au/arts/sts/bmartin/)

[7] Wikipedia: *Cosmic Microwave Background Radiation*, http://en.wikipedia.org/wiki/Cosmic_microwave_background_radiation

[8] Frequency: $f = c/\text{lambda} = 160.2\times10^9$ Hz
Therefore, wavelength: $\text{lambda} = (3.00\times10^8 \text{ m/s}) / (160.2\times10^9 \text{ per s}) = 1.87\times10^{-3}$ m = 1.9 mm

[9] "The faint glow ... of the *cosmic background radiation* ... has now been observed at many wavelengths, and all observations are compatible with the CBR being redshifted radiation emitted by a hot gas." –George O. Abell. 1982. *Exploration of the Universe, 4th Edition* (Saunders College Publishing, New York) p652. **The surface of stars is obviously such a region of hot gas.**

[10] Helge Kragh, *Cosmic Microwave Background Radiation*, as in *Encyclopedia of Cosmology*, Norriss S. Hetherington, Editor. (Garland Publishing, Inc. NY & London, 1993) p100

[11] Wikipedia: *Cosmic Microwave Background Radiation*

[12] "According to a FRW [Friedmann-Roberson-Walker expanding] model of our universe there was no net transfer of energy between the radiative component of the energy density and the matter component of the energy density, until the universe was 10^4 to 10^5 yrs old. At that time, the 'epoch of last scattering', the universe had expanded to the point that the equilibrium reactions between the photons and the plasma of matter could no longer be maintained, and the universe became transparent to all but a negligible fraction of the radiation." –Gordon McCabe, *The Structure and Interpretation of Cosmology* (December 3, 2003) p37

[13] The Sun **radiates photons of greatest abundance in the middle of visible spectrum** where the photon wavelength $\lambda_S = 500$ nm $= 5\times10^{-7}$m. –*Physics: Extended With Modern Physics,* R. Wolfson & J. M. Pasachoff (1990 Edition. Scott, Foresman and Co.) p1000

[14] Joel R. Primack & Nancy E. Abrams, *The View from the Center of the Universe* (Riverhead Books, New York, 2006) p136

[15] The comoving radial distance is obtained from Edward Wright's *Cosmology Distance Calculator* (http://www.astro.ucla.edu/~wright/CosmoCalc.html) by using the following values: z = 3800; Hubble constant H_0 = 61 (equivalent to 18.7 km/s per *MLY*); $\Omega_M = 0.25$; $\Omega_{VAC} = 0.75$

[16] Technically, this distance is called the reception distance. By the time we receive the radiation its original source will have receded. The Hubble constant, required for the distance calculation, is taken as 18.7 km/s per MLY

[17] C. Ranzan. 2005. *DSSU Cosmic Redshift-Distance Relation* (www.CellularUniverse.org/D1CosmicDistEq.htm)

[18] G.O. Abell, *Exploration of the Universe, 4th Edition* (Saunders College Publishing, New York, 1982) p655

[19] D. Layzer, *Constructing the Universe,* Scientific American Library (W H Freeman & Co. New York,1984) p263

[20] Only 13.5% of the photons originating in the N_{444} cosmic shell reach our local dodecahedral cell. And of course the energy of each photon has decreased by a factor of 3800 (the same as the redshift factor). Thermal energy has decreased by the same factor that wavelength has *increased*.

[21] In the resolution of Olbers' paradox we have the twin argument: the exponential reduction in the photon count with respect to distance; and the exponential reduction in the photon energy by the cosmic redshift also with respect to distance. Both are relentless exponential factors. Little wonder the night sky is dark.

[22] For those readers unfamiliar with DSSU theory, all you really need to know is that *space* expands regionally —but the universe itself does not expand. Since space expands in regions and contracts in other regions, the universe is cellular.

[23] From the CMB data it is seen that our local group of galaxies (including the Milky Way Galaxy and our Solar System) appears to be moving at 627 ± 22 km/s relative to the reference frame of the CMB (also called the CMB rest frame) in the direction of galactic longitude $l = 264.4^{o}$, $b = 48.4^{o}$. –Kogut, et al. *Dipole Anisotropy in the COBE Differential Microwave Radiometers First-Year Sky Maps*, Astrophysical Journal, 1993. (http://adsabs.harvard.edu/abs/1993ApJ...419....1K)

[24] The cosmic microwave background is isotropic to roughly one part in 100,000: the root mean square variations are only 18 μK (micro kelvins). –Wikipedia: *Cosmic Microwave Background Radiation*

[25] Wikipedia: *Cosmic Microwave Background Radiation*

[26] The spatial power spectrum (how much difference is observed versus how far apart the regions are on the sky) contains small anisotropies, or irregularities, which vary with the size of the region examined. They have been measured in detail. –Ibid.

[27] NASA's WMAP mission web-article: *Parameters of Cosmology: Measuring the Geometry of the Universe* (http://wmap.gsfc.nasa.gov/./mission/sgoals_parameters_geom.html)

[28] If a rhombic-dodecahedron is imagined as having an inscribed sphere with a radius of 150 MLY, then the distance spanning opposite major nodes will be 368 MLY. A major node for this polyhedron is a vertex where four boundary edges meet (rather than the usual three).

[29] Conservation of energy in the universe: "The conclusion, whether we like it or not, is obvious: Energy in the universe is not conserved." –E.R.Harrison, *Cosmology, the Science of the Universe* (Cambridge University Press, 1981) p276

[30] Wikipedia: *Cosmic Microwave Background Radiation*

[31] The textbook definition of *scattering*, applicable to astronomy, is the random redirection of a light wave or photon as it interacts with atoms or particles. –T.T. Arny, *Explorations, An Introduction to Astronomy*, 2nd Ed. (McGraw Hill)

[32] Helge Kragh, *Cosmic Microwave Background Radiation*, as in *Encyclopedia of Cosmology*, Norriss S. Hetherington, Editor (Garland Publishing, Inc. NY & London, 1993) p104

[33] Ibid., p104-5

[34] Ibid., p105

[35] D. Layzer, *Constructing the Universe,* Scientific American Library (1984) p262-67

[36] Jean-Pierre Luminet, Glenn D. Starkman and Jeffrey R. Weeks. *Is Space Finite?,* Scientific American Special Ed. Cosmos 2002 p64

[37] Jayant V. Narlikar. 1997. *The Quasi-Steady State Cosmology: Some Recent Developments*, Journal of Astrophysics and Astronomy (1997) 18 p356