The Good Word

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COSMIC MICROWAVE BACKGROUND RADIATION (CMBR): INTERPRETATION AND IMPORTANCE

by Dr. Seraphim Steger

The Cosmic Microwave Background Radiation (CMBR) has been widely touted in the past as the definitive proof of the so-called *big-bang* model. So what is the CMBR?

In 1926 **Sir Arthur Eddington (1882-1944)** reasoned that because everything is bathed in distant starlight, interstellar space should have a black body temperature of about 3° Kelvin.

George Gamow (1904 - 1968), a Ukrainian born US physicist, theorized in the late 1940's from Hubble's work that the Universe should have begun with matter and light in very high energetic states and should have behaved like a radiating fluid in thermal equilibrium. Then, in the 1950s, he and his students Ralph Alpher and Robert Hermann theorized that the Universe should be permeated by an almost uniform bath of primordial photons, the after-glow of the so-called *big-bang*, with the spectral characteristics of black body radiation, which, after 13 billion years of cosmic expansion/evolution, should have cooled to about 5° K. This black body radiation is now known as the Cosmic Microwave Background Radiation. However, the lack of sensitive enough equipment prevented this CMBR from being detected until 1965 when astronomers Arno Penzias and Robert Wilson, working for Bell Telephone Laboratories in New Jersey detected a low hum in the microwave band with their highly sensitive antennas -- no matter where in space they pointed them. To them, because the radiation was so very uniform, corresponding to 2.73°K, this implied a very uniform distribution of matter in the Universe (i.e., homogeneity of matter). Unfortunately, the post *big-bang* Universe is too large for the temperature to have cooled so uniformly given its immense size and age measured against the speed of light. This is the so-called *horizon problem,* a well recognized death sentence for the original *big-bang* theory.

However, for the malleable mainstream astronomy community, this did not mean that the *big-bang* theory was dead, but that something was missing. That missing piece of the puzzle was supplied by Alan Guth in 1979 -- *inflation*. Then, in the 1980s Guth, Linde, and Steinhardt resurrected the *big-bang* model as the *inflationary* cosmology model in which 10^{-36} to 10^{-34} seconds after the *big-bang* the Universe expanded by over 10^{30} fold. This inflation was proposed to be "due to the negative gravitational pressure produced by a postulated *inflaton field* -- a field that physicists conceived of as generating an outward repulsive pressure on space, causing the Universe to expand."[1]

"This means that in a brief flicker of time, about a trillionth of a trillionth of a trillionth of a second after the big bang, the size of the Universe increased by a greater percentage than it has in the 15 billion years since. Before this expansion, matter that is now in far-flung regions of the cosmos was much closer together than in the standard cosmological model, making it possible for a common temperature to be easily established [before the inflationary phase]. Then, through Guth's momentary burst of cosmological inflation -- followed by the more usual expansion of the standard cosmological model -- these regions of space were able to become separated by the vast distances we witness currently. And so, the brief but profound inflationary modification of the standard cosmological model solves the horizon temperature problem … and has gained wide acceptance among cosmologists."[2]

"[However,] for galaxies to form, the mass and energy just after the big-bang, would have to exhibit fluctuations in density. This is necessary in order to account for the observed variations in the concentration of matter and energy throughout space today -- as evidenced by, for example, galaxies and galaxy clusters surrounded by mostly empty space. In theory, these initial differences in the concentration of mass and energy would have affected the cosmic background radiation, since different concentrations of mass and energy would result in different characteristic wavelengths of light issuing from different places in the original hot dense concentrations of matter and energy in the post plasma Universe. For this reason the big-bang model [with inflationary modifications] implied that today's cosmic microwave background radiation (CMBR) ought to manifest small fluctuations in the intensity of the microwave radiation [estimated to be on the order of 0.0003°K].

"Using ground-based and airborne instruments, early attempts to locate these expected variations in the CMBR

1. Meyer, Stephen C., ***Return of the God Hypothesis: Three Scientific Discoveries that Reveal the Mind Behind the Universe***, Harper One, New York NY, 2021, p. 120

2. Greene, Brian, ***The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory***, W. W. Norton & Company, New York, NY, 2003, pp. 355-356.

failed. Even tests using rockets launched above the atmosphere could not detect the predicted variations. In 1989, however, NASA launched a satellite known as the Cosmic Background Explorer, or COBE.

"COBE performed the very first measurements of the anisotropies [variations] of the CMBR, as small as 1 part in 1,000, in a background radiation of roughly 2.7°K. With COBE we learned that the CMBR has an almost perfect *black-body* spectrum."[3]

[Interestingly,] "scientists actually used a sophisticated statistical method to tweak slight temperature fluctuations out of the data. **But instead of the expected temperature variations of 0.0003°K, the researchers claimed temperature variations of 0.00003°K existed.** This was beyond the ability of COBE to measure, so the research team could not produce a map showing where any of the temperature fluctuations were, but they assured us that they were real. At the time, this struck me [Dr. Danny Faulkner] as a very strange result, but additional studies with more sensitive equipment [see WMAP below] eventually confirmed the findings, and even produced maps of the temperature fluctuations."[4]

"These findings resolved one of the few remaining evidential challenges facing the *big-bang* model and **sealed the case from observational astronomy for a finite Universe** [not the infinite homogeneous Universe of the models bound by the *cosmological principle* (isotropy and homogeneity)]**.** It gave a snapshot of the seeds of galaxies just after the creation of matter itself. For many scientists these images were startling in their significance. As George Smoot, the director of the COBE program, who eventually won the Nobel Prize for his discovery put it, 'If you're religious, it's like seeing God.'[5]

[And so] "it was with the follow-up mission of WMAP (Wilkinson Microwave Anisotropy Probe), launched in 2001, that the details of the statistics of the CMBR became known … [and revealed the 0.00003° temperature variations seen in the CMBR with the WMAP in Figure 1 below.]

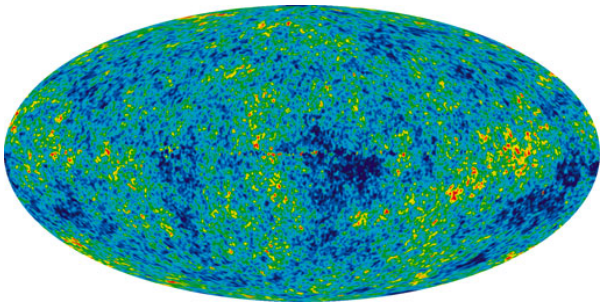

Figure 1: 7-year *WMAP* data of the microwave sky (image courtesy of NASA/WMAP science team) with different colors representing those ever so slightly different temperatures.

"With the launch of *WMAP* we entered the high-precision era of cosmology, and the story of fluctuations went from being purely theoretical to become observationally quantitative. This understanding builds up the [theory of] *early Universe cosmology* [for evolutionary cosmologists].

"Second, observations starting in 1998 from supernovae type IA showed that the Universe today is undergoing an accelerated expansion [the most favored interpretation by mainstream cosmologists]. As *standard candles*, these supernovae are important tools to measure cosmological distances, which made this discovery possible. This was a rather unexpected result. We would naturally expect that all the matter in the Universe would cause the expansion to slow down [by gravitational attraction]. To explain this strange behavior we have put forward the existence of a mysterious force that, against gravity, drives cosmological structures apart, faster and faster. To understand this '*dark energy*' component in the cosmos is one of the main goals of the *late Universe cosmology* … [a major *fudge-factor* for the standard concordance Lambda Cold Dark Matter (ΛCDM) model.]

"The CMBR is [theorized to be] the oldest memory of the 13.7 billion year-old Universe we live in. It is indeed the only fossilized record of microphysics in the early Universe which shows evidence of a young, vibrant Universe. The CMBR is [believed by mainstream physicists and astrophysicists to be] the first light in the Universe and its fantastic journey started at the surface of last scattering, when the Universe was about 380,000 years old.[6] We measure the anisotropies in the CMBR as fluctuations in temperature, against an almost uniform temperature field. The statistics in the temperature field can in turn be used to [theoretically] trace back what mechanism generated them. To understand the origin of these fluctuations in the temperature field, we need to discuss *inflation* ...

"Inflation is the most popular description of what we believe was a dramatic event in the history of the Universe. In the inflationary picture, when the Universe was just a small fraction of a second old, it underwent a spectacular expansion phase, which pushed cosmological scales far outside the horizon. During this period space itself was expanding at a speed greater than that of the light. This simple idea [from general relativity] has important insights when we try to explain the temperature distribution in the microwave sky.

"So why is inflation such a good idea? Inflation not only provides a mechanism by which the problems of the standard cosmological model are ameliorated [the *horizon problem* and the formation of planets, stars, galaxies, etc.], when combined with Quantum Mechanics, it also explains the origin of the temperature perturbations in the sky and the seeds of large scale structure …

"Inflation offers a simple, dynamic solution to the cosmological problems, **but the exact mechanism driving the process of inflationary expansion is still rather speculative. This is because the precise physics of inflation is essentially unknown, and it is a matter of dispute whether we will ever be able to fully understand it.**"[7]

In other words, *inflation* is pure scientific speculation, i.e., extrapolation back in time to try and

3. Meyer, pp. 106-107.
4. Faulkner, Danny R., ***The Expanse of Heaven***, Master Books, Green Forest, AK, 2016, p. 258.
5. Meyer, pp. 106-107.
6. The age of the Universe theorized when the initial plasma of nuclei, electrons, and photon energies cooled sufficiently to form neutral atoms with initial density inhomogeneities for gravitational attraction to occur, to form matter aggregations, and to consequently induce fluctuations in the CMBR.
7. Ribeiro, Raquel H., ***Aspects of Inflation and the Very Early Universe***, (Ph.D. Thesis), Department of Applied Mathematics and Theoretical Physics, University of Cambridge, Cambridge, U.K., 2013, pp. 1-2, 16, of 253. https://www.academia.edu/22654302/Aspects_of_inflation_and_the_very_early_Universe?email_work_card=view-paper

theorize what might have occurred using the laws of physics, to explain the formation of the Universe with its innumerable stars, planets, galaxies, and superclusters, and giant voids, etc.

Nevertheless, a number of scientists working in astronomy and astrophysics have come to the belief that there is evidence for a *creation event*. For example, Robert Jastrow (1925-2008), a religiously agnostic Jewish scientist at NASA, reflected on the obvious theistic implications of the big-bang in his popular book ***God and the Astronomers***[8] (originally published in 1978 and updated in 2000) -- implications which made him personally uncomfortable. Dr. Frank Turek writes about Jastrow as follows:

"So the Universe had a beginning. What does that mean for the question of God's existence? The man who now [2008] sits in Edwin Hubble's chair at the Mount Wilson observatory has a few things to say about that. His name is Robert Jastrow, an astronomer we've already quoted in this chapter. In addition to serving as the director of [the] Mount Wilson [observatory], Jastrow is the founder of NASA's Goddard Institute of Space Studies. Obviously his credentials as a scientist are impeccable. That's why his book ***God and the Astronomers*** made such an impression on those investigating the implications of the Big-Bang, namely those asking the question 'Does the Big-Bang point to God?' Jastrow reveals in the opening line of chapter 1 that he has no religious axe to grind. He writes, 'When an astronomer writes about God, his colleagues assume he is either over the hill or going bonkers. In my case it should be understood from the start that I am an agnostic in religious matters.'

"In light of Jastrow's personal agnosticism, his theistic quotations are all the more provocative. After explaining some of the Big Bang evidence we've just reviewed, Jastrow writes, 'Now we see how the astronomical evidence leads to a biblical view of the origin of the world. The details differ, but the essential elements in the astronomical and biblical accounts of Genesis are the same: the chain of events leading to man commenced suddenly and sharply at a definite moment in time, in a flash of light and energy.'

"The overwhelming evidence for the Big Bang and its consistency with the biblical account in Genesis led Jastrow to observe in an interview, 'Astronomers now find they have painted themselves into a corner because they have proven, by their own methods, that the world began abruptly in an act of creation to which you can trace the seeds of every star, every planet, every living thing in this cosmos and on the earth. And they have found that all this happened as a product of forces they cannot hope to discover. ... That there are what I (or anyone) would call supernatural forces at work, is now, I think, a scientifically proven fact.'

"By evoking the supernatural, Jastrow echoes the conclusion of Einstein contemporary Arthur Eddington. As we mentioned earlier, although he found it *repugnant*, Eddington admitted, 'The beginning seems to present insuperable difficulties unless we agree to look on it as frankly supernatural.'

"Now why would Jastrow and Eddington admit that there are *supernatural* forces at work? Why couldn't natural forces have produced the Universe? Because these scientists know as well as anyone that natural forces– indeed all of nature– were created at the Big Bang. In other words, the Big Bang was the beginning point for the entire physical Universe. Time, space, and matter came into existence at that point. There was no natural world or natural law prior to the Big Bang. Since a cause cannot come after its effect, natural forces cannot account for the Big Bang. Therefore, there must be something outside of nature to do the job. That's exactly what the word supernatural means.

"The discoverers of the radiation afterglow, Robert Wilson and Arno Penzias, were not Bible-thumpers either. Both initially believed in the Steady State Theory. But due to the mounting evidence, they've since changed their views and acknowledged facts that are consistent with the Bible. Penzias admits, 'The Steady State theory turned out to be so ugly that people dismissed it. The easiest way to fit the observations with the least number of parameters was one in which the Universe was created out of nothing, in an instant, and continues to expand.'

"Wilson, who once took a class from Fred Hoyle (the man who popularized the Steady State Theory in 1948), said, 'I philosophically liked the Steady State. And clearly I've had to give that up.' When science writer Fred Heeren asked him if the Big Bang evidence is indicative of a Creator, Wilson responded, 'Certainly there was something that set it all off. Certainly, if you are religious, I can't think of a better theory of the origin of the Universe to match with Genesis.' George Smoot echoed Wilson's assessment. He said, 'There is no doubt that a parallel exists between the big-bang as an event and the Christian notion of creation from nothing.'"[9]

"In a memorable conclusion to his book, Jastrow observed that the discovery of a definite cosmic beginning: 'is an exceedingly strange development, unexpected by all but the theologians. They have always accepted the word of the Bible: *In the beginning God created the heavens and the earth*. … The development is unexpected because science has had such extraordinary success in tracing the chain of cause and effect backward in time. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by the hand of theologians who have been sitting there for centuries."[10]

Current Status of The Concordance Model, aka the Lambda Cold Dark Matter Model (ΛCDM)

Currently the simplest cosmological model that fits most all of the cosmological observations reasonably well, and especially because of its theoretical success with the Cosmic Microwave Background Radiation, is the ΛCDM model, also called the *Concordance Model* (since it fits different kinds of observations) or the *standard model of cosmology*.[11] In the name, Λ [lambda] stands for the cosmological constant, i.e., *dark energy*, and CDM stands for cold dark matter, which is assumed to make up most of the matter in the universe.

8. Jastrow, Robert, ***God and the Astronomers,*** W.W. Norton Company, Inc., New York, NY, 2000, pp. 149.

9. Turek, Frank (D. Min.), *God and the Astronomers*, ***Cross Examined Org*** (blog), April 3, 2008, at https://crossexamined.org/god-and-the-astronomers/

10. Meyer, p. 107.

11. https://lambda.gsfc.nasa.gov/education/graphic_history/

The model is a mathematical parameterization of *Big-Bang* cosmology as described by the Friedman-Lemaître-Roberson-Walker (FLRW) metric. That solution for Einstein's General Relativity equations is for a flat, infinite, homogeneous, isotropic Universe with no center. ΛCDM assumes that the universe is composed of photons, neutrinos, ordinary baryonic matter (protons, neutrons, and electrons), and adds cold dark matter [a necessary *fudge factor* which makes up most of the matter in the universe] which only interacts gravitationally. In contrast to normal matter, *dark matter* does not radiate electromagnetic energy in the form of detectable x-rays, light, infrared or microwave radiation. Hence, it is "dark". Plus the mysterious "dark energy" [an *antigravity fudge factor*] has been theorized to be responsible for the observed acceleration in the Hubble expansion of the Universe. *Dark energy*, sometimes referred to as *quintessence*[12], is assumed to be a form of constant vacuum energy density which is now designated by Einstein's cosmological constant Λ (the Greek letter lambda). Einstein originally included this constant in his equations to represent curvature of the Universe. The standard (6 parameter) ΛCDM model further imposes the constraint that space is flat (Euclidean).[13]

But does the current Lambda Cold Dark Matter (ΛCDM) cosmology model truly describe physical reality? Most naturalistic evolutionary astronomers, cosmologists, and physicists, in their philosophical bias, would probably say, "Yes!" And according to Dr. Wendy L. Freedman (of the Department of Astronomy & Astrophysics & Kavli Institute for Cosmological Physics, University of Chicago, and one of the leading researchers on the Hubble Constant), the current Lambda Cold Dark Matter (ΛCDM) cosmology model is still explaining things quite well especially as better distance parallax data is continually released from the *Gaia* EDR3 database by the Gaia Collaboration group[14] and better temperature variations released by the *Planck* ESA (European Space Agency).[15,16] She notes:

"Over the last decade, the unprecedented increase in accuracy obtained by a broad range of independent cosmological experiments and observations has provided striking and compelling support for our current standard Lambda Cold Dark Matter (ΛCDM) model. This concordance cosmology has been remarkably successful in explaining an even wider range of observations, from the exquisite precision in recent measurements of fluctuations in the temperature and polarization of the cosmic microwave background (CMB) radiation (Planck Collaboration, et al., 2020; Aiola et al. 2020) to observations of large-scale structure and matter fluctuations in the universe (e.g., baryon acoustic oscillations[17] (BAO), Macaulay et al. 2019).[18]"

However, the concordance model of cosmology, when objectively analyzed, is not without its issues. As Drs. Scott Dodelson and Fabian Schmidt write in their 2021 textbook of cosmology:

"We summarize the current state of observational and theoretical cosmology, epitomized by the concordance model of cosmology. ... Three observational pillars of the concordance cosmology are: [1] the Hubble diagram, mapping out the expansion history of the late-time universe; [2] Big Bang Nucleosynthesis (BBN), which, combined with measurements of the primordial elemental abundances, constrains the amount of ordinary matter and early-time expansion rate; and [3] the cosmic microwave background (CMB), which provides a view of the perturbations when the universe was less than 400,000 years old. **The price of the consistent picture afforded by the concordance model of cosmology is the introduction of three ingredients beyond the Standard Model of particle physics: dark matter, dark energy, and inflation** [i.e., 3 *ad hoc* fudge-factors].

"The existence of structure in the universe was known long before the detection of CMB anisotrophies: various efforts to map out the distribution of galaxies in the local universe clearly showed that they are not distributed homogeneously. The number of galaxies and volume covered by such surveys has grown exponentially. Two surveys in particular broke new ground: the Sloan Digital Sky Survey (SDSS) and the Two Degree Field Galaxy Redshift Survey (2dF), which between them compiled the redshifts of, and hence the distances to, over a million galaxies ...

"The galaxies in [the Sloan Digital Sky Survey Collaboration] are clearly not distributed randomly: the Universe has structure on large scales."[19]

12. Aristotle's 5th element: earth, air, fire, water and *quintessence*, the incorruptible and eternal element from which the stars were made.
13. The ΛCDM model also includes a number of assumptions related to primordial perturbations, i.e., deviations from the homogeneous FRW [Freedman, Robertson-Walker] model … Often the term "Concordance Model" is used for this type of FRW model, and the term ΛCDM model is used when these other assumptions are included. Source: Kurki-Suonio, Hannu, ***Cosmology I (Kosmologiâ)***, §1, 1.5, 2020, http://www.courses.physics.helsinki.fi/teor/cosmology/
14. Gaia Collaboration, *Gaia Early Data Release 3: Summary of the contents and survey properties*, ***Astronomy & Astrophysics***, 2021, Vol. 649, May 2021,pdf at https://ui.adsabs.harvard.edu/abs/2021A%26A...649A...1G/abstract
15. European Space Agency, *From an Almost Perfect Universe to the Best of Both Worlds, 2018, July 17*, https://sci.esa.int/web/planck/-/60499-from-an-almost-perfect-universe-to-the-best-of-both-worlds
16. Planck Collaboration, *Planck 2018 results. VI Cosmological Parameters* ***Astronomy & Astrophysics*** 2018, July 16, pdf at https://www.cosmos.esa.int/documents/387566/387653/Planck_2018_results_L06.pdf
17. European Space Agency, *What are Baryonic Acoustic Oscillations?*, https://sci.esa.int/web/euclid/-/what-are-baryonic-acoustic-oscillations-
18. Freedman, Wendy L., *Measurements of the Hubble Constant: Tensions in Perspective*, ***Astrophysical Journal***, (2021), July 1, , p. 2 of 48. pdf at https://arxiv.org/pdf/2106.15656.pdf
19. Dodelson, Scott and Schmidt, Fabian, ***Modern Cosmology***, 2nd Edition, Academic Press, Cambridge, MA, 2021, §1, 1.5, preview at https://www.amazon.com/Modern-Cosmology-Scott-Dodelson-ebook/dp/B087JNKW63/ref=sr_1_3_sspa?dchild=1&keywords=Cosmology&qid=1616199132&sr=8-3-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUE1UVJR

In contrast to the opinions of Dr. Wendy Freedman and most other mainline cosmologists, creationist cosmologists and some others would say, "No! The current Lambda Cold Dark Matter (ΛCDM) cosmology model does not represent reality." They wouldn't argue with the data which the marvels of modern technology have been able to harvest. Their argument would be with the interpretation of that data and the ΛCDM cosmology model itself. That model presupposes an infinite, flat, homogeneous, isotropic universe, with no center and no border, in which an observer at any point in the Universe would essentially see the same thing. Its maximally symmetric distribution of matter is envisioned by physicists as a fluid with a uniform matter density, allowing for an easier mathematical solution to Einstein's field equations. But those presuppositions do not accurately portray our Universe as we see it. The possibility that we live in a very special God created place in a young finite Universe, close to the centre of a large gigaparsec-scale spherical void near the center of the Universe more closely resembles a model described by the Lemaître-Tolman-Bondi (LBT) metric[20] which doesn't abide in the Cosmological Principle (by not being homogenenous) nor bow to the Copernican Principle (which states an observer at any point in space should see the same as any other point in space reflecting an infinite universe where there is no edge, no border). Such a model would, at face value, appear to be a more realistic alternative to the idealized ΛCDM model with its maximal symmetries, and three *fudge-factors*: dark matter, dark energy, and inflation. As Drs. Lukovic, Haridasu, and Vitorio insightfully write in 2018:

"As mentioned above, the reason for introducing dark energy into the cosmological models was to explain the present accelerated state of the Hubble flow confirmed firstly by the SN [Super Nova] Ia observations. However, in an inhomogeneous cosmological model, the functional form of the cosmic expansion w.r.t. redshift ($H(z)$) can have the same feature of (apparent) acceleration at low redshifts [much closer to earth] not due to the presence of a component with negative pressure, but due to a gradient in the matter density profile. Although such a cosmological model does not need dark energy to explain the apparent acceleration, it would mean that we are positioned at a special place in the Universe - in a giant under-dense region, also called the *void*. The bare existence of a giant void is going against the cosmological principle. In principle, the cosmic isotropy is well confirmed from CMB [Cosmic Microwave Background] observations, while the tests of homogeneity are not as easy to perform ... Following the findings from high-redshift SN Ia, the void models gained popularity as the alternative explanation for cosmic acceleration (48, 84, 183, 234) ...

"Only the observer located at the very centre of the void will enjoy the isotropic view of the Universe, while the off-centre position inside the void will introduce a level of anisotropy ...

"This is obviously in a privileged position and against the Copernican principle."[21]

In other words, a Lemaître-Tolman-Bondi (LTB) model is still a type of *big-bang* model with *inflation* and evolutionary time-scale nebular accretion. However, the earth can be in a very privileged position in a finite, non-homogeneous, isotropic and non-accelerating Universe, near the center. Unfortunately, as configured to date, these models have not performed as well as the ΛCDM in regard to matching 21st century observational data. So optimization of these LTB-type models would be necessary for a better data fit and for consideration as a creationist model.

Creationist Model and Explanation for the CMBR

Although mainstream cosmologists have certainly used the CMBR data to their advantage in advancing the ΛCDM model, creationist astrophysicist Dr. Danny Faulkner has proposed a model that is consistent with the Biblical record and also gives an creationist explanation for the CMBR that should be welcome in Orthodox circles as well:

"The *raqiya* [רָקִיעַ, the expanse] that God made on Day Two encompasses what we today would call outer space. On Day Four, God placed the astronomical bodies in the *raqiya*, and so one of the purposes of the *raqiya* is to be a place for the heavenly bodies. However, the primary purpose for the *raqiya* given in *Genesis 1:6-7 was to separate the waters below from the waters above*. Clearly, the waters below are the surface and ground water of the earth, but what of the waters above? If the *raqiya* is the space of the Universe then there must be water at the edge of the Universe. All of this leads to three startling conclusions.

"First, there is an edge to the universe. While permissible within the mathematics of cosmological models today, most cosmologists resist such a possibility.

"Second, if the Universe has an edge, then the Universe is finite in size, and it has a center. The word *raqiya* refers to something that is spread or stretched out. If this spreading was reasonably symmetrical about the earth, then the earth is near the center of the Universe. Again, while not contrary to the mathematics and physics of cosmological models, most cosmologists resist the idea that the Universe has a center, let alone that the earth could be near that center.

MVg1MUFQRDAmZW5jcnlwdGVkSWQ9QTAwMTMwMjVCVldLNzlHOE4zQU8mZW5jcnlwdGVkQWRJZD1BMDQ4MzM3MzNWM09BODZBTkhLUUomd2lkZ2V0TmFtZT1zcF9hdGYmYWN0aW9uPWNsaWNrUmVkaXJlY3QmZG9Ob3RMb2dDbGljaz10cnV1

20. Garcia-Bellido, Juan, and Haugølle, Troels, *Confronting Lemaitre-Tolman-Bondi Models with Observational Cosmology*, ***Journal of Cosmology and Astroparticle Physics***, (2008), 2008:4, pp. 1-28, pdf at http://arxiv-export-lb.library.cornell.edu/pdf/0802.1523.

21. Lukovic, Vladimir V., Haridasu, Balakrisha S., and Vitorio, Nicola, *Cosmological Constraints from Low-Redshift Data,* §2.3 Challenging the cosmological principle: LTB models, ***Foundations of Physics***, (2018), 48(2), pdf, pp. 4-5 of 23, https://www.researchgate.net/publication/322568426

"Third, a layer of water is at the edge of the Universe.

"Again, water at the edge of the universe probably is not a problem per se, although most cosmologists would reject the possibility. If there is water at the edge of the Universe, might not the cool, low pressure environment of space cause it rapidly to disperse or transform into solid or gas? If not, then what processes would prevent that? I do not know. For now, let us assume that water in some form exists at the edge of the Universe. This layer of water forms a shell at least roughly centered on the earth. Being made of matter, the water must radiate [electromagnetic energy, i.e., x-ray; ultraviolet, visible, or infrared light, microwaves, etc.]. Depending upon the thickness and other physical conditions of this layer of water, that radiation would take the form of a black body spectrum. If most galaxy red-shifts are *cosmological,* this water at the edge of the Universe would have a high red-shift too, and so its blackbody spectrum would be red-shifted as well, effectively cooling its temperature. Therefore, this model requires that there be a radiation field consisting of a cool blackbody coming from every direction of space. This is what we see in the CMBR. The CMBR is the one prediction of the *big-bang* model, which is why the *big-bang* became the single favored cosmology once the CMBR was discovered a half century ago. For many years biblical creationists have criticized the *big-bang* model without offering any [alternative] mechanism for the CMBR. However, this biblically based cosmological model explains the CMBR in a straightforward way, and so we now have a viable explanation for the CMBR"[22] [-- one quite different from the ΛCDM].

Beyond CMBR: Other Creationist Objections to Inflationary Cosmogonies

The timeline of creation in both the *big-bang and inflationary models* nevertheless contradict the Biblical model and timeline as Hieromonk Damascene has noted in our previous article. In inflationary models the inflation happens very early in the first second of time, lasts the smallest fraction of a second, and expands the measurable Universe 10^{30} fold. The creation of stars, earth, sun, and moon, and the nebular accretion of the galaxies subsequently took billions of years. In the Biblical model the expanse of the heavens is created on Day 2; the earth with green plants and the seas on Day 3; and the sun, moon, and stars created and set in the expanse on Day 4. In truth, the inflationary model has essentially has only one appealing fact for Orthodox Christians: it had a beginning in time.

In 2013 Australian creationist physicist Dr. John Hartnett listed 22 problems that he had envisioned with the standard *big-bang/inflation* model. Here is a sampling of them:

"1. No Creator; either the Universe created itself or there is an unknown naturalistic cause for the initial expansion ...

"4. It involved the spontaneous creation of energy, space and time from nothing, where nothing means nothing, not even space or time ...

"5. Why did the big-bang bang? No-one knows. How did it start? The physics does not exist to describe it ...

"9. From the initial hot big bang explosion matter and anti-matter formed from pure normal energy? But we only observe normal matter. A particle asymmetry is therefore assumed but theoretically and experimentally cannot be justified.

"10. Stars must form from hydrogen and helium gas initially, but without dark matter conveniently at the right density at their putative centers where they form, no star will or can form. Without dark matter physics must be violated.

"11. Same problem exists for formation of galaxies and clusters of galaxies. So in all simulations an initial concentration of dark matter is assumed ...

"15. How do you know the expansion of the Universe is accelerating? Only by applying the standard model with dark matter and dark energy to the observations. Two fudge factors are required to come to that conclusion.

"16. What is dark energy? It is not normal energy that we know like electromagnetic photons, i.e. radiation. It has the effect of anti-gravity. Normal energy gravitates— it does not anti-gravitate ...

"20. Millions of spiral galaxies rotate too fast and hence they need a Universe of 85% dark matter, but it is not observed in the lab. If it is so ubiquitous why has it not been discovered after 40 years of searching?

"21. There are many more problems—like the *cosmological constant problem*, the *monopole problem*, the *isotropy problem*, the *smoothness problem,* and the *anthropic Universe* (also called the *Goldilocks Universe*) where it is finely tuned for life to exist.

"22. Lastly, why are atheists so determined to eliminate a Creator from their Universe? Even now the origin in time is the one thing they hate the most about the standard model, and they want to find a way that either the Universe had no beginning or that it had many possible beginnings and humans sample several of them simultaneously, which makes no sense at all. But that is Professor Stephen Hawking's idea."[23]

Carmeli-Hartnett Creationist Cosmological General Relativity (CGR) Theory

Since Dr. Hartnett's main body of work in cosmology, until recently, was based on Israeli physicist Moshe Carmeli's (1933-2007) Cosmological Special and General Relativity Theory, we will briefly summarize Carmeli's approach with whom Dr. Hartnett worked for a number of years, then update it with Dr. Hartnett's more recent findings.

Theoretical Israeli physicist Moshe Carmeli noted that there were really only two things that astronomers actually measure: distance and velocity. On the largest scales of the Universe, he saw that astronomers really could only take still pictures of the galaxies as they are seen in the sky. From these pictures, the red-shifts are derived and then, using the Hubble law, distances are

22. Faulkner, p. 277-278.

23. Hartnett, John Gideon, *Does the claimed 'find' of 'dark matter' end the big bang crisis,* ***Bible Science Forum***, December 18, 2013, https://biblescienceforum.com/2013/12/18/does-the-claimed-find-od-dark-matter-end-the-big-bang-crisis/

calculated. Carmeli then recast Einstein's relativity theory in terms of *spacevelocity* [red-shift] rather than time by substituting a *spacevelocity* dimension, the expansion of space, in place of Einstein's *time* dimension. But unlike the big-bang theorists, Carmeli was not interested in what happened in the unobservable past, but only in the motion of galaxies in the observable present. Moreover, his theory made testable predictions. For example in 1996 he predicted that the "*expansion"* of the Universe would be accelerating, which was confirmed in 1998 by Nobel Prize winner Saul Perlmutter, *et. al*.[24] That should have given him some credence, but, he was ignored.

Nevertheless, Dr. Hartnett has repetitively verified the observational validity of Carmeli's theory in a number of different cosmological areas and published a number of scientific papers in highly respected peer reviewed physics journals:

In 2005 he showed that Carmeli's CGR accurately produces the Tully-Fisher type relation in spiral galaxies, a relation showing the fourth power of the rotation speed was proportional to the mass of the galaxy without the need for dark matter when using the properties of Carmeli's metric alone.[25]

2. In 2005 he also also provided a CGR solution to the rotation curve anomaly in the outer regions of spiral galaxies: larger accelerations followed Newtonian force laws, but lower accelerations followed Carmelian metrics as predicted by Milgrom's MOND theory[26] for which Milgrom had no prior theoretical basis.[27]

3. From 2005-2008 Dr. Hartnett analyzed the observational red-shift data from a variety of supernova types as well as Gamma-ray burst data. From his analysis on the largest scales of the Universe, no dark matter was necessary to show a good fit for the red-shifts when using the Carmeli metrics.[28,29,30]

4. In 2006-2007 in collaboration with Firmin Oliveira, Dr. Hartnett suggested that the evolution of the Universe expansion rate from deceleration to acceleration, which according to "acceptable" cosmological models occurred about 8.54 billion years ago, could also be explained without *dark matter* or *dark energy*.[31] Subsequently, they developed CGR solutions for measuring luminosity, distance, angular size, surface brightness, and matter density for type Ia supernovas (SNe Ia) without the need for *dark energy* or *dark matter* after correcting some earlier errors.[32]

So, in summary, the Carmeli-Hartnett Cosmological General Relativity with its *spacevelocity* dimension *i.e.*, the expansion of space (red-shift), has been able to explain several cosmological phenomena without the need to resort to *dark matter* and *dark energy* -- a very appealing aspect of their theory. During these years Dr. Harnett also realized that Carmeli's CGR theory might be applicable to a *Biblical Model of Creation*.

The Hartnett Carmeli Young Earth Model

In a 2007 Dr. Hartnett put forth his first creationist cosmological model which emphasized Einstein's time-dilation during a period of very rapid multifold expansion on Day 4 of Biblical creation. His spherically symmetric, low matter density, "young-earth" model relied on relativistic time-dilation on earth and a very rapid expansion of the Universe consistent with the *stretching/spreading* of the *expanse/heavens* in *Scripture* being a very large multifold stretching of the fabric of space just as in *inflationary models*. So in reality, it was a modified *inflationary-big-bang* model:

"I propose that the only 5D *spacetime velocity* metric that can be correct on both the local scale ... and on the cosmological scale … is one that requires that enormous cosmological acceleration and accompanying time dilation .... This means the Universe is very young as measured by Earth clocks. It only has the appearance of great age because we are biased by the vast size of the Universe … I postulate that during Creation Week, specifically on Day 4, Earth clocks ran extremely slowly compared to the rest of the Universe ...

"Within the framework of Carmelian cosmology … the acceleration of the fabric of the expanding Universe must

24. Perlmutter S, Aldering G., Goldhaber G., *et al*., *Measurements of Ω and Λ from 42 High-red-shift Supernovae*, ***The Astrophysical Journal*** (1999), 517:565-585, pdf at https://iopscience.iop.org/article/10.1086/307221/pdf

25. Hartnett, John, *The Carmeli Metric Correctly Describes Spiral Galaxy Rotation Curves,* ***International Journal of Theoretical Physics***, (2005) 44:349-362, pdf at https://archive.org/details/arxiv-gr-qc0407

26. MOND = Modified Newtonian dynamics is a hypothesis that proposes a modification of Newton's laws to account for observed properties of galaxies.

27. Hartnett, John, *Spiral Galaxy Rotation Curves Determined from Carmelian General Relativity,* ***International Journal of Theoretical Physics*** (2005) 45:2118-2136, pdf at https://www.researchgate.net/publication/1825755

28. Hartnett, John Gideon, *Carmeli's Accelerating Universe is Spatially Flat Without Dark Matter,* ***International Journal of Theoretical Physics***, (2005) 44:485-492*, pdf at https://www.researchgate.net/publication/226016070*

29. Hartnett, John, *The Distance Modulus Determined from Carmeli's Cosmology Fits the Accelerating Universe Data of the High-red-shift Type Ia Supernovae Without Dark Matter*, ***Foundations of Physics***, (2006) 36:839-861, pdf at https://www.researchgate.net/publication/225748684

30. Hartnett, John, *Extending the red-shift-Distance Relation in Cosmological General Relativity to Higher red-shifts,* ***Foundations of Physics***, (2008) 38:301-328, pdf at https://www.researchgate.net/publication/2205810

31. Oliveira, FJ, Hartnett JG, *Carmeli's Cosmology Fits Data for an Accelerating and Decelerating Universe without Dark Matter nor Dark Energy,* ***Found. Physics, Lett.,*** (2006) 19(3):277-283, pdf at https://link.springer.com/article/10.1007/s10702-006-1007-4

32. Hartnett, John G., and Oliveira, Firmin J., *Luminosity Distance, Angular size and Surface Brightness in Cosmological General Relativity,* ***Foundations in Physics***, (2007) 37:446-454, pdf at https://www.researchgate.net/publication/225879664

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have been extremely large at high red-shift and zero in the solar system. This then leads to the conclusion that at the Creation massive time dilation occurred with respect to the observer at the centre of a spherically symmetric, expanding Universe. It also means that what we would calculate as the one-way speed of light (not the actual speed of light that determines the physics in any local environment) is extremely large at high red-shift—a direct result of massive time dilation and not any change in the speed of light. Therefore, light from the most distant galaxies could traverse the distances in a matter of a few days as measured by Earth-based atomic clocks ...

"The time dilation effect occurred on Earth during the Creation Week and was switched off simultaneously with the cessation of the acceleration of the expansion. This means the Universe may no longer be expanding; we only see residual effects because of the finite travel time of light."[33]

In 2013 Dr. Hartnett modified his CGR-based model of a symmetric, isotropic, expanding finite total mass Universe with a centrally placed galaxy (i.e., more like a biblical earth-centered model). Again, dark matter was not a necessary component as long as the density of matter in the Universe varied as a function of red-shift, as would be expected with expansion. This modified Smoller-Temple FRW-metric "white hole" cosmology in which a "shock wave" causes a time reversal centered on a central galaxy, violates the *Copernican Principle* because it places the earth in a special position relative to the shock wave.[34] He notes:

"I theorized on a new model – call it the Hartnett-Carmeli model if you like–which is 5D. I added the time dimension to Carmeli's space and velocity dimensions, to create a linearized 5 dimensional model, something like an extension of special relativity but in 5 dimensions. That is shown in appendix 6. I then used that, making additional assumptions, to explore the idea of rapid time-dilation during Creation. [35]

But just because a theory can be made to fit certain observational results, that doesn't necessarily make it the correct cosmology. Indeed, Dr. Hartnett began to notice problems with Carmeli's CSR and CGR theory and consequently his own. In 2015 he reflected on the previous 12 years:

"In the years leading up to 2015 I had discovered several serious inconsistencies with Carmeli's cosmology. Besides those, there did not exist a viable 5D (space-time-velocity) version that could be used to give a robust description of the early Universe on a biblical timeline …

"By August 2015 … I had come to the conclusion that Jason Lisle's *Anisotropic Synchrony Convention (ASC) model* was better than my own *Carmeli-Hartnett model*.[36]

"So that brings me up to the present [January 2019]. I now believe that Lisle's ASC model is the best solution by a long shot. It works when other ESC based time-dilation models fail. For example, the problem of the effects of the Curse in the Universe, can be answered with the ASC model but not with a time-dilation model."[37]. ✠ ✠ ✠

Next Issue: Lisle's ASC vs. Einstein's ESC Cosmology Models

33. Hartnett, John, *A 5D Spherically Symmetric Expanding Universe Is Young*, ***Journal of Creation***, (2007) 21:69, 73. pdf at https://creation.com/a-5d-spherically-symmetric-expanding-Universe-is-young

34. Hartnett, John Gideon, *A Valid Finite Bounded Expanding Carmelian Universe Without Dark Matter,* ***International Journal Theoretical Physics*** (2013) 52:4360-4366, pdf at https://www.researchgate.net/publication/258162875

35. Hartnett, John, *Does My Use of Carmeli's Cosmology Provide a Valid Solution to the Starlight-Travel Problem?* ***Bible Science Forum*** (blog,2016), November 2016, https://biblescienceforum.com/2016/11/19/my-use-of-carmelis-cosmology-a-valid-solution/

36. Hartnett, John Gideon, *An Update: Correspondence on Cosmology,* ***Bible Science Forum*** (blog), Feb 7, 2015, https://biblescienceforum.com/2015/02/07/an-update-correspondence-on-cosmology/

37. Hartnett, John Gideon, *The effects of the Curse visible in the cosmos present another biblical creationist starlight travel-time problem,* ***Bible Science Forum*** (blog, Jan 3, 2019), https://biblescienceforum.com/2019/01/03/the-effects-of-the-curse-visible-in-the-cosmos-present-another-biblical-creationist-starlight-travel-time-problem/