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# THE BIG BANG THEORY—A SCIENTIFIC CRITIQUE [PART II]

**Bert Thompson, Ph.D., Brad Harrub, Ph.D., and Branyon May**

[EDITOR'S NOTE: With the May issue of *Reason & Revelation*, we started a three-part series investigating the Big Bang Theory. Part I began with a historical introduction, moved on to an examination of some of the scientific concepts upon which the Big Bang has been constructed, and ended with a section on why the Big Bang is scientifically flawed. Part II, below, picks up where Part I concluded, in examining additional reasons why the Big Bang Theory is not a valid option for the origin of the Universe.]

## COSMIC MICROWAVE BACKGROUND RADIATION

In 1978, Arno Penzias and Robert Wilson were honored with the Nobel Prize in physics for their discovery of the cosmic microwave background radiation (referred to variously in the literature as CMB, CMR, or CBR; we will use the CMB designation throughout our discussion). The two researchers from Bell Laboratory serendipitously stumbled onto this phenomenon in June 1964, after first thinking it was an equipment malfunction. For a short while, they even attributed the background noise to what they referred to as "white dielectric material"—i.e., bird droppings (Fox, 2002, p. 78). The electromagnetic radiation they were experiencing was independent of the spot in the sky where they were focusing the antenna, and was only a faint "hiss" or "hum" in its magnitude. The microwaves, which can be related to temperature, produced the equivalent of approximately 3.5 K background radiation at 7.3 cm wavelength ("K" stands for Kelvin, the standard scientific temperature scale; 0 K equals absolute zero—the theoretical point at which all motion ceases: -459° Fahrenheit or -273° Celsius). Unable to decide why they were encountering this phenomenon, Penzias and Wilson sought the assistance of Robert Dicke at Princeton University who, with his colleagues, immediately latched onto this noise as the "echo" of the Big Bang. A prediction had been made prior to the discovery, that if the Big Bang were true, there should be some sort of constant radiation in space, although the prediction was for a temperature several times higher (see Weinberg, 1977, p. 50; Hoyle, et al., 2000, p. 80).

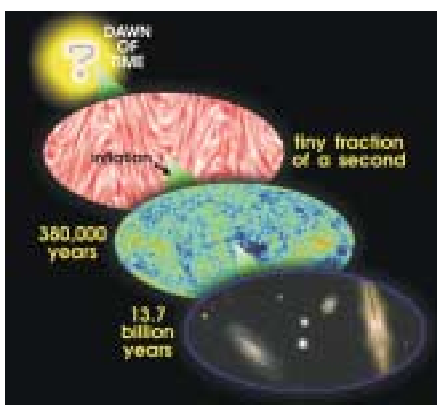


Figure 1 — Artist's concept of crucial periods in the development of the Universe according to Big Bang inflationary cosmology

Previously, in our section on the Steady State Theory, we referred to the fact that a "new theoretical concept" eventually would be responsible for dethroning that theory. Our reference was to Penzias and Wilson's discovery of the existence of the cosmic microwave background radiation. Described by some evolutionists as the "remnant afterglow of the Big Bang," it is viewed as a faint light shining back to the beginning of the Universe (well, at least close to the beginning...say, within 300,000 to 400,000 years or so). This radiation, found in the form of microwaves, has been seized upon by proponents of the Big Bang Theory as proof of an initial catastrophic beginning—the "bang"—of our Universe. However, the temperature estimates of "space" were first published in 1896, even prior to George Gamow's birth in 1904 (see Guillaume, 1896). C.E. Guillaume's estimation was 5-6 K, and rather than blaming that temperature on some type of "Big Bang" explosion, he credited the stars belonging to our own galaxy.

The cosmic background radiation spelled almost instant doom for the Steady State Theory, because the theory did not predict a background radiation (since there was no initial outpouring of radiation in that model). Plus, there was no way to introduce the idea of such background radiation into the existing theory. Therefore, the Quasi-Steady-State Theory, a slight variation by Hoyle, Burbidge, and Narlikar, was formed to try to make sense of this "chink" in the armor of the Steady State Theory. The British science journal *Nature* stated it well: "Nobody should be surprised, therefore, if the handful of those who reject the Big Bang claim the new data as support for their theories also" (see "Big Bang Brouhaha," 1992, 356:731). The prediction made by *Nature* was right on target. The CMB radiation data have indeed been used by almost all theorists as an *ad hoc* support for their views. A logical question to ask would be: "Do these various groups all claim it on the same scientific grounds?" The answer, of course, is no.

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Speaking of the CMB radiation, Joseph Silk referred to the results as "the cornerstone of Big Bang cosmology" (1992, p. 741). There can be no doubt that there exists a cosmic electromagnetic radiation on the microwave order, and that its temperature correlation is approximately 3 K (technically 2.728 K; see Harrison, 2000, p. 394). This fact is not in dispute—verifiable data have been compiled from the numerous experiments that have been conducted. As David Berlinski observed: "The cosmic hum is real enough, and so, too, is the fact that the universe is bathed in background radiation" (1998, p. 30). The ground data have been collected using the Caltech radio millimeter interferometer and the Owens Valley Array. Low-atmosphere instruments also have recorded CMB radiation using two balloon flights: MAXIMA (which, in 1998, flew at a height of approximately 24.5 miles for one night over Texas) and BOOMERANG (which, in 1998, flew at a height of around 23.5 miles for ten days over Antarctica), as well as from the Cosmic Background Explorer (COBE) and the Microwave Anisotropy Probe (MAP) satellite missions by NASA [see Figure 4, p. 54] (Peterson, 1990; Flam, 1992; Musser, 2000).

What **is** in dispute is the **explanation** for the phenomenon. The late Sir Arthur Eddington—in his book, *The Internal Constitution of the Stars* (1926)—already had provided an accurate explanation for this temperature found in space. In the book's last chapter ("Diffuse Matter in Space"), he discussed the temperature in space. In Eddington's estimation, this phenomenon was not due to some ancient explosion, but rather was simply the background radiation from all of the heat sources that occupy the Universe. He calculated the minimum temperature to which any particular body in space would cool, given the fact that such bodies constantly are immersed in the radiation of distant starlight. With no adjustable parameters, he obtained a value of 3.18 K (later refined to 2.8)—essentially the same as the observed "background" radiation that is known to exist today.

In 1933, German scientist Erhard Regener showed that the intensity of the radiation coming from the plane of the Milky Way was essentially the same as that coming from a plane normal to it. He obtained a value of 2.8 K, which he felt would be the temperature characteristic of intergalactic space (Regener, 1933). His prediction came more than thirty years before Penzias and Wilson's discovery of the cosmic microwave background. The radiation that Big Bang theorists predicted was supposed to be much hotter than what was actually discovered. Gamow started his prediction at 5 K, and just a few years before Penzias and Wilson's discovery, suggested that it should be 50 K (see Alpher and Herman, 1949; Gamow, 1961). As Van Flandern noted:

> The amount of radiation emitted by distant galaxies falls with increasing wavelengths, as expected if the longer wavelengths are scattered by the intergalactic medium. For example, the brightness ratio of radio galaxies at infrared and radio wavelengths changes with distance in a way which implies absorption. Basically, this means that the longer wavelengths are more easily absorbed by material between the galaxies. But then the microwave radiation (between the two wavelengths) should be absorbed by that medium too, and has no chance to reach us from such great distances, or to remain perfectly uniform while doing so. **It must instead result from the radiation of microwaves from the intergalactic medium. This argument alone implies that the microwaves could not be coming directly to us from a distance beyond all the galaxies, and therefore that the Big Bang theory cannot be correct.**
>
> None of the predictions of the background temperature based on the Big Bang was close enough to qualify as successes, the worst being Gamow's upward-revised estimate of 50 K made in 1961, just two years before the actual discovery. Clearly, without a realistic quantitative prediction, **the Big Bang's hypothetical "fireball" becomes indistinguishable from the natural minimum temperature of all cold matter in space** (2002, 9:73-74, parenthetical item in orig., emp. added).

Matter, whether on Earth or in space, absorbs radiation, and the CMB electromagnetic radiation is very likely the result of that absorption. Matter is known to absorb and emit radiation (known as blackbody radiation) caused by a change in temperature. Space is not an "empty" place, as some once thought, but is filled with stars, planets, nebulae, comets, asteroids, interstellar particles of dust and gas, and galaxies, all of which both absorb and emit varying amounts of radiation (see Akridge, et al., 1981, 18[3]:161). Fred Hoyle, Geoffrey Burbidge, and J.V. Narlikar, in their book, *A Different Approach to Cosmology* (2000), and Eric Lerner, in his book, *The Big Bang Never Happened* (1991), support the possibility of simple absorption and re-emission of the cosmic radiation. [Hoyle, et al., also suggested: "It seems very reasonable to suppose that the microwave radiation might very well have arisen from hydrogen burn-

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ing in stars" (2000, p. 313).] Hoyle and his colleagues added to this thought when they stated that the "radiation field is generated by discrete objects and becomes smooth through scattering and diffusion in space" (p. 306). This, then, portrays a practical reason for the overall isotropy [spread out evenly in all directions] of the CMB radi ation through thermalization and the scattering effect, also known as the Sunyaev-Zeldovich Effect (Humphreys, 1992, p. iii).

Despite their strong words of affirmation declaring to the world that they now had "proof," Big Bang supporters have had to admit that their theories about the CMB radiation are not really as concrete as they would like us to believe. Evolutionist Karen Fox confessed: "This radiation in and of itself doesn't require the big bang theory per se be correct" (2002, p. 134). Hoyle, et al., were a little more blunt: "...[T]he existence of the microwave radiation does not necessarily have anything to do with a big bang" (2000, p. 313). In fact, while the Big Bang Theory predicts that cosmic background radiation should exist, it does not necessarily predict that it should exist in thermal equilibrium. As Berlinski went on to note: "Although Big Bang cosmology does predict that the universe should be bathed in a milky film of radiation, it makes no predictions about the uniformity of its temperature" (1998, p. 30).

There was one thing, however, that cosmologists did recognize regarding the "uniformity of temperature" found in the background radiation. Initially, it represented a serious problem for the Big Bang Theory. It was "too" uniform—as science writers pointed out in articles with titles such as "Too Smooth a Universe" (see Folger, 1991). The formation of stars, galaxies, etc., during the early years of the Universe's formation, **required** that variations be present in the earliest distribution of the matter so that the matter ultimately would coalesce into those stars, galaxies, etc. And, as everyone acknowledged, the existence of these variations should have had some effect on the background radiation (see Lipkin, 1991, p. 23).

And that was the problem. When NASA sent up its COBE satellite in 1989, it found, at that time, a 3 K (or, to be more precise, a 2.735 ± 0.06 K) temperature—measured to an accuracy of 1 part in 10,000 (Peterson, 1990). In order for the early Universe to actually have formed in the manner in which they thought it did, scientists recognized that there **must** have been variations, however slight, in the background radiation. Yet, the background radiation seemed more pristine with each new look at the skies. Until 1992, the evidence of any serious fluctuations in the background radiation had been conspicuously absent, leaving the Big Bang concept riddled with problems for which there were seemingly no solutions (see Folger, 1991).

Perhaps you have heard that old saying: "That was then; this is now." Big Bang supporters now are suggesting that there is clear-cut evidence that the "cosmic egg" did, in fact, possess the necessary variations that allowed matter to coalesce into stars, galaxies, etc. A second survey was performed using NASA's COBE satellite, and was carried out to an accuracy, not of 1 in 10,000, but to 1 in 100,000 (see Flam, 1992). Astrophysicist George Smoot, and a team of scientists from the University of California at Berkeley, documented what seemed to be minor variations in the background temperature of the known Universe, thereby establishing the "fact" that there were variations present in the matter formed in the early stages of the Big Bang—variations that are presumed to represent the early defects that could explain how the Universe got to be so "lumpy" (see Smoot and Davidson, 1993). Smoot remarked to the Associated Press at the time, "If you're religious, it's like looking at God." On the front cover of Smoot's 1993 book, *Wrinkles in Time*, British astrophysicist Stephen W. Hawking is quoted as saying that the findings represent "the scientific discovery of the century, if not all time." And on the back cover of the book, the reader will find in big, bold, blue letters "**Behold the Handwriting of God**," followed by the statement: "George Smoot and his dedicated team of Berkeley researchers had proven the unprovable—uncovering, inarguably and for all time, the secrets of the creation of the Universe." WOW! Talk about fanfare!

In late 1998, the BOOMERANG balloon telescope was launched to measure cosmic microwave background radiation. This balloon carried the telescope for 10 days while circumnavigating Antarctica. Image courtesy of NASA.

In discussing the anisotropy of the radiation field, however, three things need to be considered. First, the temperature being measured is only a couple of degrees above absolute zero, the point at which all motion ceases. Yet this radiation is alleged to have had its origin from an initial temperature of $10^{32}$ Celsius (Fox, p. 175). Second, most people likely are unaware of the infinitesimal nature of the variations being reported. In fact, these "variations" differ by barely **thirty-millionths** of a Kelvin! Some scientists doubt that these are even large enough to account for the large-scale structure of the Universe (see Flam, 1992, 256:612). In an article titled "Boomerang Data Suggest a Purely Baryonic Universe" that he authored for *Astrophysics Journal*, astronomer Stacy McGaugh of the University of Maryland wrote:

> [C]osmic microwave background is very smooth. Structure cannot grow gravitationally to the rich extent seen today unless there is a non-baryonic component that can already be significantly clumped at the time of recombination without leaving **indiscriminately large fingerprints on the microwave background** (2000, 541:L33, emp. added).

But, as one scientist acknowledged, "the large fingerprints are just not observed" (Hartnett, 2001, 15[1]:10). Third, while the variations that have been measured have been documented in 1 part in **100,000**, cosmologists have stated that variations greater than 1 part in **10,000** are necessary for galaxies and clusters to form in the cosmological time that is allegedly available for gravity to carry out its work (see Rowan-Robinson, 1991).

Halton Arp likewise is skeptical of the significance of the new COBE results showing that the Universe displays a very slight anisotropy in the background radiation, which then is supposed to account for the rather clumpy distribution of matter in galaxies, superclusters, strings, etc. In his 1999 book, *Seeing Red: Redshifts, Cosmology and Academic Science*, Dr. Arp noted that in spite of these extremely slight irregularities of

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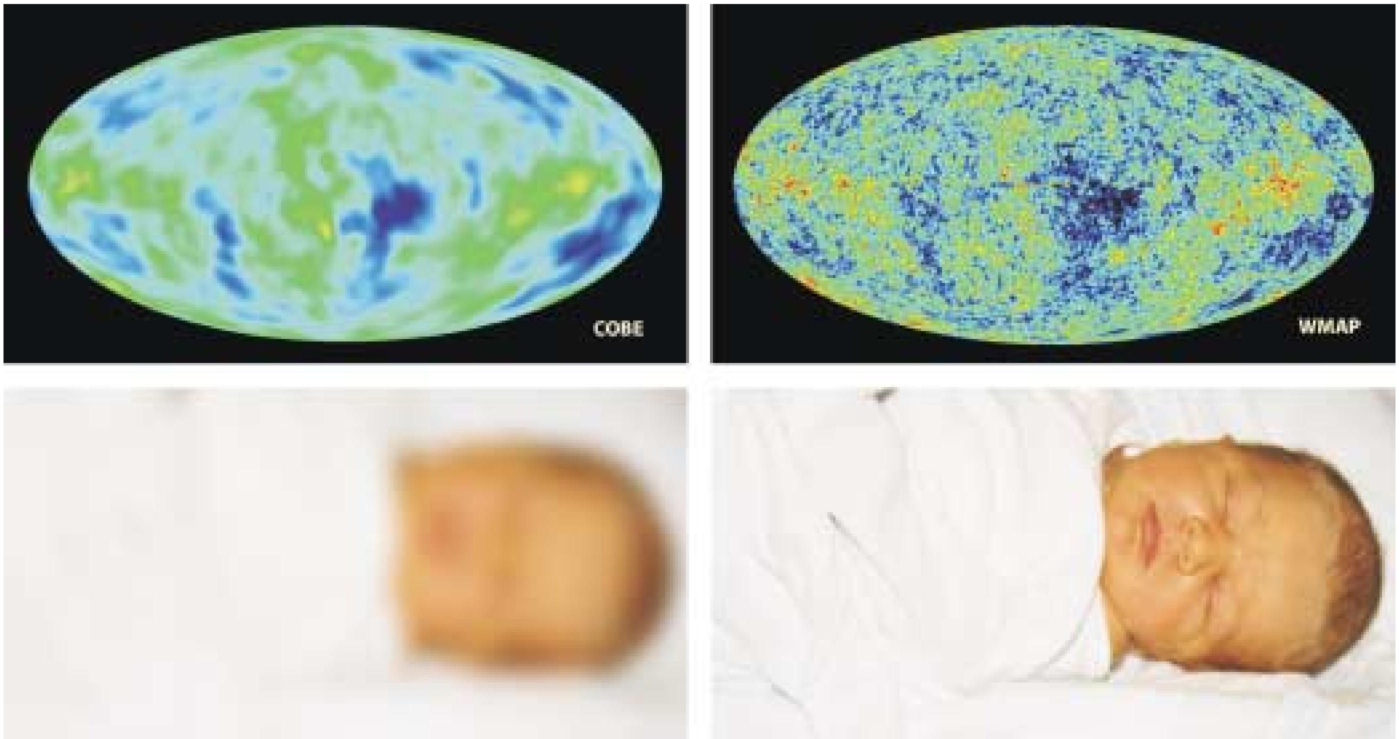


Figure 2 — Image at top left allegedly represents a "baby picture" of the Universe taken by the COBE satellite, first launched November 18, 1989. [Oval shape is a projection to display the entire sky, similar to the way the globe of the Earth can be projected as an oval.] Colors indicate "warmer" (red/yellow) and "cooler" (blue) spots. Image at top right (taken by NASA's Wilkinson Microwave Anisotropy Probe [WMAP], launched June 30, 2001) brings the COBE picture into sharp focus, similar to refocusing a camera lense after taking an infant's snapshot, as in examples above. The high-resolution WMAP image supposedly depicts the microwave light from 380,000 years after the Big Bang, which is said to have occurred 13.7 billion years ago. This would be the equivalent of taking a picture of an 80-year-old man or woman on the day of his or her birth. CMB images courtesy of NASA.

1 part in 100,000, the background radiation is **still too smooth** to account for the clumpiness of the Universe (p. 237). The British journal, *Nature*, commented with subdued understatement: "The simple conclusion, that the data so far authenticated are consistent with the doctrine of the Big Bang, has been amplified in newspapers and broadcasts into proof that 'we now know' how the Universe began. This is cause for some alarm" (see "Big Bang Brouhaha," 1992, 356:731). There is indeed "cause for alarm." Allow us to explain.

With the aid of a weather balloon, a telescope known as BOOMERANG spent ten days in December 1998 taking pictures of the Universe while flying over Antarctica. A few months earlier, a similar telescope called MAXIMA had flown high above Texas for a single night (see "MAXIMA, a Balloon-borne...," 2000). Both telescopes were designed to perform the exact same task, which was to observe the cosmic microwave radiation.

The telescopes were constructed to make precise maps of the "background radiation glow" on scales finer than one degree, which, according to researchers, would correspond to the size of the observable Universe at the time the radiation is thought to have been released. The design behind these experiments centered on the alleged random fluctuations (referred to as "hot" and "cold" spots) generated by cosmic inflation in the first split second, which would have caused some regions of the Universe to be denser than others. As Ron Cowen summarized the matter in the September 28, 2002 issue of *Science News*: "The hot and cold spots represent the slightly uneven distribution of photons and matter in the early universe, which scientists view as the seeds of galaxy formation" (162:195).

Supposedly, the telescopes could capture this difference in densities, which is said to have been caused by the ensuing battle between pressure and inertia that caused the plasma to oscillate between compression (an **increase** in density and pressure) and rarefaction (a **decrease** in density and pressure). As the Universe aged, so the theory goes, **oscillations** between compression and rarefaction developed on ever-larger scales. The fine detail in background radiation provided by these telescopes was supposed to provide a "snapshot" of the sound waves during those oscillations. Areas of compression would be slightly hotter, thus brighter; areas of rarefaction would be cooler, thus darker. So, scientists spent many hours analyzing bright and dark areas captured by the telescopes.

Initially, it appeared that the data fit quite nicely into researchers' theories. Cosmologist Michael S. Turner of the University of Chicago told a press conference in April 1999: "The Boomerang results fit the new cosmology like a glove" (as quoted in Musser, 283[1]:14). Additionally, a team of researchers, led by Paolo de Bernardis of the University of Rome, and Andrew E. Lange of the California Institute of Technology, declared in the April 27, 2000 issue of *Nature* that each of the BOOMERANG findings was "consistent with that expected for cold dark matter models in a flat (Euclidean) Universe, as favoured by standard inflationary models" (de Bernardis, et al., 404: 955, parenthetical item in orig.). The MAXIMA team concluded similarly.

Once again, however, that was then, this is now. As it turns out, the images these two telescopes projected have challenged the very core of the Inflationary Big Bang Model itself. Three months after the *Nature* article appeared, George Musser penned an article ("Boomerang Effect") for the July 2000 issue of *Scientific American*, in which he wrote:

> [W]hen measurements by the BOOMERANG and MAXIMA telescopes came in...scientists were elated.... And then the dust settled, revealing that two pillars of big bang theory [the current

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> status of the microwave background radiation and the necessity of a flat Universe—BT/BH/BM] were squarely in conflict.... That roar in the heavens may have been laughter at our cosmic confusion (283[1]:14,15).

Why is the Universe laughing at evolutionary cosmologists? What is this "confusion" all about? As Musser went on to explain, the BOOMERANG and MAXIMA telescopes

> ...made the most precise maps yet of the glow on scales finer than about one degree, which corresponds to the size of the observable universe at the time the radiation is thought to have been released (about 300,000 years after the bang). On this scale and smaller, gravity and other forces would have had enough time to sculpt matter.
>
> For those first 300,000 years, the photons of the background radiation were bound up in a broiling plasma. Because of random fluctuations generated by cosmic inflation in the first split second, some regions happened to be denser. Their gravity sucked in material, whereupon the pressure imparted by the photons pushed that material apart again. The ensuing battle between pressure and inertia caused the plasma to oscillate between compression and rarefaction—vibrations characteristic of sound waves. As the universe aged, coherent oscillations developed on ever larger scales, filling the heavens with a deepening roar. But when the plasma cooled and condensed into hydrogen gas, the photons went their separate ways, and the universe abruptly went silent. **The fine detail in the background radiation is a snapshot of the sound waves at this instant** (283[1]:14, parenthetical items in orig., emp. added).

The data collected from BOOMERANG and MAXIMA were expected to show a profusion of different-sized spots—large spots would represent oscillations that had begun fairly recently, spots half that size would represent oscillations that had gone on for longer, spots a third that size would represent oscillations that had gone on longer still, and so on. Musser continued:

> On either a Fourier analysis or a histogram of spot sizes, **this distribution would show up as a series of peaks**, each of which corresponds to the spots of a given size. The height of the peaks represents the maximum amount of compression (odd-numbered peaks) or of rarefaction (even-numbered peaks) in initially dense regions. Lo and behold, both telescopes saw the first peak [representing compression—BT/BH/BM]—which not only confirms that sounds reverberated through the early universe, as the big bang theory predicts, but also shows that the sounds were generated from preexisting fluctuations, as only inflation can produce (283[1]:14).

The data from both BOOMERANG and MAXIMA did indeed seem to be thrilling. Then, reality set in. The first significant problem with the information from the telescopes was that the data revealed only the "merest hint of a bulge where the second peak should be" (Musser, 283[1]:15). This was **really** bad news for inflationary theory, because it meant that the so-called "primordial plasma" contained numerous subatomic particles that weighed down the rarefaction of the sound waves and thereby suppressed the even-numbered peaks. Musser commented on the implication of this when he wrote:

> According to Max Tegmark of the University of Pennsylvania and Matias Zaldarriaga of the Institute for Advanced Study in Princeton, N.J., **the Boomerang results imply that subatomic particles account for 50 percent more mass than standard big bang theory predicts—a difference 23 times larger than the error bars of the theory** (283 [1]:15, emp. added).

**Twenty-three times larger?!** Whew! Where did those extra "subatomic particles" come from? No one knows. And inflationary theory cannot function with them present.

Just as the initial shock was beginning to wear off concerning the massive amounts of "extra subatomic particles" that the data revealed, more bad news began to pour in. Researchers needed (as required by inflationary cosmology) to find those "spots" (i.e., oscillations) moving outward and slightly upward at a very slight angle from an imaginary starting point on an imaginary flat plane (Euclidean geometry again—think "a sheet of paper"). The angle—according to the theory that is intended to predict a flat Universe—**could be no more than 0.8°**. The data from BOOMERANG, however, indicated an angle of **0.9°** (see Figure 3). If the Universe were flat, and if the rules of Euclidean trigonometry applied (both of which, the researchers agreed, would be the case), then the angle at which the "spots" propagated outward should have been no more than 0.8°.

Additional examination of the data revealed that this discrepancy in angles indicated that the Universe actually is **spherical**, not flat, because if anything starts out **completely** flat, then as it expands, it will not show curvature comparable to what the BOOMERANG telescope reported. As Musser wrote in *Scientific American:*

> ...[F]ollow-up studies soon showed that **the lingering discrepancy, taken at face value, indicates that the universe is in fact spherical, with a density 10 percent greater than that required to make it flat**. Such a gentle curvature seems awkward. Gravity quickly amplifies any deviations from exact flatness, so a slight sphericity today could only have arisen if the early universe was infinitesimally **close to flat** (283 [1]:15, emp. added).

"Close to flat"—even "infinitesimally close to flat"—is not the same as "exact flatness." And therein lies the problem for inflationary theory. According to the BOOMERANG and MAXIMA data, then, there were too many subatomic particles present "in the beginning." And, to make matters worse, the Universe is spherical, not flat, as inflationary theory predicts.

Evolutionists (and those sympathetic with them) who have "put all their eggs into the inflationary theory basket" are understandably upset with the BOOMERANG and MAXIMA data and the obvious conclusions stemming from them, since, as Musser noted, this placed "two pillars of big bang theory squarely in conflict." But the remaining alternatives are not much better. The only feasible alternative would seem to suggest that the trigonometric calculation used to account for "cosmic expansion"—couldn't! Such a scenario would occur only if: (1) the radiation did not travel as far as assumed (meaning it had been released **later** in cosmic history than expected); (2) the famous Hubble constant were significantly larger (which would in-

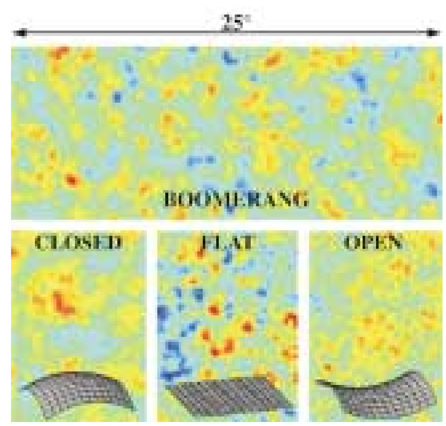


Figure 3 — The possible shapes of the Universe—closed, flat, or open—are based on how imaginary pairs of parallel lines might act. The bottom simulations represent the data that would result if each were correct, since BOOMERANG measures "hot" and "cold" spots (i.e., cosmic microwave background radiation) in the Universe. The top image depicts the **actual** BOOMERANG data.

If the Universe were "closed," the parallel lines eventually would converge upon each other (see bottom left). If the Universe were open, the parallel lines would diverge from each other (see bottom right). If the Universe were flat (like a sheet of paper), the parallel lines never would meet (see middle image).

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dicate that the Universe actually is **younger** than predicted); (3) the Universe contained more matter (which would hold back the expansion); or (4) the cosmological constant (discussed in detail later) were smaller (which would put the brakes on the current theory of cosmic acceleration).

And, unfortunately for Big Bang theorists, that **still** is not all the bad news. In its on-line "Science Update," *Nature* posted an article on Monday, March 31, 2003, titled "Sharp Images Blur Universal Picture." The author of that article, John Whitfield, remarked that

> physicists' notions of the Universe could be in trouble. New measurements from the Hubble Space Telescope hint that space is smooth, not grainy. Without graininess, our current theories predict that the Big Bang was infinitely hot and dense—tough to explain, to say the least (2003).

"Tough to explain" happens to be another one of those "mild understatements." Richard Lieu of the University of Alabama at Huntsville (upon whose research Whitfield's report was partly based), admitted: "The theoreticians are very worried. There could be quite a lot of missing physics to be found" (as quoted in Whitfield). "Missing physics"? "Quite a lot" of "missing physics"? Robert Ragazzoni of the Astrophysical Observatory in Arcetri, Italy, agreed. "You don't see anything of the effect predicted" (as quoted in Whitfield). In short, things right now aren't looking very rosy for Big Bang inflationary theory. As nucleosynthesis expert David R. Tytler of the University of California at San Diego observed: "There are no known ways to reconcile these measurements and predictions" (as quoted in Musser, 283[1]:15).

Interestingly, not so long ago, adherents of the Big Bang held to a smooth Universe, and pointed with pride to the uniform background radiation. Then they found large-scale structures, and revised their predictions. Now, they have found infinitesimally small variations, and are hailing them as the greatest discovery of the twentieth century. We must urge caution when a theory, claiming to be scientific, escapes falsification by continual modification with *ad hoc*, stopgap measures.

Let's face it: the Big Bang is a survivor. It **never** is falsified—only modified. David Lindley (1991) compared the efforts to revive existing cosmological theories with Ptolemy's work-around and fix-it solutions to an Earth-centered Solar System. Equations can be manipulated *ad infinitum* to make "messy" theories work, but Lindley warned, "skepticism is bound to arise."

And the skeptics are having a field day. In an article with a byline that reads like a *Who's Who* of Big Bang dissidents, Halton Arp and his allies have introduced a modified Steady State Theory. Not being able to resist taking a jab at their competitors, they wrote: "As a general scientific principle, it is undesirable to depend crucially on what is unobservable to explain what is observable, as happens frequently in Big Bang cosmology" (Arp, et al., 1990, 346:812). Elsewhere, Geoffrey Burbidge quipped: "To the zeroth order [at the simplest level—BT/BH/BM], the Big Bang is fine, but it doesn't account for the existence of us and stars, planets and galaxies" (as quoted in Peterson, 1991, 139:233). No, it certainly does not.


Figure 4 — Representations of NASA's COBE and WMAP satellite probes, used to detect cosmic microwave background radiation. Images courtesy of NASA.

## THE HOMOGENEITY OF THE UNIVERSE

The Big Bang model absolutely requires a uniform, homogeneous Universe. As we mentioned earlier, **isotropy** (matter being spread out evenly in all directions) and **homogeneity** (matter being spread out uniformly) are two foundational components of the standard Big Bang Theory. DePree and Axelrod addressed this fact when they wrote:

> Hubble made two very important discoveries in his studies of galaxy types and distributions. He found that the universe appeared to be both isotropic (the same in all directions), and homogeneous (one volume of space is much like any other volume of space). Together, the homogeneity and isotropy of the universe make up what we call the *cosmological principle:* **a cornerstone assumption in modern cosmology**. If we could not make this assumption (based on observation), then our cosmology might only apply to a very local part of the universe. But the cosmological principle allows us to extrapolate our conclusions drawn from our local viewpoint to the whole universe (2001, p. 363, parenthetical items and italics in orig., emp. added).

Berlinski summarized the critical need for homogeneity and isotropy in this manner:

> In describing matter on a cosmic scale, cosmologists strip the stars and planets, the great galaxies and the bright bursting supernovae, of their uniqueness as places and things and replace them with an imaginary distribution: the matter of the universe is depicted as a great but uniform and homogeneous cloud covering the cosmos equitably in all its secret places. Cosmologists make this assumption because they must. There is no way to deal with the universe object by object; the equations would be inscrutable, impossible to solve.
>
> Having simplified the contents of the universe, the cosmologist must take care as well, and for the same reason, to strip from the matter that remains any suggestion of particularity or preference in place. The universe, he must assume, is isotropic. It has no center whatsoever, no place toward which things tend, and no special direction or axis of coordination. The thing looks much the same wherever it is observed.
>
> **The twin assumptions that the universe is homogeneous and isotropic are not ancillary but indispensable to the hypothesis of an expanding universe; without them, no conclusion can mathematically be forthcoming** (1998, pp. 34-35, emp. added).

But how, exactly, could the Big Bang account for the homogeneity that is supposed to exist within the Universe? That question, in fact, was one of six major problems with the standard Big Bang model that Andrei Linde discussed at length in his widely heralded November 1994 *Scientific American* article. Number five in that list was the following.

> Fifth, there is the question about the distribution of matter in the universe. On the very large scale, matter has spread out with remarkable uniformity. Across more than 10 billion light-years, its distribution departs from perfect homogeneity by less than one part in 10,000. For a long time, nobody had any idea why the universe was so homogeneous. But those who do not have ideas sometimes have principles. One of the cornerstones of the standard cosmology was the "cosmological principle," which asserts that the universe must be homogeneous. **This assumption, however, does not help much, because the universe incorporates important deviations from homogeneity, namely, stars, galaxies, and other agglomerations of matter. Hence, we must explain why the universe is so uniform on large scales and at the same time suggest some mechanism that produces galaxies** (1994, 271:49, emp. added).

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The fact is, as Dr. Linde so eloquently pointed out, the Universe is "lumpy." **Really** lumpy! In a survey that covered one hundred-thousandth of the visible Universe, Margaret Geller and John Huchra (1989) identified a huge sheet-like structure that came to be called the "Great Wall." It contains thousands of galaxies, and extends at least 550 million light-years across the sky. Another survey, covering one two-thousandth of visible space, showed that the Universe **does** appear uniform—**but only on scales larger than 150 million light-years** (Cowen, 1990).

As it turns out, there are at least two serious problems with any suggestion that the Universe exhibits homogeneity. First, homogeneity can be defended only if one considers the matter present in the Universe at distances greater than 150 million light-years. When it comes to getting "up close and personal," so to speak, the concept of homogeneity collapses completely—as Dr. Linde himself noted.

Second, a serious problem arises even when considering the matter of the Universe at distances greater than the 150-million-light-year cut-off point. A report by Saunders, et al. (1991), based on data from the Infrared Astronomical Satellite (IRAS), documented beyond doubt that **there is more structure on large scales than is predicted by, or possible with, the standard cold dark matter theory of galaxy formation**—which led the entire group of ten authors who performed the research and authored the report to disavow completely the standard Big Bang theory. What shocked the scientific community was that the group included researchers who once were ardent supporters of the theory. The standard Big Bang Theory cannot account for the non-homogeneity of the Universe, which was Berlinski's point when he concluded: "**However useful the assumption of homogeneity may be mathematically, it is false in the straightforward sense that the distribution of matter in the universe is not homogeneous at all**" (p. 35, emp. added). Or, as Linde (quoted above) remarked with elegant understatement: "The universe incorporates important deviations from homogeneity." Indeed it does.

## DARK MATTER AND OUR "PRECARIOUSLY BALANCED" UNIVERSE

In any Big Bang scenario—according to evolutionists' assumptions about the initial conditions—the Universe can contain no more than 10% protons, neutrons, and other ordinary matter found in stars, planets, galaxies, etc. What makes up the rest of the matter—90+% of the Universe—is still a mystery. As one physicist put it: "Astronomers therefore have no idea of the composition of the bulk of the entire universe. So much for a fundamental understanding of the physical universe" (DeYoung, 2000, 36:177).

Cosmologists do not know what the "mysterious stuff" is that composes "the bulk of the entire Universe." Nor have they found any credible, direct evidence of its existence. They refer to it as "cold dark matter" [CDM] (and/or "dark energy"—discussed later). As Stacy McGaugh wrote in *Astrophysics Journal*: "As yet, we have no direct indication that CDM exists" (2000, 541: L33). A year later, John Hartnett wrote in agreement: "The dynamic behaviour of galaxies and galactic clusters begs for dark matter, as will be explained later, but to date, none has been found" (2001, 15[1]:9).

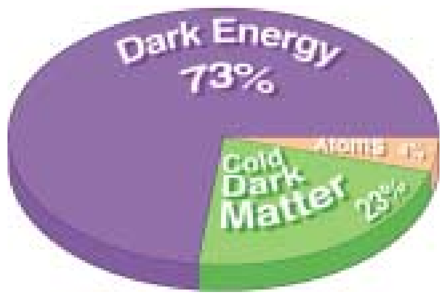


Figure 5 — Chart depicting the percentages of dark energy, dark matter, and actual matter (i.e., atoms) that must be present in order to explain the composition of the Universe via the Big Bang model

The mysterious and elusive "cold dark matter" is "cold" because it cannot interact with other matter (except gravitationally), and "dark" because it emits no detectable radiation, and therefore cannot be seen. In the March 2003 issue of *Scientific American*, David Cline authored an article titled "The Search for Dark Matter," in which he noted: "Being dark, it was never able to lose energy by emitting radiation, so it never could agglomerate into subgalactic clumps such as stars or planets" (288[3]:52). [In the scientific literature, cold dark matter also is referred to as "missing mass," "hidden matter," and "shadow matter."] Carl Sagan once described it as "dark, quintessential, deeply mysterious stuff wholly unknown on earth" (1994, p. 399). In his *Scientific American* article, Cline commented on this "unknown material" that makes up most of the Universe:

> **The terms we use** to describe its components, "dark matter" and "dark energy," **serve mainly as an expression of our ignorance**.... Essentially, all we know is that dark matter clumps together, providing a gravitational anchor for galaxies and larger structures such as galaxy clusters.... To detect dark matter, scientists need to know how it interacts with normal matter. Astronomers assume that it interacts only by means of gravitation, the weakest of all the known forces of nature. If that really is the case, physicists have no hope of ever detecting it (288[3]: 52,54, emp. added).

Cline also noted that even though, after seventy years of looking for it, we have no proof of the existence of dark matter, nevertheless, "nearly everyone accepts that it is real" (288[3]:52). Why is this so? The fact is, evolutionists **must** have this matter to support their theories. As DeYoung put it: "Popular versions of the big bang model **require immense amounts of dark matter** existing throughout space" (36:177, emp. added). Yes, they do, for two reasons. First, dark matter is necessary in order to allow for expansion and galaxy formation. If this "extra" matter did not exist, the ordinary matter of the Universe would have scattered into the empty reaches of space without ever coming together to form galaxies. Second, dark matter is mandatory for the success of the inflationary model of the origin of the Universe, and to ensure that the structure of the Universe is "flat," thereby guaranteeing that it will continue without end (concepts discussed below).

According to evolutionary cosmologists, the baffling yet profuse substance known as dark matter is present throughout the Universe, and, in fact, is the "invisible glue that holds it all together" (Lerner, 1991, p. 13; cf. DeYoung, 2000, 36:177). What is dark matter? DeYoung noted: "This is an unanswered question since dark matter has never been directly observed, and may not even exist.... In reality, however, the dark matter mystery remains completely unsolved after seven decades of intense study" (36:180,181).

Matter supposedly comes in a variety of types and forms: baryonic and non-baryonic, as well as cold and hot. Baryonic matter represents all the conventional matter (what Cline called "normal matter") comprised of protons and neutrons. Non-baryonic dark matter is any matter not of a conventional nature—i.e., not composed of protons and neutrons. The "cold" and "hot" designations apply to this latter form only, and have to do with its motion [slow (cold) vs. fast (hot)] in relation to gravity. According to their own studies, evolutionists have concluded that the Universe is composed of a mere 4% baryonic matter, which **leaves 96% of the Universe as "dark" matter**

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**and/or "dark" energy.** In an article titled "Cosmology Gets Real" that appeared in the March 13, 2003 issue of *Nature*, staff writer Geoff Brumfiel wrote:

> With the addition of the latest data on the CMB [cosmic microwave background radiation—BT/BH/BM], courtesy of NASA's Wilkinson Microwave Anisotropy Probe, our picture of the universe is now clearer than ever. CMB studies have confirmed that the Universe is indeed flat. **The Wilkinson probe has now set ratios for the composition of the cosmos: 23% dark matter and 73% dark energy, leaving only 4% for the galaxies, stars and people** (422:109, emp. added).

Or, to echo the sentiments of cosmologist Michael Turner of the University of Chicago: "Ninety-six percent of the Universe is stuff that we've never seen" (as quoted in Brumfiel, 422:109) [see Figure 5, p. 55].

Of the unseen Universe, dark matter is believed to constitute one third (33%) of its total mass (Milgrom, 2002, 287[2]:44). And, "the galaxy motions suggest that the dark matter mass totals at least ten times that of all the visible galaxies" (DeYoung, 36:178). However, perhaps it would be wise to heed the evolutionists' own warning:

> Many suggestions have been made concerning the nature of the missing dark matter. Before embarking on flights of fancy, the reader should bear in mind that the astronomical evidence for a universe dominated by exotic forms of matter is slim, and the laboratory evidence for the various proposed candidates is equally slim. **Effective inflation, unless finely tuned, mandates the missing matter, yet we do not know what form it takes and so far have no evidence that it actually exists** (Harrison, 2000, p. 468, emp. added).

In his article in *Nature* on the character of the Cosmos, Brumfiel concluded: "...[T]he holes in our knowledge are still considerable. Researchers are confident that dark energy and dark matter are out there, but they don't know what kind of entities they are or how to find them" (422:109).

But those "minor inconveniences" have not stopped those same researchers—in a last-ditch effort to establish the validity of their theories—from assigning actual percentages to the amount of dark matter that is supposed to exist, nor from giving specific names to its supposed forms. Some of these non-baryonic members allegedly include such eerie things as axions (named, believe it or not, after a laundry detergent!), WIMPS (weakly interacting massive particles), CHAMPs (Charged Massive Particles), and MACHOs (MAssive Compact Halo Objects) [Glashow, 1989; Palca, 1991; Silk, 1991]. Karen Fox admitted:

> The fact is that the dark matter problem is reaching something of a crisis, although few astronomers have been willing to admit this yet. Forget not finding any ideal dark matter candidates. The problem isn't that no one can find the missing matter (although they can't) but that even if theorists stomp their feet and shake their heads, observations haven't even shown that the universe is at the critical density (2002, pp. 122-123, parenthetical item in orig.).

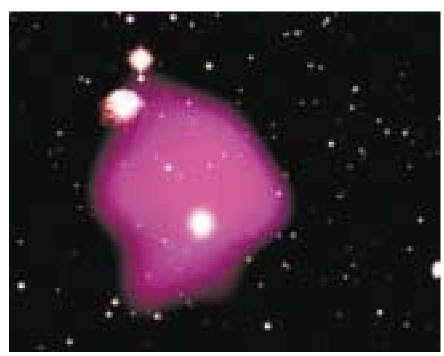
But if "observations haven't even shown that the universe is at the critical density," then that plays havoc with the idea of inflation producing a Big-Bang-type of Universe that is flat, and that will expand indefinitely. As Fox casually remarked: "The dark matter problem affects the basics of the big bang model" (p. 124). It certainly does! John Gribbin confirmed such a position when he wrote that dark matter, "in a nutshell, is one of the biggest problems in cosmology today" (1981, pp. 315-316). Note the dates on these seemingly parallel statements. Interesting, is it not, that more than twenty years separate them, yet dark matter still "is one of the biggest problems in cosmology today"? [The reader may want to investigate the views of physicist Mordehai Milgrom of the Weizmann Institute of Science in Rehovot, Israel (see Milgrom, 2002). Dr. Milgrom has suggested that instead of opting for dark matter, cosmologists need to "re-tool the laws of physics," which he proposes to do via his concept known as Modified Newtonian Dynamics (MOND). Like American astronomer Halton Arp, Dr. Milgrom is viewed as somewhat of a heretic. In fact, "Dark-Matter Heretic" was the title of an article on the *American Scientist* Web site's "Science Observer" for January-February 2003 (see "Dark-Matter...").]

The fact is, the existence of dark matter is not merely a **theoretical prediction**, but rather a **necessary invention**—one that is required to fill the gaping holes in Big Bang cosmology and its cousin, inflationary theory (more about this shortly). Incredibly, **the hypothetical construct invented to *investigate* the theory has become the main support *for* the theory.** [As Berlinski put it: "The wish is father to the act" (1998, p. 31).] The importance of dark matter to evolutionary cosmology cannot be overstated. As Fox admitted: "Dropping dark matter out of their models would make it impossible for theorists to understand how a universe could get from the big bang to what it looks like today" (p. 124). Yes, it most definitely would, as Harnett went on to explain:

> These two issues [the existence of dark matter, and the microwave background radiation—BT/BH/BM] are fundamentally important to the evolutionary cosmologist. The missing dark matter in galaxies, galaxy clusters, and the whole universe, and the smoothness of the CMB radiation, create unassailable problems in the formation of stars and galaxies in the "early universe." ...The important questions left unanswered, of course, concern how stars and galaxies could have originated (2001, 15[1]:10).

On another front, an immense amount of time and energy has been expended in an attempt to determine the ultimate fate of the Universe. Will it collapse back on itself in a "Big Crunch," or will it simply continue expanding? Scientists have denoted the difference in these two—eventual contraction versus eternal expansion—as the Universe's "critical density." Simply put, if the mass density of the Universe itself is larger than the critical density, then gravity will prevail and the Universe allegedly will experience a Big Crunch. If the mass density of the Universe is lower than the critical density, then the Universe will expand forever, accelerating until it experiences a "Big Chill" (see Figure 6, p. 57).

A third option is supposed to exist, however, when the mass density of the Universe is exactly equal to the critical density. According to scientists, this would allow the expansion of the Universe to continue forever (even though the speed at which the Universe expands would decrease somewhat over time). To quote DeYoung:



Is the gravity associated with the galaxies (white spots) visible in this image strong enough to contain this glowing hot gas (pink)? This image, taken by the Röentgen Satellite (ROSAT), shows confined hot gas highlighted in an artificial color using x-ray light. Without dark matter, scientists are unable to explain why such galaxies and gases behave as they do. Image courtesy of NASA.

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Dark matter is also involved in the popular inflationary big bang model which predicts that the curvature of the universe must be flat. This means that the density of matter is exactly balanced between a universe which eventually collapses (a closed, finite universe), and one which expands forever (an open, infinite universe). The required critical density for a flat universe is about $10^{-26}$ g/cm$^3$. This corresponds to approximately 10 hydrogen atoms per cubic meter of space. Observed density estimates, although crude, lead to a value 10-100 times smaller than the critical density. Therefore, a great amount of dark matter is needed to result in a flat, closed universe with zero curvature (2000, 36: 180, parenthetical items in orig.).

In theory, scientists should be able to determine the fate of the Universe. In practical terms, however, there are major problems. One of the most important, as Dr. DeYoung has pointed out, is that there simply is not enough "ordinary" (observable) matter in the Universe to account for the observed gravitational forces that are holding galaxies together. Nor is there enough ordinary matter to ensure the "zero curvature" required by the inflationary concept (discussed in detail below) to guarantee the continued expansion of the Universe. Thus, in an attempt to salvage their naturalistic theories of the origin of the Universe, scientists simply invented dark matter. We say "invented" because dark matter is something that has been neither seen nor measured. As one scientist put it:

> So, cold dark matter is an unknown, unseen substance that is, nonetheless, essential to the process of self-creation. ...Unfortunately, 90-99% of this matter is missing from the Universe. At this point, the Big Bang starts to bear striking similarities to the fable of the emperor's invisible new clothes (Major, 1991, 11:23).

This is hardly an overstatement. An experimental report by French astronomers, Crézé, et al., in *Astronomy and Astrophysics* (1998), concluded that there is **no dark matter in the disk of the Milky Way Galaxy**. In commenting on the research, Alexander Hellemans wrote in *Science* shortly before the report by Crézé and his coworkers was published:

> By studying the movement of stars in the disk of our Milky Way galaxy, two teams of French astronomers have concluded that **what you see is what you get: The mass of the visible stars appears to account for all the material in the galactic disk**. These findings, derived from data gathered by the European astrometric satellite Hipparcos, imply that **the main body of our galaxy contains no "dark matter"**—invisible material that astronomers believe accounts for up to 90% of the mass of the universe (1997, 278:1230, emp. added).

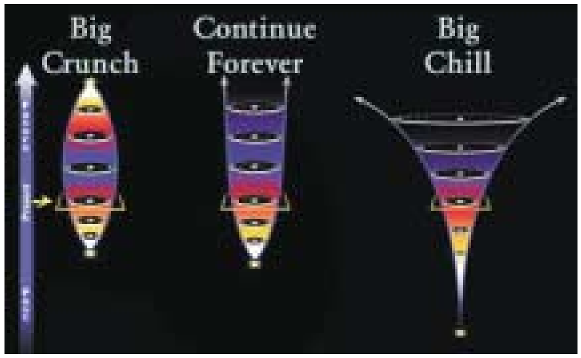


Figure — 6 Three models depicting the possible fate of the Universe from an evolutionary viewpoint. (1) In an expanding Universe, the combined gravity from the matter slows expansion. If the pull is strong enough, the expansion will stop and reverse itself, resulting in a "Big Crunch." (2) If the gravitational forces equal the expansion forces, then the Universe theoretically will continue forever (even though expansion slows down over time). (3) If gravitational forces are not strong enough, and are overcome by expansion forces, then the Universe supposedly will continue to expand, eventually ending in a "Big Chill."

Dr. Crézé and his colleagues analyzed the motion of stars perpendicular to the galactic disk in a sphere of radius 125 parsecs around the Sun. By analyzing the distribution of motion for 100 stars, the team was able to analyze the gravitational pull dragging them back toward the galactic disk. Why is this type of research important? *Nature* staff writer Brumfiel explained when he wrote in regard to dark matter:

> **The key to understanding it lies in its effects on stars and galaxies**. According to general relativity, all mass distorts the space around it. When light from distant objects passes close to dark matter, it should be bent—a process called gravitational lensing.... Cosmologists also know a little about how dark matter interacts with other matter. The faster a particle moves, the more energy it transfers to any particles that it collides with. If, during the early Universe, dark matter was moving at close to the speed of light, it would have left its mark on the process by which matter clumped together to form stars and galaxies. **But astronomers can watch star and galaxy formation occurring in very distant parts of the Universe, and so far they have not seen any evidence of the influence of fast-moving dark matter** (2003, 422:109-110, emp. added).

The experimental research of Crézé, et al., agrees perfectly with Brumfiel's assessment—since the French team found **no evidence of fast-moving dark matter in the Milky Way Galaxy**.

Some might criticize the research of Crézé's team as being too small a sample in too small of a volume. Such criticism is muted, however, in a Ph.D. dissertation by Honc-Anh Pham of the Paris Observatory. She analyzed the motion of **10,000 stars** in the Milky Way disk (as opposed to Crézé's **100**). Pham's research produced a result similar to that of Crézé, et al. As Pham remarked: "These studies confirm that the **dark matter** [presumed to be] associated with the galactic disc **in fact doesn't exis**t" (as quoted in Hellemans, 278:1230, emp. added).

One implication of this research could be that the Milky Way Galaxy is much younger than evolutionary astronomers believe. If our galaxy were representative of other galaxies, then it also would imply a much younger Universe as a whole. Have such astronomers abandoned the dark matter hypothesis and deduced a much younger Universe? Hardly! Instead, they have merely argued that the dark matter must be lurking in the **halo** of the Milky Way, rather than in the **disk**. The galactic halo is a large, spherical area that encircles the galaxy, and contains such things as dust, gas, and globular clusters. However, other scientists have debunked the idea that dark matter resides in the halo, and have concluded that the "dark chunks" previously reported in 1995 and 1996 (see Glanz, 1996) are very likely nothing but dim stars in the Magellanic Clouds (see Glanz, 1998, 281:332-333). Nathalie Palanque-Delabrouille of the Centre d'Études de Saclay in France concluded: "A halo interpretation of the other candidates becomes dubious" (as quoted in Glanz, 281: 333). James Glanz, in reporting on this for *Science*, wrote: "One of astronomy's great mysteries, it seems, is still unsolved.... That's bad news for astronomers, who thought they finally had an answer to the puzzle of what could be holding galaxies together" (281:332,333).

The "other" bad news is—**that's not all the bad news!** Read on.

## DARK ENERGY

As we noted previously, the concept of the Universe's expansion is critical to the Big Bang Theory and its cosmological cousin, Inflationary Theory. David Cline, in his March 2003 article on dark matter for *Scientific American*, noted: "Dark energy, despite its confusingly similar name [to dark matter—BT/BH/BM], is a separate substance that entered the picture only in 1998. It is spread uniformly through space,

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exerts a negative pressure and causes the expansion of the universe to accelerate" (288[3]:52). Geoff Brumfiel, writing in the March 13, 2003 issue of *Nature* about scientists' efforts to figure out **why** the Universe is expanding, observed that certain scientists have made

> an extraordinary suggestion: that the expansion of the Universe is accelerating, **pushed outwards by some kind of phantom force for which there was no explanation. This phenomenon of dark energy seemed odd**. But according to the general theory of relativity, mass and energy are equivalent. And when cosmologists looked at the amount of energy they needed to create the mysterious force, they found that it accounted perfectly for the mass still missing from their picture (422:109, emp. added).

Thus was born the idea of "dark energy." In the June 25, 2001 issue of *Time*, staff writer Michael Lemonick authored an article titled "The End," in which he commented: "...[A]strophysicists can be pretty sure they have assembled the full parts list for the cosmos at last: 5% ordinary matter, 35% exotic dark matter and about 60% dark energy" (157[25]:55). Astrophysicist John Barrow (co-author with Frank Tipler of the 1986 classic, *The Anthropic Cosmological Principle*) has suggested that the force of this dark energy is alleged to be "fifty per cent more than that of all the ordinary matter in the Universe" (2000, p. 191). That "dark energy" is the "phantom force" of which Brumfiel spoke. Or as science writer Paul Preuss remarked, it is an "an unknown form of energy often called the cosmological constant" (see Preuss, 2000).

Ah, yes—the famed "cosmological constant." Albert Einstein was the first to introduce the concept of the so-called cosmological constant—which he designated by the Greek letter Lambda (Λ)—to represent this "phantom force" or "unknown form of energy." It is—to be quite blunt—nothing more than a "fudge factor" set in place to make modern cosmology possible.

But this is no ordinary fudge factor. It happens to be, as Barrow correctly noted, "the smallest number ever encountered in science." And, as he went on to observe, the value of lambda

> is bizarre: roughly $10^{-120}$—that is, 1 divided by 10 followed by 119 zeros! This is the smallest number ever encountered in science. Why is it not zero? How can the minimum level be tuned so precisely? If it were 10 followed by just 117 zeros, then the galaxies could not form. **Extraordinary fine-tuning is needed to explain such extreme numbers**.... Why is its final state so close to the zero line? How does it "know" where to end up when the scalar field starts rolling downhill in its landscape? **Nobody knows the answers to these questions**. They are the greatest unsolved problems in gravitation physics and astronomy.... The only consolation is that, **if these observations are correct, there is now a very special value of lambda to try to explain** (pp. 259,260-261, emp. added).

A "very special value" indeed! Why is it so vanishingly small? Efstathiou, et al., writing on "The Cosmological Constant and Cold Dark Matter" in *Nature*, lamented:

> The cosmological term is a potential correction to the gravitational interaction. **If present at all, the cosmological term is incredibly small**: Its cumulative effects would show up only at the very largest length scales. However, **there is no compelling understanding of *why* the term is small** (1990, 348:705-707, emp. and italics added).

*Nature's* Brumfiel admitted:

> Dark energy is a more vexing problem, but the solution could lie in the nature of empty space. According to quantum theory, particles and their antiparticle equivalents are continually being created and annihilated, even in a vacuum. Some researchers have speculated that this vacuum energy could be what is accelerating the Universe's expansion. **But theoretical predictions for vacuum energy are up to 120 orders of magnitude greater than the strength of dark energy seen today** (2003, 422:110, emp. added).

What?!—**120 orders of magnitude greater than the strength of dark energy *seen today***? That implies that we have "seen" dark energy "today." But we have not! Similar to dark matter, "dark energy" is another mysterious concept that has been fabricated because the "theory still isn't jibing perfectly with observation" (Fox, p. 143). "Isn't jibing perfectly" is yet another magnificent understatement, considering that just previously, Fox had this to say concerning the present situation:

> For one thing, when the math was done to find what the cosmological constant should be via theory, **it was $10^{120}$ (that's a 1 followed by 120 zeros) times bigger than what we actually witness**. A cosmological constant that large would mean that everything in the universe should be expanding so quickly that you would not be able to see beyond the end of your nose (p. 143, parenthetical item in orig., emp. added).

What did Fox say—a 1 followed by 120 zeros? In the normal realm of science, that sort of error would be nothing short of catastrophic. No, on second thought, it would not even be scientific. Nobel Laureate Steven Weinberg, in his book *The First Three Minutes*, commented on this horrendous figure and its potential acceptance: "If we were to take this calculation seriously, it would undoubtedly be the most impressive quantitative disagreement between theory and experiment in the history of science!" (1977, p. 186). Or, to quote cosmologist Michael Turner: "Those models raise more questions than they answer. We've flushed out the basic features of the Universe. What we need now is a good story" (as quoted in Brumfiel, 422:110). "A good story" is exactly the foundation on which evolutionary cosmology has been constructed. It appears that Mark Twain was correct when he wrote in *Life on the Mississippi*: "There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact" (1883, p. 156).

Gravitational forces and the known laws of physics are not enough to explain the behavior of certain components within the Cosmos, such as these two spiral galaxies that were caught by the Hubble Space Telescope in a near collision. While evolutionary theories require immense amounts of dark matter and dark energy in order to explain the behavior of the Universe, both remain strictly theoretical concepts, since neither has been observed. Image courtesy of NASA.

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## CAN INFLATIONARY THEORY SAVE THE BIG BANG?

In the February 2001 issue of *Scientific American*, Philip and Phylis Morrison authored an article titled "The Big Bang: Wit or Wisdom?," in which they remarked: "We no longer see a big bang as a direct solution" (284[2]:95). It's no wonder. As Andrei Linde also wrote in *Scientific American* (seven years earlier) about the supporting evidences for the Big Bang: "We found many to be highly suspicious" (1994, 271[5]:48).

Dr. Linde's comments caught no one by surprise—and drew no ire from his colleagues. In fact, long before he committed to print in such a prestigious science journal the Big Bang's obituary, cosmologists had known (though they were not thrilled at the thought of having to admit it publicly) that the Big Bang is, to use our earlier phrase, "scientifically brain dead."

But it was because of that very fact that so many evolutionists had been working so diligently to find some way to "tweak" the Big Bang model so as to possibly revive it. As Berlinski rightly remarked:

> Notwithstanding the investment made by the scientific community and the general public in contemporary cosmology, a suspicion lingers that matters do not sum up as they should. Cosmologists write as if they are quite certain of the Big Bang, yet, within the last decade, they have found it necessary to augment the standard view by means of various new theories. These schemes are meant to solve problems that cosmologists were never at pains to acknowledge, so that today they are somewhat in the position of a physician reporting both that his patient has not been ill and that he has been successfully revived (1998, p. 30).

Scientists are desperately searching for an answer that will allow them to continue to defend at least some form of the Big Bang Model. Berlinski went on to note:

> Almost all cosmologists have a favored scheme; when not advancing their own, they occupy themselves enumerating the deficiencies of the others.... **Having constructed an elaborate scientific orthodoxy, cosmologists have acquired a vested interest in its defense**.... Like Darwin's theory of evolution, Big Bang cosmology has undergone that curious social process in which a scientific theory has been promoted to a secular myth (pp. 31-32,33, 38, emp. added).

Enter inflationary theory—and the idea of (gulp!) a self-created Universe. In the past, it would have been practically impossible to find **any** reputable scientist who would have been willing to advocate a self-created Universe. To hold such a view would have been professional suicide. George Davis, a prominent physicist of the past generation, explained why when he wrote: "No material thing can create itself." Further, as Dr. Davis took pains to explain, such a statement "cannot be logically attacked on the basis of any knowledge available to us" (1958, p. 71). The Universe is the **created**, not the **Creator**. And until fairly recently, it seemed there could be no disagreement about that fact.

But, once again, "that was then; this is now." Because the standard Big Bang model is in such dire straits, and because the evidence is so conclusive that the Universe had some kind of beginning, evolutionists now are actually suggesting that **something came from nothing**—that is, **the Universe literally created itself from nothing**! Edward P. Tryon, professor of physics at the City University of New York, was one of the first to suggest such an outlandish hypothesis: "In 1973," he said, "**I proposed that our Universe had been created spontaneously from nothing**, as a result of established principles of physics. This proposal variously struck people as preposterous, enchanting, or both" (1984, 101:14-16, emp. added). This is the same Edward P. Tryon who went on record as stating: "Our universe is simply one of those things which happen from time to time" (1973, 246:397).

Three years **earlier**, as it turned out, physicist Alan Guth of MIT had published a paper titled "Inflationary Universe: A Possible Solution to the Horizon and Flatness Problems," in which he outlined the specifics of inflationary theory (see Guth, 1981). Three years **later**, the idea that the Universe had simply "popped into existence from nothing," took flight when, in the May 1984 issue of *Scientific American*, Guth teamed up with physicist Paul Steinhardt of Princeton to co-author an article titled "The Inflationary Universe," in which they suggested:

> From a historical point of view probably the most revolutionary aspect of the inflationary model is the notion that all the matter and energy in the observable universe may have emerged from almost nothing.... The inflationary model of the universe provides a possible mechanism by which the observed universe could have evolved from an infinitesimal region. **It is then tempting to go one step further and speculate that the entire universe evolved from literally nothing** (1984, 250:128, emp. added).

Therefore, even though principles of physics that "cannot be logically attacked on the basis of any knowledge available to us" precluded the creation of something out of nothing, suddenly, in an eleventh-hour effort to resurrect the comatose Big Bang Theory, it was suggested that indeed, the Universe simply had "created itself out of nothing." As physicist John Gribbin suggested (in an article he wrote for *New Scientist* titled "Cosmologists Move Beyond the Big Bang") two years after Guth and Steinhardt offered their proposal: "...new models are based on the concept that particles [of matter—BT/BH/BM] can be created out of nothing at all...under certain conditions" and that "...matter might suddenly appear in large quantities" (1986, 110 [1511]:30).

Naturally, such a proposal would seem—to use Dr. Tryon's word—"preposterous." Be that as it may, some in the evolutionary camp were ready and willing to defend it—practically from the day it was suggested. One such scientist was Victor Stenger, professor of physics at the University of Hawaii. A mere three years after Guth and Steinhardt had published their volley in *Scientific American*, Dr. Stenger authored an article titled "Was the Universe Created?," in which he said:

> ...the universe is probably the result of a random quantum fluctuation in a spaceless, timeless void.... So what had to happen to start the universe was the formation of an empty bubble of highly curved space-time. How did this bubble form? What *caused* it? Not everything requires a cause. It could have just happened spontaneously as one of the many linear combinations of universes that has the quantum numbers of the void.... Much is still in the speculative stage, and **I must admit that there are yet no empirical or observational tests that can be used to test the idea of an accidental origin** (1987, 7[3]:26-30, italics in orig., emp. added.).

Not surprisingly, such a concept has met with rather stiff opposition from certain quarters within the scientific establishment. For example, in the summer 1994 edition of the *Skeptical Inquirer*, Ralph Estling wrote a stinging rebuke of the idea that the Universe created itself out of nothing. In his curiously titled article, "The Scalp-Tinglin', Mind-Blowin', Eye-Poppin', Heart-Wrenchin', Stomach-Churnin', Foot-Stumpin', Great Big Doodley Science Show!!!," Estling wrote:

> The problem emerges in science when scientists leave the realm of science and enter that of philosophy and metaphysics, too often grandiose names for mere personal opinion, untrammeled by empirical evidence or logical analysis, and wearing the mask of deep wisdom.

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And so they conjure us an entire Cosmos, or myriads of cosmoses, suddenly, inexplicably, causelessly leaping into being out of—out of Nothing Whatsoever, for no reason at all, and thereafter expanding faster than light into more Nothing Whatsoever. And so cosmologists have given us Creation *ex nihilo*.... And at the instant of this Creation, they inform us, almost parenthetically, the universe possessed the interesting attributes of Infinite Temperature, Infinite Density, and Infinitesimal Volume, a rather gripping state of affairs, as well as something of a sudden and dramatic change from Nothing Whatsoever. They then intone equations and other ritual math ematical formulae and look upon it and pronounce it good.

I do not think that what these cosmologists, these quantum theorists, these universe-makers, are doing is science. I can't help feeling that universes are notoriously disinclined to spring into being, ready-made, out of nothing, even if Edward Tryon (ah, a name at last!) has written that "our universe is simply one of those things which happen from time to time...." Perhaps, although we have the word of many famous scientists for it, our universe is **not** simply one of those things that happen from time to time (18[4]:430, parenthetical item in orig., emp. added).

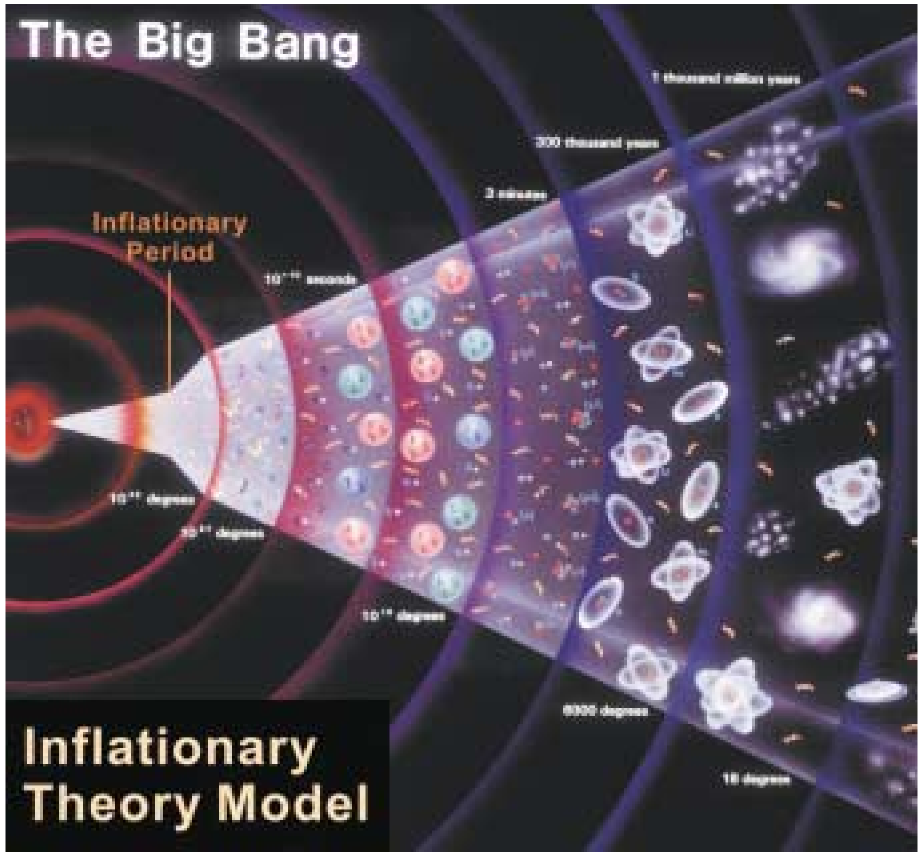


Figure 7 — Artist's depiction of the Big Bang Inflationary Model. Image courtesy of CERN.

Estling's statements set off a wave of controversy, as was evident from subsequent letters to the *Skeptical Inquirer*. In the January/February 1995 edition of that journal, numerous letters were published, discussing Estling's article. Estling's response to his critics was published as well, and included the following observations:

All things begin with speculation, science not excluded. But if no empirical evidence is eventually forthcoming, or can be forthcoming, all speculation is barren.... **There is no evidence, so far, that the entire universe, observable and unobservable, emerged from a state of absolute Nothingness.** Quantum cosmologists insist both on this absolute Nothingness and on endowing it with various qualities and characteristics: this particular Nothingness possesses virtual quanta seething in a false vacuum. Quanta, virtual or actual, false or true, are not Nothing, they are definitely Something, although we may argue over what exactly. For one thing, quanta are entities having energy, a vacuum has energy and moreover, extension, i.e., it is something into which other things, such as universes, can be put, i.e., we cannot have our absolute Nothingness and eat it too. If we have quanta and a vacuum as given, we in fact have a pre-existent state of existence that either pre-existed timelessly or brought itself into existence from absolute Nothingness (no quanta, no vacuum, no pre-existing initial conditions) at some precise moment in time; it creates this time, along with the space, matter, and energy, which we call the universe.... I've had correspondence with Paul Davies [a British astronomer who has championed the idea that the Universe created itself from nothing —BT/BH/BM] on cosmological theory, in the course of which, I asked him what he meant by "Nothing." He wrote back that he had asked Alexander Vilenkin what he meant by it and that Vilenkin had replied, "By Nothing I mean Nothing," which seemed pretty straightforward at the time, but these quantum cosmologists go on from there to tell us what their particular breed of Nothing consists of. I pointed this out to Davies, who replied that these things are very complicated. I'm willing to admit the truth of that statement, but I think **it does not solve the problem** (1995, 19[1]:69-70, emp. added).

This is an interesting turn of events. Evolutionists like Tryon, Stenger, Guth, and Steinhardt insist that this marvelously intricate Universe is "simply one of those things which happen from time to time" as the result of a "random quantum fluctuation in a spaceless, timeless void" that caused matter to evolve from "literally nothing." Such a suggestion, of course, would seem to be a clear violation of the first law of thermodynamics, which states that neither matter nor energy may be created or destroyed in nature. Berlinski acknowledged this when he wrote:

Hot Big Bang cosmology appears to be in violation of the first law of thermodynamics. The global energy needed to run the universe has come from nowhere, and to nowhere it apparently goes as the universe loses energy by cooling itself.

This contravention of thermodynamics expresses, in physical form, a general philosophical anxiety. Having brought space and time into existence, along with everything else, the Big Bang itself remains outside any causal scheme (1998, p. 37).

But, as one might expect, supporters of inflation have come up with a response to that complaint, too. In discussing the Big Bang, Linde wrote in *Scientific American*:

In its standard form, the big bang theory maintains that the universe was born about 15 billion years ago from a cosmological singularity—a state in which the temperature and density are infinitely high. Of course, one cannot really speak in physical terms about these quantities as being infinite. **One usually assumes that the current laws of physics did not apply then** (1994, 271[5]:48).

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Linde is not the only one willing to acknowledge what the essence of Big-Bang-type scenarios does to the basic laws of physics. Astronomer Joseph Silk wrote:

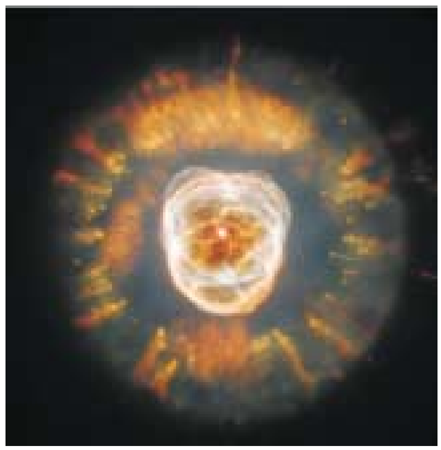
> The universe began at time zero in a state of infinite density. Of course, the phrase "a state of infinite density" is completely unacceptable as a physical description of the universe.... **An infinitely dense universe [is] where the laws of physics, and even space and time, break down** (as quoted in Berlinski, 1998, p. 36).

But there are other equally serious problems as well. According to Guth, Steinhardt, Linde, and other evolutionary cosmologists, before the inflationary Big Bang, there was—well, **nothing**. Berlinski concluded: "But really the question of how the show started answers itself: before the Big Bang there was nothing" (p. 30). Or, as Terry Pratchett wrote in *Lords and Ladies*: "The current state of knowledge can be summarized thus: In the beginning, there was nothing, which exploded" (1994, p. 7). Think about that for just a moment. Berlinski did, and then wrote:

> The creation of the universe remains unexplained by any force, field, power, potency, influence, or instrumentality known to physics—or to man. **The whole vast imposing structure organizes itself from absolutely nothing. This is not simply difficult to grasp. It is incomprehensible**.
>
> Physicists, no less than anyone else, are uneasy with the idea that the universe simply popped into existence, with space and time "suddenly switching themselves on." The image of a light switch comes from Paul Davies, who uses it to express a miracle without quite recognizing that it embodies a contradiction. **A universe that has suddenly switched itself on has accomplished something within time; and yet the Big Bang is supposed to have brought space and time into existence**.
>
> Having entered a dark logical defile, physicists often find it difficult to withdraw. Thus, Alan Guth writes in pleased astonishment that the universe really did arise from "essentially...nothing at all": "as it happens, a false vacuum patch" "[$10^{-26}$] centimeters in diameter" and "[$10^{-32}$] solar masses." **It would appear, then, that "essentially nothing" has both spatial extension and mass. While these facts may strike Guth as inconspicuous, others may suspect that nothingness, like death, is not a matter that admits of degrees** (p. 37, emp. added).

In their more unguarded moments, evolutionary theorists admit as much. Writing in *Astronomy* magazine on "Planting Primordial Seeds," Rocky Kolb suggested: "In a very real sense, quantum fluctuations would be the origin of everything we see in the universe." Yet just one sentence prior to that, he admitted: "...**[A] region of seemingly empty space is not really empty, but is a seething froth** in which every sort of fundamental particle pops in and out of empty space before annihilating with its antiparticle and disappearing" (1998, 26[2]:42,43, emp. added).

Ultimately, the Guth/Steinhardt inflationary model was shown to be incorrect (see Guth and Weinberg, 1983), and a newer version was suggested. Working independently, Russian-American physicist Andrei Linde, and American physicists Andreas Albrecht and Paul Steinhardt, developed the "new inflationary model" (see Hawking, 1988, pp. 131-132; Linde, 1994, 271[5]:51).



This image, nicknamed the Eskimo Nebula because of the "parka" surrounding the dying star, was captured by the Hubble Telescope in December 1999 after it was repaired. Image courtesy of NASA.

However, this model also was shown to be incorrect, and was discarded. Renowned British astrophysicist Stephen W. Hawking put the matter in proper perspective when he wrote:

> The new inflationary model was a good attempt to explain why the universe is the way it is.... In my personal opinion, **the new inflationary model is now dead as a scientific theory**, although a lot of people do not seem to have heard of its demise and are still writing papers on it as if it were viable (1988, p. 132, emp. added).

Later, Linde suggested numerous modifications, and is credited with producing what became known as the "chaotic inflationary model" (see Hawking, pp. 132ff.). Dr. Hawking also performed additional work on this particular model. However, in an interview on June 8, 1994, dealing with inflationary models, Alan Guth conceded:

> First of all, I will say that at the purely technical level, inflation itself does not explain how the universe arose from nothing.... Inflation itself takes a very small universe and produces from it a very big universe. But inflation by itself does not explain where that very small universe came from (as quoted in Heeren, 1995, p. 148).

After the chaotic inflationary model, came the eternal inflationary model, which was set forth by Linde in 1986. As Barrow summarized it in *The Book of Nothing*:

> The spectacular effect of this is to make inflation self-reproducing. Every inflating region gives rise to other subregions which inflate and then in turn do the same. The process appears unstoppable—eternal. No reason has been found why it should ever end. Nor is it known if it needs to have a beginning. As with the process of chaotic inflation, every bout of inflation can produce a large region with very different properties. Some regions may inflate a lot, some only a little; some may have many large dimensions of space, some only three; some may contain four forces of Nature that we see, others may have fewer. The overall effect is to provide a physical mechanism by which to realize all, or at least almost all, possibilities somewhere within a single universe.
>
> These speculative possibilities show some of the unending richness of the physicists' conception of the vacuum. It is the basis of our most successful theory of the Universe and why it has the properties that it does. Vacuums can change; vacuums can fluctuate; vacuums can have strange symmetries, strange geographies, strange histories. More and more of the remarkable features of the Universe we observe seem to be reflections of the properties of the vacuum (2000, pp. 256,271).

Michael J. Murray discussed the idea of the origin of the Universe via the Big Bang inflationary model.

> According to the vacuum fluctuation models, our universe, along with these other universes, were generated by quantum fluctuations in a preexisting superspace. Imaginatively, one can think of this preexisting superspace as an infinitely extending ocean of soap, and each universe generated out of this superspace as a soap bubble which spontaneously forms on the ocean (1999, pp. 59-60).

Magnificent claims, to be sure—yet little more than wishful thinking. For example, cosmologists speak of a special particle—known as an "inflaton"—that is supposed to have provided the vacuum with its initial energy. Yet as scientists acknowledge, "...the particle that might have provided the vacuum energy density is still un-

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identified, even theoretically; it is sometimes called the inflaton because its sole purpose seems to be to have produced inflation" (see "The Inflationary Universe"). In an article on "Before the Big Bang" in the March 1999 issue of *Analog Science Fiction & Fact Magazine*, John Cramer wrote:

> The problem with all of this is that **the inflation scenario seems rather contrived and raises many unresolved questions**. Why is the universe created with the inflaton field displaced from equilibrium? Why is the displacement the same everywhere? What are the initial conditions that produce inflation? How can the inflationary phase be made to last long enough to produce our universe? Thus, **the inflation scenario which was invented to eliminate the contrived initial conditions of the Big Bang model apparently needs contrived initial conditions of its own** (1999, emp. added).

Cosmologist Michael Turner put it this way: "If inflation is the dynamite behind the Big Bang, we're still looking for the match" (as quoted in Overbye, 2001). Or, as journalist Dennis Overbye put it in an article titled "Before the Big Bang, There Was...What?" in the May 22, 2001 issue of *The New York Times*: "The only thing that all the experts agree on is that no idea works—yet" (2001). Barrow admitted somewhat sorrowfully: "So far, unfortunately, **the entire grand scheme of eternal inflation does not appear to be open to observational tests**" (2000, p. 256, emp. added). In his book, *The Accelerating Universe*, Mario Livio wrote in agreement:

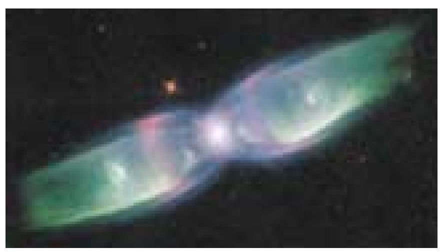
> If eternal inflation really describes the evolution of the universe, then the beginning may be entirely inaccessible to observational tests. The point is that even the original inflationary model, with a single inflation event, already had the property of erasing evidence from the preinflation epoch. **Eternal inflation appears to make any efforts to obtain information about the beginning, via observations in our own pocket universe, absolutely hopeless** (2000, pp. 180-181, emp. added).

Writing in the February 2001 issue of *Scientific American*, Philip and Phylis Morrison admitted:

> We simply do not know our cosmic origins; intriguing alternatives abound, but none yet compels. We do not know the details of inflation, nor what came before, nor the nature of the dark, unseen material, nor the nature of the repulsive forces that dilute gravity. The book of the cosmos is still open. Note carefully: **we no longer see a big bang as a direct solution. Inflation erases evidence of past space, time and matter.** The beginning—if any—is still unread (284[2]:95, emp. added).

But Dr. Barrow went even farther:

> As the implications of the quantum picture of matter were explored more fully, a further radically new consequence appears that was to impinge upon the concept of the vacuum. Werner Heisenberg showed that there were complementary pairs of attributes of things which could not be measured simultaneously with arbitrary precision, even with perfect instruments. This restriction on measurement became known as the Uncertainty Principle. One pair of complementary attributes limited by the Uncertainty Principle is the combination of position and momentum. Thus we cannot know at once where something is **and** how it is moving with arbitrary precision....
>
> The Uncertainty Principle and the quantum theory revolutionised our conception of the vacuum. **We can no longer sustain the simple idea that a vacuum is just an empty box**. If we could say that there were no particles in a box, that it was completely empty of all mass and energy, then we would have to violate the Uncertainty Principle because we would require perfect information about motion at every point and about the energy of the system at a given instant of time....
>
> This discovery at the heart of the quantum description of matter means that the concept of a vacuum must be somewhat realigned. **It is no longer to be associated with the idea of the void and of nothingness or empty space. Rather, it is merely the emptiest possible state in the sense of the state that possesses the lowest possible energy; the state from which no further energy can be removed** (2000, pp. 204, 205, first emp. in orig.; last emp. added).



Twin jet nebula as seen by the Hubble Space Telescope. Cosmic accident, or incredible design? Image courtesy of NASA.

The simple fact is, to quote R.C. Sproul, "Every **effect** must have a **cause**. That is true by definition.... It is impossible for something to create itself. The concept of self-creation is a contradiction in terms, a nonsense statement.... [S]elf-creation is irrational" (1992, p. 37, emp. in orig.).

Furthermore, science is based on observation, reproducibility, and empirical data. But when pressed for the empirical data that document the claim that the Universe created itself from nothing, evolutionists are forced to admit, as Dr. Stenger did, that "...there are yet no empirical or observational tests that can be used to test the idea...." Estling summarized the problem quite well when he stated: "There is no evidence, so far, that the entire universe, observable and unobservable, emerged from a state of absolute Nothingness." Agreed.

[to be continued]

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## SPEAKING SCHEDULES

**Dr. Bert Thompson**

| | | |
|---|---|---|
| July 11-13 | Clarksville, TN | (931) 647-7825 |
| July 25-27 | Calhoun City, MS | (800) 482-0157 |

**Dr. Brad Harrub**

| | | |
|---|---|---|
| June 2-4 | Galesville, AL | (205) 643-5629 |
| July 7-12 | Lake Tawakoni, TX | (903) 560-0288 |

**Dr. Dave Miller**

| | | |
|---|---|---|
| June 18 | Columbiana, AL | (205) 669-5506 |
| July 16 | Clanton, AL | (205) 755-5987 |

**Kyle Butt**

| | | |
|---|---|---|
| July 14-17 | Columbiana, AL | (205) 669-0244 |
| July 20-23 | Greenville, AL | (334) 546-0968 |

**Eric Lyons**

| | | |
|---|---|---|
| June 15 | Columbia, TN | (931) 388-5925 |
| June 25 | Columbiana, AL | (205) 669-4339 |

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# NOTE FROM THE EDITOR

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In January of 1981, Apologetics Press released the first issue of its then-new publication on Christian evidences, *Reason & Revelation*. Since that time, the journal has been published without interruption on a regular, monthly basis. Over the years, we have published within its pages numerous articles on various aspects of apologetics.

As a result, we now have in our files a repository of hundreds of articles covering more than two decades, and representing the fruit of years of research on a variety of topics. With the introduction of our Article Reprint Series, much of that research now is available once again.


Each reprint covers a subject in which our readers have repeatedly expressed a more-than-casual interest. A small sampling of some of the available topics includes: "Reaction to Big Bang Euphoria"; "The Grand Canyon and the Age of the Earth"; "Big Bang or Big Crunch?"; "Human and Chimp DNA—Proof of Evolution?"; "Neanderthal DNA Studies"; "Origin of Human Blood Types"; "Polystrate Fossils and Evolution"; "Scientists are Human, Too!"; "Frauds in Science"; "Did Darwin Repent?"; "The Anthropic Principle"; "The Demise of Mitochondrial Eve"; "Origin of Human Blood Types"; etc.

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In addition to the Article Reprints discussed above, we also have published in tract form many longer, feature articles from *Reason & Revelation* (containing too much information to be included in the Article Reprint Series). At the present time, there are over 70 titles available in our tract series, covering such topics as: the origin of races; the scientific case for creation; euthanasia; racism; the problem of evil, pain, and suffering; the creation/evolution controversy; human cloning; stem-cell research; fossil man; the dinosaur controversy; the methodology and limitations of science; extraterrestrial life; and numerous others. A complete listing can be found in our published catalog or at our online WebStore.

If we can assist you in any way with either of these services, please call on us. We would be happy to do so.

**Bert Thompson**

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