

tions, it shows the reasonableness of this classical model of the hydrogen atom. Inclusion of the change in the electric attraction force in that region would have lowered the spectral frequency. Instead of the radiation frequency being  $f = 8.78 \times 10^{14}$  Hz, it would have been somewhat lower. Recalling that the  $H_\alpha$  spectral frequency  $f_\alpha = 4.568 \times 10^{14}$  Hz it is reasonable to expect one of the fundamental modes of vibration to be lower than that obtained when the spacial variation in electric attraction was neglected.

This model of the hydrogen atom is a perfect radiator in the sense that it has no ohmic loss and has an extremely high Q. For an explanation of Q, see ref-

erence 1, page 61. This extreme efficiency assures sharp spectral lines and wave trains long enough to satisfy the phase coherence required in optical standing wave experiments. Much more work needs to be done before the precise configuration and force functions can be developed. It has, however, the potential for many modes of vibration within the hydrogen spectral range.

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## EDUCATIONAL COLUMN

### TEACHING ABOUT ORIGIN QUESTIONS: ORIGIN OF THE UNIVERSE

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#### Abstract

*In the first article in this series (CRSQ 21:115-19) the author stated a positive, scientifically objective alternative to the "conventional wisdom" of a mechanistic, materialistic origin of the universe and life on the earth, and an animalistic origin of human beings. He listed support data, and demonstrated the validity of Total Creationism and Total Evolutionism as contrasting viewpoints about origins: (1) the former a set of ideas based upon belief in Eternal, Personal Creator God Who created all things, (2) the latter a contrasting set of ideas based upon the belief that all things derived from some Eternal, Impersonal Matter-Energy condition. Further he contrasted inquiries about the present involving scientific hypotheses and theories, and inquiries about the past involving unnatural singularities and speculation about what "could have been" or what "might have happened." This article contains discussion of specific examples and illustrations of the above points as applied to teaching about the origin of the universe.*

#### Introduction

Total Creationism and Total Evolutionism are viewpoints about origins that involve belief in unnatural objects and/or events (singularities) that cannot possibly be submitted to scientific study. To protect the integrity of a pluralistic educational curriculum, both of these contrasting viewpoints about origins should be presented in the public schools to neutralize the current exclusive, monopolistic ideas of "evolutionary" origin of all things.

Of course professional scientists do not study the supernatural or the unnatural. Science, as a proper and orderly profession, entails specifically the direct and/or indirect, repeatable observation(s) of natural objects and/or events that occur or exist in the physical environment. Nevertheless professionally qualified scientists of the majority do present objective, scientific facts in support of Total Evolutionism; and, also, professionally qualified scientists of the minority do pre-

sent objective, scientific facts in support of Total Creationism, as listed in the December 1984 article in this series.

However, Total Evolutionism, as well as Total Creationism, relate to inquiries scientists make about the past, unnatural, non-repeatable aspects of life on the earth, about the solar system, and about the entire cosmos; such inquiries being quite different than inquiries scientists make about natural objects and/or events in the present. Because there is this discernable difference between inquiries in the present, and inquiries about the past, the purpose of this second part of the continuing series on "Teaching about Origin Questions" will be to show that limitations exist regarding any inquiries about the origin of the universe.

Importantly, in further introduction, is the very real problem in teaching about origin questions concerning the use of the term "hypothesis." In proper, orderly scientific work, a hypothesis must be testable, as numerous leading evolutionists have written repeatedly. Astronomers and astrophysicists quickly claim that they do formulate hypotheses about their natural environment.

But modern science teachers can state pointedly that no scientist has ever studied or been initially aware of any natural objects, first events, or prior conditions by which the universe supposedly came into existence. Astronomer Dr. Robert Jastrow has admitted this point

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repeatedly in various publications. Of course leading astronomers have propounded, and the prevailing majority of scientists have accepted at one time or another, certain basic thoughts relevant to the beginning of the universe, which are associated with "big bang," "steady-state," or "oscillating" concepts.

Nevertheless, with regard to creation/evolution discussions of the origin of the universe, clarity of understanding is gained if the modern science teacher insists that a hypothesis in proper, orderly science is testable, amenable to some direct or indirect study. Thus, one can only refer to a "Big Bang" *concept* as the most popular idea of scientists about the origin of the universe. No "scientific hypothesis" about some "big bang" is involved. Ideas of scientists about the origination and generation of the universe are *after the fact*. No prior study of a "big bang" explosion has ever occurred, nor will ever be possible according to present technology. (Some might still hope that a "time machine" will be invented.)

**Cosmology and Cosmogony Defined**

Because of the above situation, discussions of the origin of the universe should begin with the fact that all ideas of origination and generation of the universe must be recognized, necessarily, as part of *cosmogony*, and *not* directly involved with *cosmology*. Admittedly astronomers and astrophysicists currently want to include cosmogony "within" cosmology.

But this practice is quite regrettable with regard to rigor of communication and meaning; thus, the modern science teacher must demand *careful delineation* of the two terms, "cosmology" and "cosmogony." The very real distinction between cosmology and cosmogony is most instructive as a beginning point for discussion on the origin of the universe, since the distinction is a useful means of certifying specific limitations of scientists.

Today many astronomers and astrophysicists do not acknowledge rigorously the difference between cosmology and cosmogony. They do not abide by the fact that cosmogony *cannot* properly nor correctly be subsumed under cosmology. Noteworthy is the fact that cosmology is the *science* of the cosmos.

**Cosmology**

**The study of the nature of the structure of the universe; use of tools and technology to describe aspects of the observable and physical universe.**

By the very definition of the term, then, cosmology entails characteristic activities of scientists; i.e., astronomers, who study *natural* objects and/or events in space, as an extension of the natural environment on the surface of the earth. For instance, cosmologist-astronomers study the present brightness of stars, detect sequences of changes of stars and planets, and deduce the arrangement of the planets with respect to the sun (even though there is, as yet, no observational means for checking such deductions). In contrast cosmogony involves *ideas* scientists have about the beginning of the universe.

**Cosmogony**

**A list of ideas or formulations centered on origination and generation of the universe.**

Astronomers put forth numerous sets of cosmogonical

ideas about the origin of the universe; and, in turn, scientists have certain cosmogonical ideas about the origin or ultimate beginning of the solar system. But cosmogonical ideas about what "might have happened" before the present are always beyond the scope of proper, orderly scientific work.

The very significant difference, then, between cosmology and cosmogony is found in the fact that cosmologist-astronomers study what is *now presently seen*; whereas, the ideas of cosmogonist-astronomers center on presumed or imagined past events that might have occurred *before the present*. Even contentions about light coming from great distances (and hence related to some past events) do not significantly detract from the fact that the light is detected in the "present" of the lifetime of some astronomer.

To delineate further and enlarge upon the stated difference between cosmology and cosmogony, modern science teachers should show students explicitly: (1) how specific aspects of scientific activities in the *present* are utilized by astronomers, *as cosmologists*, and (2) how extensive speculation, imagination, and scenario formulations about the *past* are employed by astronomers, *as cosmogonists*. Brief attention to such actions of cosmologists, and then of cosmogonists, will be given in the following sections.

**Methods of Cosmologists**

Early on, then, the modern science teacher should illustrate limitations of scientists. Like all scientists, astronomers are restricted to studying aspects of the universe as they find them "present" during their lifetime. In their specialized approach to *natural* aspects of their environment scientists most commonly begin by stating a question, by formulating a problem, such as—for astronomers—what is the size of the universe?

With this question stated, a very valuable point can be made about *boundaries of measurement* within which cosmologist-astronomers must operate. This phase of preparation for clarification about cosmological studies can be accomplished by reference to the accompanying distance-scale pyramid (Figure 1).

Radar pulses and laser beam technique can be used—along with other points about velocity of light, orbits,

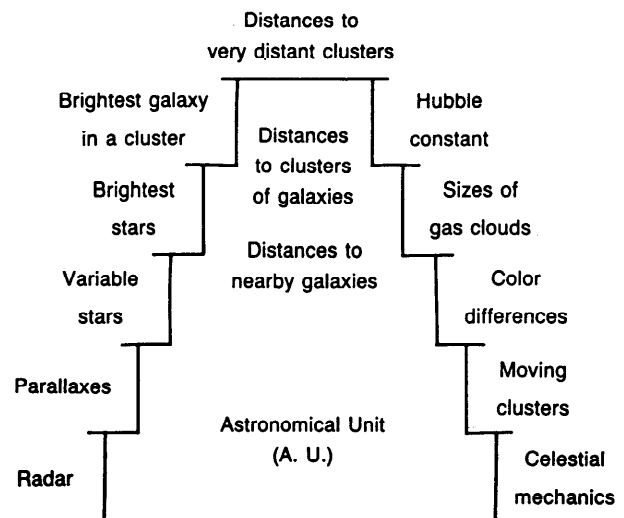


Figure 1. The Distance-Scale Pyramid.

size of planets, and gravitation—as part of celestial mechanics to gain good approximations of comparative distances of Mercury, Venus, Earth and Mars from the Sun.

Then the parallax principle can be used to calculate distances between the earth and a star as seen from different positions of the earth during a given year. By this trigonometric method the distance to some star can be measured to an accuracy of one percent out to a distance of 160 light years. (A light year is the distance light travels in one year at the speed of 186,000 miles per second.)

However, a word of caution is needed here. Modern science teachers should be ever alert to help students become aware of possible semantic confusion in the very words used by scientists as specialists, and even by non-specialists. Too, too often the word “measurement” is used carelessly. When a scientist measures a table top (length, width or thickness), some agreed upon range of probable error is necessarily involved. Dimensions on the earth can be measured, mainly, with very high degrees of accuracy (with very low probable error).

But scientists do not “measure” the size of the universe, and they do not “measure” the age of the universe. Nor do scientists “measure” the age of a rock. In each instance scientists are limited to stating *estimates*. Thus every opportunity should be taken to clarify possible confusion between the words “measurement” and “estimate.” Too, too often the word “measurement” is used by astronomers when the term “estimate” would be more accurate.

Actually the accuracy of distance estimation becomes worse and worse beyond the distance of 160 light years and the parallax principle *cannot* be used for further distances into space. What can be used?

Astronomers, as cosmologists, identify color differences of certain variable stars, size of gas clouds of the brightest stars, and comparisons of brightness in different clusters. Herein is exemplified the dependence of astronomers upon the *comparative method*. Comparative color, comparative brightness and/or intensity are all that astronomers can use. Therefore, *only vague estimates* are possible as astronomers strive to develop an answer to the problem, what is the size of the universe?

It is true that laser beams, radio telescopes, and x-ray detection devices are used in deriving further *estimates* of great distances in the universe. However, particularly important regarding limitations of astronomers, as cosmologists, is the fact that the distance-scale pyramid is mostly an array of vague estimates—involving, particularly, comparative *estimates of brightness*. Accuracy cannot be anything like that attained by radar measurements and parallax calculations.

#### Methods of Cosmologists

Modern science teachers should be intent upon clarifying subtle nuances of meaning regarding origin questions. Therefore modern science teachers must highlight the differences between cosmological studies accomplished more or less in accordance with proper limiting principles of science (i.e., observational, quantitative, mechanical, and correctable), and the tendency of “free-thinkers” after Galileo to move away from adherence to such limiting principles. This tendency to

move from careful cosmological *study* into cosmological *thinking* is fully characteristic of writers since Descartes and Kant to modern astronomers and astrophysicists, who discuss freely and openly their *ideas* on the beginning of the universe.

Thus in teaching about first origins the modern science teacher should very candidly point out that, from the time of Descartes and Kant, modern cosmologists have “invented” ideas that are *not* fully naturalistic, but substitutionally *unnaturalistic*. Cosmologists of the nineteenth century to the present repeatedly have utilized unnatural ideas about objects and/or events regarding their imagined origin of the universe.

For instance, Lemaitre imagined a primeval atom that came into existence *ex nihilo*, appearing suddenly out of nothing, that is, from no previously existing matter. Gamow imagined that an infinitely large structure of eternal existence evidently was the source of the universe. But these concepts *do not* involve naturally occurring objects and/or events of any magnitude known to scientists. Careful natural scientists deal with naturally occurring objects and/or events *in the present*. (Imaginative ideas typical of Descartes, Swendenborg, Kant, Buffon, Lemaitre, Gamov, Hoyle, Bondi, and Gold are summarized in Table I.)

Those cosmologists formulated a variety of cosmological schemes in contrast to the primary cosmological position of Copernicus, Kepler and Newton, held for centuries and centuries, that God was the Creator of heaven and earth and all therein. Those cosmologists went far beyond observationally grounded science of the cosmos (cosmology); and, in doing so, they relied heavily upon their imaginations to write *scenarios* about very *unnatural* objects and/or events of origination and generation and the universe as substitutions of the “traditional” cosmogony of Copernicus, Kepler and Newton.

#### Cosmologists Are Analogy Dependent

Furthermore cosmologists are very dependent upon an analogy between sound transmission and light transmission, presumably over great stretches of space from distant stars to the earth. Early in any serious discussion of creation/evolution ideas on the origin of the universe a careful analysis of the astronomers’ analogy between known, *measurable* sound transmission and interpreted, *deduced* light transmission should be made quite evident by the modern science teacher. See Figure 2. This important analogy between sound and light is basic to the concept of “red shift” of light, which in turn is one of the basic “arguments” raised regarding the question, Is the universe expanding?

In brief review, the Doppler effect as it applies to sound is noted when a train whistle, for example, seems higher as the train is approaching a listener and lower as the train passes on in the distance. A simple explanation of this observational phenomenon is that the wavelength of sound heard is affected by the velocity of the object from which the sound is emitted. Thus the approaching train seems to have a higher pitch because the wavelength of the sound is shorter, whereas a departing train seems to have a lower pitch because the wavelength of the sound is longer.

Similarly for light, the wavelength that is measured is also dependent upon the velocity of the object emitting the light. (Of course astronomers still accept Ein-

TABLE I. ON COSMOGONIES

Making plausible guesses as to the origin of the universe is evidently a challenging pastime. Given : (1) a generous supply of matter in a simple "undifferentiated" form, (2) the known laws of nature, and (3) infinite time, the object is to derive the present state of the physical world .

Primeval Atom "Hypothesis" (Lemaitre, 1927)	Big-Bang "Hypothesis" (Gamow, 1947)	Steady-State "Hypothesis" (Hoyle, 1948)
<ol style="list-style-type: none"> <li>1. Superatom of radius equal to earth's orbit.</li> <li>2. Explosive radioactive disintegration followed by:                             <ol style="list-style-type: none"> <li>1. rapid expansion.</li> <li>2. deceleration by gravitation.</li> <li>3. renewed expansion evidenced by red shift of distant galaxies.</li> </ol> </li> <li>3. During first and second stages, aggregations formed into planets and stars.</li> <li>4. Cosmic rays are really "fossil rays" of expansion.</li> <li>5. Primeval atom came into being <i>ex nihilo</i>; that is, appearing suddenly from no previously existing matter.</li> </ol>	<ol style="list-style-type: none"> <li>1. More sophisticated than one by Belgian Jesuit Lemaitre.</li> <li>2. Began with infinitely large structure that expanded to present state. (How did explosion propagate over infinite distance?)</li> <li>3. Primordial matter called "ylem" (i-lem) of <math>10^{14}</math> g/cm<sup>3</sup> density.</li> <li>4. First contraction phase yielded pre-ylem stage of density, then violent elastic rebound of catastrophic episode.</li> <li>5. Known atoms were synthesized from atoms in less than an hour in intense heat of explosion.</li> <li>6. Evidently expansion will continue indefinitely.</li> </ol>	<ol style="list-style-type: none"> <li>1. That is, continuous creation.</li> <li>2. Infinitely old, infinitely large universe is constantly expanding.</li> <li>3. New matter appears to replenish lost matter in space.</li> <li>4. Self-creating matter is hydrogen which condenses into galaxies within which evolve stars, planets, satellites, comets, plants, animals and people. (Mankind is condensation out of nothingness.)</li> <li>5. Hoyle said question about source of new matter is "meaningless and unprofitable" (or Hoyle does not know).</li> <li>6. After 17 years Hoyle abandoned his idea. (See <i>Nature</i>, 208:113, Oct. 9, 1965.)</li> </ol>

stein's idea that the velocity of light is absolute, and is not affected by the velocity of the source of light.) By means of a prism that separates light into a complete spectrum of wavelength, it is possible to analyze the light emitted by stars, galaxies and nebulae. From such data astronomers have calculated the velocity of stars, which seem to move only a few miles per second. However, many galaxies seem to be moving at very high velocities as detected through analysis of those light sources.

Characteristic of Doppler shifts of light of many galaxies is a shift in the spectrum lines that move systematically further and further toward the red end of the spectrum of light. This is called the "red shift."

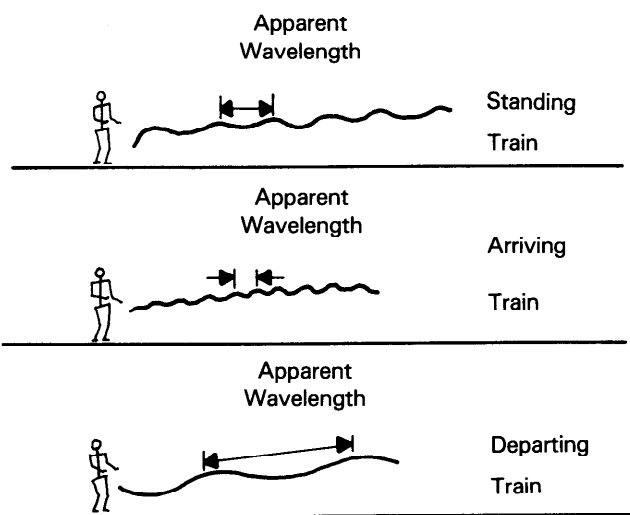


Figure 2. Representation of the Doppler Effect.

Since red has a long wavelength in contrast to blue, which has a short wavelength, astronomers *interpret*, analogously to sound transmission interpretations, that distant galaxies are moving away from the observer and the earth.

But the red shift is difficult to detect. There is significant controversy between astronomers, such as Arp and Bacall, regarding various anomalies in red shifts. Results are not consistent for light from certain stellar objects considered to be at the same distance or any varying distances from the earth.

A careful study of the Doppler effect with regard to sound is most instructive in building understanding of the Doppler shift in light upon which astronomers base so much of their thinking about the "big bang," expanding universe cosmogony. It is paramountly important that the modern science teacher make very explicit that this analogical reasoning is vital to—is at the heart of—modern cosmogonical thinking. Remove this analogy between sound transmission and light transmission from their thinking and modern cosmogonists would be without a most significant *circumstantial* support for their expanding universe idea. (See Table II on types of evidence.)

**Cosmogonies Are "Historical" Theories**

Cosmogonists, then, are dealing with "Historical" Theories. Yet not history involving human beings, but rather "historical" in the sense of *past*, imagined, conjectured, speculated events presumed to have been antecedent to the present universe. But "Historical" Theories are different than proper, orderly scientific theories (like the Atomic Theory or the Gene Theory) that involve testing of ideas about *natural* phenomena in the "present" lifetime of scientific inquiries. The tests that cosmogonist-astronomers employ, however,

**TABLE II. TWO SETS OF EVIDENCE**  
**Circumstantial Evidence for Big Bang Origin**  
**of the Universe**

1. Red shift of light spectra.
2. Occurrence of nova and supernovae.
3. Detection of background radiation and radio noise.

**Circumstantial Evidence for Creator Origin**  
**of the Universe**

1. Angular momentum in solar system, of universe.
2. Orderly patterns (designs) of constellations.
3. Orderly patterns (designs) of planetary motions, of comet motions.

are tests of the internal consistency and reasonableness of their ideas about *unnatural*, imagined phenomena in the past.

Is it reasonable that the present *order* of planetary orbits, star constellations, cycles of elements and cycles

of seasons came out of chaos, which would logically follow explosion of some presumed dense substance? Students can readily understand that patterns of buildings, automobiles, and even playground equipment are manifestations of intelligent designs of architects and engineers. Clearly the modern science teacher will be fully responsible to point out that the order, pattern and regularity of the present universe are consistent with the Design Argument for the existence of the Creator, the Ultimate Cause of all things in the heaven and on the earth.

Furthermore, "Historical" Theories are most properly labelled *models* of origin, and then an even clearer separation from proper, orderly scientific theories is possible. (See accompanying main points of Evolution Model and Creation Model with regard to the universe in Table III—each formulated to bring out the greatest contrasts in two positions.)

**TABLE III. ON THE ORIGIN OF THE UNIVERSE**

Because the primeval origins are completely beyond the limitations of scientific method, which is based upon initial observations, experimentation and repeatability, no one will ever be able to say, within present technology, a. "Scientists have proved that all things have evolved from a primeval common origin," or b. "Scientists have now proved the special creation of all things in the beginning." Therefore the question as to which *model* of origins is ultimately the better model of origins can never be fully resolved scientifically, and one of the two models of ultimate origins is accepted by an individual, eventually, *as a belief*, not by any scientific proof or historic proof.

In the chart below, certain features of origins are related to the two main possible models of origins; each formulated to bring out the greatest contrasts in the two positions.

Evolution Model (Evolution Cosmogony)	Creation Model (Creation Cosmogony)
<b>(a) Origin of the universe:</b>	
Eternal existence of some form of matter (no cause). 1. Big-bang concept: explosively expanding from primeval state of extremely high density. 2. Steady state concept: continual appearance of matter with simultaneous decay of matter, resulting in constancy. (Above violate law of conservation of matter and second law of thermodynamics and cause and effect assumption.)	Universe created essentially in present form (cause: Eternal Creator). 1. Light sources established. 2. Light rays, with electromagnetic fields, created directly and light sources seen instantly. 3. Whole universe created full grown and functioning perfectly with unique fitness of earth for life quite evident. (No observed facts of scientists can be used to contradict above ideas.)
<b>(b) Origin of elements:</b>	
Nucleogenesis of subnuclear and subatomic particles involving hydrogen initially leading to ascending series of elements. (No mention of initiating energy source.)	Creator was source of cosmic nucleosynthesis which He empowered.
<b>(c) Origin of stars, galaxies:</b>	
Stellar and galactic evolution in some kind of evolutionary series based on assumption of what "must have happened": "young" to "old."	Essentially stable, completed (finished) creation with concurrent principle of disintegration consistent with all astronomic measurements since man began to make such observations.
<b>(d) Origin of solar system:</b>	
Nebular, tidal, dust cloud, collision, and close encounter concepts have been proposed but no evolutionary theory can be used to explain these peculiarities: anomalous distribution of moons, differing chemical compositions, geometrical placement, and the unique atmosphere and hydrosphere of the earth. —Processes of cosmos supposedly processes of origination and integration.	Primeval perfect, complete, functioning earth, moon, and planets created simultaneously; followed by imposed principle of disintegration with great catastrophes (asteroids, comets, bombardments of moon and Mars, etc.) —Processes of cosmos observed to be processes of conservation and degeneration or decay.

Now the majority of scientists resist making a separation, or distinction, between models or ideas of origin and proper, orderly scientific theories. No doubt resistance to such a delineation centers in the conscious or unconscious realization by cosmogonists that they do not want their scientific specialist colleagues, or non-specialist citizens, to appreciate the difference. Cosmogonists no doubt would like their ideas on origination and generation of the universe to *appear* as scientific as the broad conceptualizations of the Kinetic-Molecular Theory or the Atomic Theory.

And of some significance regarding public reporting of cosmogonical ideas is the fact that cosmogonists write their ideas of origination and generation of the universe or parts thereof in terms of *scenarios!* Evidently, to make cosmogonical ideas attractive to persons of all degrees of scientific training, authors of such ideas draw up "scenarios" (a type of play) of moon origin, say, or origin of Mars. Such scenarios appear even in the most prestigious scientific journals!! So it is very important that students understand that cosmogonists are authors of play-like scenarios, which are significantly different than proper, orderly scientific theories regarding the nature and structure of matter that are generated by physicists and chemists.

### Evidence and "The Beginning"

Is cosmogony only speculation, imagination and conjecture? No! Cosmogonists "build" upon certain empirical findings accumulated by cosmologists, *after the fact* of the beginning of the universe, which can be employed to support circumstantially the "big bang," expanding universe cosmogony.

Cosmogonists *do* utilize certain conditions of the present as a basis for extrapolations backward into time. But cosmogonists are limited to beginning with *circumstances of the present*, and they are totally unable to test scientifically, through any repeatable observations, how these circumstances actually came into existence. No one knows the initial conditions of the universe.

The modern science teacher should help students realize that cosmogonists do have some *circumstantial* evidence in support of their commonly adopted ideas. But the evidence is *only* circumstantial.

And each one of the points of circumstantial evidence may be used to support the contention that some

*beginning* of the universe is required. Students can grasp that nontheistic cosmogonists "begin" the universe with the "big bang" concept, which is so popular today. Conversely, theistic cosmogonists, as did many "founders" of modern physical science, maintain that "In the beginning" the universe was created essentially in the present form.

No evident cause is given by nontheistic cosmogonists. Apparently proponents of evolutionary cosmogonies consider that some inherent propensity for organization into a dense particle preliminary to explosion was characteristic of Eternal Matter. A logical question is, What caused the formation of that dense substance? But just at this point nontheistic cosmogonists ignore the "cause and effect" assumption so basic to all scientific thought. Apparently nontheistic cosmogonists ignore excellent circumstantial evidence given in Table II in support of the Creator origin of the universe.

The theistic cosmogonist accepts Eternal God, Who has existed outside of time and space, as the Ultimate Cause of the heaven and the earth, and all that is therein. Thus the theistic cosmogonist goes one step beyond the nontheistic cosmogonist as far as cause and effect is concerned. Yet even the theistic cosmogonist must have a "given": the Creator, the Eternal One—the original cause of it all. And belief in the Eternal, Personal Creator was commonly characteristic of those early scientists (i.e., Copernicus, Brahe, Kepler, Newton) who began the discipline of modern science. Modern theistic cosmogonists are standing with those early scientists in contrast to the majority of nontheistic evolutionary cosmogonists.

Logically the modern science teacher will want to explicate further aspects of cosmogonical *thinking* that need careful attention. Therefore the science teacher should raise such questions as: What is the universe expanding from? Where is the center of the universe? What caused the proposed expansion after the supposed "big bang" explosion? These questions, of course, cannot be answered scientifically within the present technology. However discussion of such interrogations will help students comprehend more fully the distinction possible between *scientific* questions, and what are essentially metaphysical questions about first origins, which are fundamentally outside the purview of proper, orderly scientific work.

## PANORAMA OF SCIENCE

### Meteor Crater Has Its Youth Restored (to some Extent)

On the cover of *Nature* for 19 April 1984, was a picture of Meteor Crater, Arizona; and the caption stated that the crater was about 50 million years old. Shortly thereafter, a letter took issue with this estimate, and maintained, on the basis of thermoluminescence, that the crater is about 50 thousand years old.<sup>1</sup>

Here is a reduction by a factor of one thousand. But many Creationists will believe that the proposed 50 thousand years is still much inflated. The letter mentions ". . . two major pluvial episodes of Pleistocene age . . ." as indicated by patterns of erosion. Might these not indicate something which happened during

the Flood, the crater itself having been formed before or during the Flood?

The thermoluminescence, on which the estimate of age was formed, is supposed to have accumulated slowly after the crater was made, from natural radioactivity. Is it not possible, however, that the meteorite (if such it was) brought in extra radioactivity, which speeded up the accumulation of thermoluminescence, but which has by now disappeared?

Here is another matter which may be worth some investigation by Creationists.

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Suggested by William I. Thompson III