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Science & Mormonism Series 1: Cosmos, Earth, and Man

Chapter Title: The Scale of Creation in Space and Time

Chapter Author: John S. Lewis

This book from which this chapter is excerpted is available through Eborn Books:

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Recommended Citation

John S. Lewis, "The Scale of Creation in Space and Time" in *Science & Mormonism Series 1: Cosmos, Earth, and Man*, edited by David H. Bailey, Jeffrey M. Bradshaw, John S. Lewis, Gregory L. Smith, and Michael R. Stark (Orem, UT, and Salt Lake City: The Interpreter Foundation and Eborn Books, 2016), <https://interpreterfoundation.org/reprints/science-and-mormonism/SM1Chap08.pdf>.

SCIENCE & MORMONISM SERIES 1

COSMOS, EARTH, AND MAN

DAVID H. BAILEY, JEFFREY M. BRADSHAW, JOHN S. LEWIS,
GREGORY L. SMITH, AND MICHAEL R. STARK



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David H. Bailey, Jeffrey M. Bradshaw, John S. Lewis,
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The Interpreter Foundation
Eborn Books

2016

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Published by:

The Interpreter Foundation

Orem, UT

MormonInterpreter.com

and

Eborn Books

254 S. Main Street

Salt Lake City, UT 84101

EbornBooks.com

Cover artwork by Kelsey Fairbanks Avery.

Science and Mormonism 1: Cosmos, Earth, and Man / David H. Bailey, Jeffrey M. Bradshaw, John S. Lewis, Gregory L. Smith, and Michael R. Stark (eds.) — 1st edition

Includes bibliographical references.

ISBN-13: 978-1-89071-84-11 (Hardbound), 978-1-89071-84-28 (Softbound)

THE SCALE OF CREATION IN SPACE AND TIME

John S. Lewis

The accounts of creation in Genesis, Moses, and Abraham as well as in higher endowments of knowledge given to the faithful are based on visions in which the seer lacked the vocabulary to describe and the knowledge to interpret what he saw and hence was obliged to record his experiences in the imprecise language available to him. Modern attempts to explain accounts of these visions frequently make use of concepts and terminology that are completely at odds with the understanding of ancient peoples: they project anachronistic concepts that the original seer would not have recognized. This chapter reviews several aspects of the creation stories in scripture for the purpose of distinguishing anachronistic modern reinterpretations from the content of the original vision.

The Extent of Creation

Genesis is often read as a description of the origin of the Universe rather than the Earth. But ancient views of the cosmos had no concept of anything remotely similar to our modern sense of the word “Universe.” In the ancient world the general concept was that Earth was the center of creation. The heavens were the night sky as seen by the naked eye from Earth’s surface, tacitly assuming it to be a local and Earth-fixed phenomenon. The cosmos so imagined by most philosophers may have been mere thousands of kilometers in diameter, although Archimedes suggested a size of about two light years.

The cosmos (Greek: *ὁ κόσμος*; “order”) was an intimate spherical volume centered on Earth and containing the Sun, Moon, and known planets (Mercury, Venus, Mars, Jupiter, and Saturn). These seven bodies were generally pictured as much smaller than Earth and very close. They were all assumed to travel around Earth, which was fixed and immobile at the center of the Kosmos. This set of seven *wandering* heavenly bodies, collectively called “planets” (Greek: *οἱ πλάνητες ἀστέρες*; “wandering stars”) was regarded as complete and final, since seven was a mystical



Figure 1: *Birth of a Solar System*

number symbolic of perfection. Similarly, $3\frac{1}{2}$ was regarded as a broken number symbolic of disaster, as in Revelation. In Latin, each such planet was referred to as *stella errans*, “wandering star,” or “unruly star,” with no concept that Earth and the planets were bodies of similar nature. The earth (lower case) was literally the ground on which we stood, in classical thought the sole fixed base in all creation. Earth (capitalized) is a modern concept that recognizes our planet as yet another member of a family of related bodies, a fellow-wanderer in the Sun’s family, not the center of all creation. It embodies the Copernican notion of Earth as an eighth wanderer.

The seven planets of antiquity wandered in complex and largely unpredictable (unruly; rule-less) patterns across the sky. There was no room for planetary satellites (moons), asteroids, etc. Meteors, comets, or meteorites in this conception must not be real material bodies, but signs sent by God. Further, the seven heavenly bodies must be perfect, featureless celestial spheres, not composed of gross matter. It was implicit that the creation of this tiny Earth-centered cosmos was a single creative event or episode. Our present understanding of the vastness of the Universe is a product of twentieth century astronomical research, completely alien to the ancient mind. Indeed, the Universe as now understood is vastly larger than any astronomer of the year 1900 could have imagined. Since all ancient creation concepts were Earth-centered and local, they were stories of the creation of Earth. Everything else was either incidental or non-physical. Earth was not so much the center of creation as the only material body in creation.

These conceptions persisted for millennia. There is a wonderful (but sadly undocumented) tradition that Thomas Jefferson, no mean natural philosopher himself, upon reading of the 1807 fall of the Weston, Connecticut, meteorite in Silliman’s *American Journal of Science*, responded, “I would find it easier to believe that two Yankee professors would lie, than that stones should fall from the sky.”¹ As late as the mid-1800s meteorites were often assumed to be volcanic debris.



Figure 2: *Fantastic Depiction of the Solar System*, German School, 19th century, colorized

The cosmos thus pictured did not even include the stars. Until the seventeenth century it was nearly universally accepted that the surface of the cosmic bubble, the black “dome of heaven,” was close to Earth and enclosed all creation. This “firmament” was a solid (firm) dome surrounding our little cosmos. The stars were often described as pinholes in the firmament that admitted light from the celestial realms above into our tiny universe. The Latin word *firmamentum* conveyed no sense of vast spaces and countless other Suns and worlds. It meant a support, framework, or prop—a strong, solid structural element. The dome of the sky was just that, a dome. To the ancients, therefore, the heavens were just the local envelope that surrounded Earth and its seven celestial companions. The scriptural account of creation was a narration of the creation of Earth and, implicitly, its seven accompanying wanderers. Calling it an account of the creation of the Universe is a historical absurdity.

If we were to define “Universe” as meaning *everything that exists*, the Hebrews and Greeks would have pictured it as referring at least to Earth, and possibly to the realm of the seven wanderers (the part of the Solar System known to them), so that their understanding of the word “Universe” would have reflected a wildly different concept of the scale of material existence than that familiar to us. The heavens, what can be seen by the unaided eye from Earth’s surface, would correspond rather closely to their understanding of what “Universe” must mean. This was the general view of antiquity. This was the model adopted by Aristotle and passed by him down through the Middle Ages: a cozy, Earth-centered creation in which Earth itself was the only true material object. Aristotle, arguing that Earth was the center, and

that “all things tend toward the center,” concluded that other gravitating bodies were impossible because “there cannot be more than one center.”² There were no other stars, no other Earths. Scripture, interpreted in this manner, seemed to make Creation synonymous with the creation of Earth.

This conception had not been shared by all the Greeks. Some imagined the stars to be other Suns, each with a cosmos of its own, packed together like a barrel full of bubbles. But Aristotle argued that such bubbles had to be spherical (since, according to Plato, the sphere was a perfect shape, and everything in the heavens was by definition celestial and therefore perfect). Spheres, however, cannot be packed together so as to fill space.

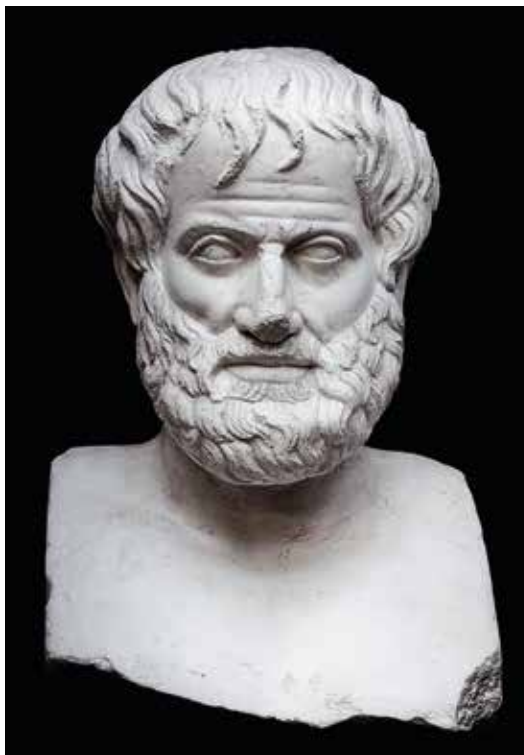


Figure 3: *Bust of Aristotle, 384-322 BC*

Therefore if there were other *κοσμοι*, there would have to be voids in the interstices between the bubbles. But this was impossible under Aristotle’s principle that “nature abhors a void,” and thus it was impossible for the stars to be other suns with their own families of planets. Note that all these governing principles (perfection of spheres, mystical numbers, abhorrence of voids) were nothing more than the wisdom of men, not based upon observations of the Universe and not even in principle testable or verifiable. The authority of a Plato or Aristotle took precedence over observation. Aristotle’s writings, adopted and taught by the Church, shaped interpretations of scripture for centuries to come: our understanding of sacred texts was made to conform to pagan philosophy.

The Age of Earth

Eighteenth and nineteenth century authorities typically take the word “day” in Genesis to be literally one modern Earth day, even though such days did not exist until day four of the creation, and the Hebrew word יום (*yōm*) was used both literally and figuratively, as in English. It is well known that such a constrained time scale is ruled out by every available method of dating astronomical and geological history.

The antiquity of Earth was a subject of active debate in the early nineteenth century. Some adherents of a conservative interpretation of scripture ignored or sought to explain away the overwhelming evidence from geology. The more liberal scientific interpretations of geological history suggested an age of 100,000 to millions of years for Earth. Almost alone, W. W. Phelps, Joseph Smith’s book of Abraham



Figure 4: Photo Montage of Isis Temple at Philae Island and a Star-Birthing Region in the Orion Nebula

scribe, offered a vastly larger perspective. In the *Times and Seasons*, a letter from Phelps to the Prophet's brother William states:

That eternity, agreeable to the records found in the catacombs of Egypt, has been going on in this system (not the world)³ almost 2555 millions of years; and to know that deists, geologists and others are trying to prove that matter must have existed hundreds of thousands of years: — it almost tempts the flesh to fly to God, or muster faith like Enoch to be translated and see and know as we are seen and known!⁴

Lacking any explanation of what was meant by “this system” and “the world,” it is difficult to compare these numbers to much more precise ages of specific events determined by science. The nineteenth-century usage of “world” encompassed everything from planet to Creation, whereas the word “system” in an astronomical context suggests the Solar System.

The relationship between human time and God's time is hinted at in several places in scripture. The Bible offers only a single explanation when Peter writes:

But, beloved, be not ignorant of one thing, that *one day is with the Lord as a thousand years, and a thousand years as one day.* (2 Peter 3:8, emphasis added)

This certainly cautions us regarding the figurative nature of this measure of time, and suggests that God's time is enormously flexible compared to our Earthly time. But both of the statements in 2 Peter 3:8 cannot simultaneously be literally true.

Elder Bruce R. McConkie has also commented that the days of creation are figurative, and not to be taken literally. In the June 1982 *Ensign* he wrote, “What is a day? It is a specified time period; it is an age, an eon, a division of eternity.”⁵ We commend this statement to those Church members who believe that Elder McConkie advocated a one-week duration for the creation.

Considering that Doctrine and Covenants 77:6 refers to “...this earth during the seven thousand years of its continuance, or its temporal existence,” what led Phelps to speak of Earth as 2,555 million years old? The answer appears to be straightforward. Though 7000 Earth years is in conflict with all physical, chemical, genetic, archaeological, and linguistic evidence, 7000 years of God is not ruled out. The arithmetic is easy. One day of God is 1000 years of man, and therefore in Joseph Smith’s reckoning, a day of God is 365×1000 days of man. The 2.555 billion years in question therefore corresponds to $2,555,000,000/365,000$ years of God, which is 7000 years of God for each day of Earth’s existence. A more careful calculation, using the true average length of the year including leap years (365.257 days) gives 2,556,799,000 Earth years. Clearly Joseph Smith did not intend the “7000 years” of Earth’s age to refer to Earth years.

The same number surfaces again in Elder McConkie’s address, “The Seven Deadly Heresies,” delivered at BYU in 1980. He refers to God as “an infinite and eternal being who has presided in our universe for almost 2,555,000,000 years,”⁶ but without any indication of the source or significance of that number.

In the book of Abraham (5:13), after a discussion of the creation of Earth in which the stages are called “times” instead of days, we find “Now I, Abraham, saw that it was after the Lord’s time ... for as yet the Gods had not appointed unto Adam his reckoning.” This may have been the scriptural basis for Phelps’s calculation.

Creation as an Ongoing Process

The creation of Earth is explicitly described in LDS scripture as a process of bringing order to chaotic matter, not as the creation of matter *ex nihilo*. This is in perfect accord with the scientific evidence regarding the creation of Earth. It also places the origin of matter in the distant past, not as a part of the events surrounding Earth’s formation, a conclusion also in accord with scientific studies of the origin of the elements starting 13.7 billion years ago.

LDS scripture, beginning with the book of Moses, portrays creation as diachronic: spread out over time. Many worlds came into existence before Earth existed, and many no longer exist; creation continues to the present (see Moses 1:33-38). In LDS doctrine, there are governing laws “irrevocably decreed in heaven before the foundation of the world” (D&C 130:20), on the basis of which laws worlds come into being, age, and die. Life on earlier worlds is a natural consequence of this view.

President Snow's couplet saying that God once lived in mortality on a world similar to ours requires that generations of planets pre-existed Earth. The laws of nature, on which the formation, evolution, and death of worlds over lifetimes of billions of years are predicated, must have been in existence long before the formation of our planet.

Thus the origins of the Universe and of Earth were widely separated events. The origin of Earth and the rest of the Solar System 4.55 billion years ago occurred in the context of a collapsing interstellar cloud, just as we see today in the Orion Nebula and elsewhere, accompanied by the simultaneous formation of thousands to millions of other stars and planetary systems in a starburst. The role of stars in the Earth Creation story is variously represented by the different scriptural sources. Genesis says that on the fourth day "he made the stars also. And God set them in the firmament of the heaven to give light upon the earth" (Genesis 1:16-17). The book of Moses says "the stars also were made even according to my word. And I, God, set them in the firmament of the heaven to give light upon the earth" (Moses 2:16). The book of Abraham likewise has the Sun, Moon, and stars "organized" in the "expanse of heaven" on the fourth "day" (Abraham 4:14-15). We are also told in another place that "he caused the stars also to appear." Is it just that the stars became visible from the vantage point of Earth's surface on the fourth day, or were they created after Earth was already old enough to have life? Interestingly, the astronomical evidence favors most stars being far older than Earth, but the starburst associated with the origin of the Solar System would also have formed thousands to millions of nearby stars in the same creative episode, some forming a little earlier than the Sun, and some a little later.

LDS scriptures conform well to our reading of Genesis as the story of the creation of Earth. The extension of this scripture to the Universe and its origin is inconsistent with science and is an anachronistic misreading of the story, inserting the concept and word Universe where scriptures do not. Creation was going on for billions of years before the creation of Earth and continues today. Earth is indeed billions of years old, as Joseph Smith was one of the very first to say.

The visions recounted in scripture, viewed as attempts to convey the seer's experiences without access to modern terminology, are remarkably informative and deserving of study. We would do well to try to picture what the seer saw, and to be cautious in our interpretation of those visions in terms of concepts alien to the seer's conceptual framework.

Conclusion

As scientists, we can understand a great deal about when things happened, where they happened, how long they took, but science is completely silent on the subject of the who and the why of creation. There is no way that you can answer those questions from observation. The universe was created by God and we know from the New Testament that, in this case, it was actually Jesus Christ who carried out



Figure 5: *Photo Montage of the Hubble Space Telescope Observing Deep Space While Orbiting the Earth*

the work in accordance with the plan, which I suppose would permit us to call our Heavenly Father the architect of existence and Jesus Christ the builder.

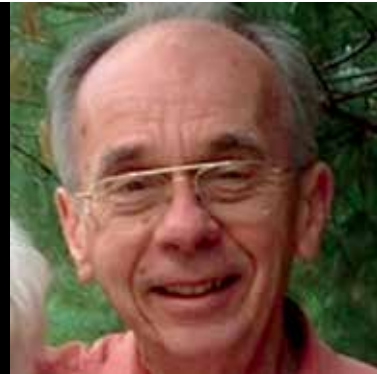
If the scriptures are God's handiwork and the universe is God's handiwork, then science and religion represent two independent witnesses of creation. And we're told throughout the Old Testament that two or more independent witnesses are required in order to certify the truth. They are not opposites but they are like the views seen from your two eyes. If you close one eye and then close the other, alternating back and forth, you don't see the same thing with the two eyes. But, it is the combination of those two views, which gives you three-dimensional perception and shows you a lot of things that neither eye by itself sees.

I am awed when I look at the Hubble Deep Space Telescope images where every spot of light in the picture is a galaxy. And every one of those galaxies has hundreds of billions of stars in it, and those galaxies are in all different shapes and colors. I think about how many worlds are within that field of view. I find it deeply touching, say nothing of what it does to the scientific side of my brain. It's so valuable to gain a new perspective on who you are and where you are and what's around you. The famous British astronomer Sir Arthur Eddington said the more we learn about the universe the less it looks like a great machine and the more it looks like a great thought.

Endnotes

1. “Ursula Marvin of the Harvard-Smithsonian Center for Astrophysics reports that the closest remark recorded from Jefferson on the subject is as follows: ‘We certainly are not to deny what we cannot account for. ... It may be very difficult to explain how the stone you possess came into the position in which it was found. But is it easier to explain how it got into the clouds from whence it is supposed to have fallen? The actual fact, however, is the thing to be established’” (Linda T. Elkins-Tanton, *Asteroids, Meteorites, and Comets* (New York City, NY: Infobase Publishing, 2010), 24).
2. Aristotle, *On the Heavens*, Book 1, Part 8.
3. “The phrase ‘(not the world)’ was added to the 1844 article as originally published. It is not known who added the phrase — Phelps, the editor, or someone else” (E. R. Paul, *Science, Religion, and Mormon Cosmology* (Urbana, IL: University of Illinois Press, 1992), 190 n. 47).
4. W. W. Phelps, “The Answer,” *Times and Seasons* 5 (December 1844): 758.
5. Bruce R. McConkie, “Christ and the Creation,” *Ensign* 12:6 (June 1982), 11.
6. Bruce R. McConkie, “The Seven Deadly Heresies,” in *1980 Devotional Speeches of the Year* (Provo, UT: Brigham Young University Press, 1980), 75.

JOHN S. LEWIS



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His research interests are related to the application of chemistry to astronomical problems, including the origin of the Solar System, the evolution of planetary atmospheres, the origin of organic matter in planetary environments, the chemical structure and thermal history of icy satellites, the hazards of comet and asteroid bombardment of Earth, and the extraction, processing, and use of the energy and material resources of nearby space.

He was the first to predict the existence of deep global oceans on the large icy moons of Jupiter and the presence of a radioactive heat source (40K) in Earth's core to power core convection, generate the geomagnetic field, and drive continental drift. He also developed the standard atmospheric and cloud composition models of Venus and the giant planets.

He served on the Board of Directors of American Rocket Company (AmRoc) during the development of hybrid rocket motors for the private launch business, a process that culminated in the use of an AmRoc-designed motor to propel SpaceShipOne to an altitude of over 100 km and win astronaut's wings for its pilots in 2004. He is presently Chief Scientist for Deep Space Industries, an asteroid-mining company.

He has served as a member or Chairman of a wide variety of NASA and National Academy of Sciences (NAS) advisory committees and review panels, spanning topics ranging from planetary exploration and the origin of life to interstellar communication. He has written 19 textbooks and popular science books, has authored over 150 scientific publications, and has given invited lectures at over 100 colleges, universities, and research centers throughout the world.

He and Sister Lewis are converts who joined the Church in 1981. They served for a year at Tsinghua University in Beijing through BYU's China Teachers Program, and served as missionaries for 18 months in the International Zone of the Family History Library in Salt Lake City. They recently returned from the New Zealand Wellington Mission. They have six children and 34 grandchildren. Four of their grandchildren are currently serving missions. He is presently a member of the High Council of Mount Vernon, Washington Stake.