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Fifty-Seven Years of Creation Astronomy

Part II: Issues and Advances

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Abstract

A significant quantity of creation astronomy work has appeared since the launch of *CRSQ*. A previous article analyzed the breadth and diversity of this work. The present article complements the former by examining some of the issues raised by this literature. It first notes the importance of methodological precision (e.g., mindfulness of the distinction between mixed questions and science *per se*); second, it identifies major unresolved issues (light-travel time, the cosmic microwave background, and star-formation/development); and third, it notes areas of significant progress (exploration of the light-travel time issue and a nascent young-Earth model for Solar-System history).

Key Words: astronomy, historical survey, fringe science, light-travel time, cosmology, stellar physics, Solar System

Introduction

Two of the most prominent battlegrounds between mainstream- and creation-science are geology and biology; deep-time advocates appeal to the former, and neo-Darwinists, to the latter. Paleontology, occupying the intersection of the two, thus plays a significant role as well. The conflict naturally spills over into astronomy, which in some ways represents an extension of geology to the Universe as a whole. In particular, the vast distance scales of astronomy seem to imply vast timescales as well, with many processes (including but not limited to the propagation of light) requiring millions or billions of years to occur. Thus, the application of a straightforward reading of Scripture to astronomical observations is a vital aspect of the young-Earth creation (YEC) apologetic.

Part I (Repp, 2021) surveys the astronomy efforts of the YEC community since the inception of *CRSQ*. The number of astronomy articles in creation journals exhibits vigorous and diverse activity, comparable in quantity to that in paleontology. However, other than classifying articles into subfields, Part I largely ignores the content of these articles, making, for instance, no attempt to identify particular areas of progress or the lack thereof. To analyze such topics will involve unavoidable subjectivity; nevertheless, given more than a half-century of data, we should at least attempt to do so. Thus, this article addresses the following three questions: In which areas has creationary astronomy exhibited progress? Which major issues remain unresolved? And might any lessons be available from our own history?

Before considering these questions (in reverse order), one caveat is in order: This article does not attempt to duplicate Danny Faulkner's periodic reviews of the

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state of creation astronomy (Faulkner and DeYoung, 1991; Faulkner, 1998a, 2018c, 2019ab); instead, it represents one person's attempt to answer the three questions above, making no claim to comprehensiveness. Furthermore, this article largely restricts itself to the literature surveyed in Part I, namely, *Creation Research Society Quarterly*, *Proceedings of the International Conference on Creationism*, *Journal of Creation* and predecessors, and *Answers Research Journal*.

We first examine insights to be gleaned from our own history.

Attempting to Learn from History

Regarding Fringe-Science Theories

One feature of creationary astrophysics in the late 70s/early 80s was its openness to what might be called fringe-science theories. We should note at the outset that some advocates of these theories made worthwhile contributions in other areas; the following discussion of their missteps (decades after the fact) should not detract from the value of their work as a whole.

At least three such categories stand out: attempts to disprove relativity, attempts to reformulate electrodynamics, and attempts (uniformly unsuccessful) to resurrect geocentrism. All three of these areas fall squarely into the realm of science *per se*, rather than reconstructive mixed questions of history. We consider each in turn.

Attacks on relativity relied heavily on arguments by relativity-skeptic Herbert Dingle (1890–1978).[1] Thomas G. Barnes (1911–2001) seems to have penned the first such critique in the surveyed literature; Barnes also served for years on the editorial board of *CRSQ* and was perhaps the first to use geomagnetic decay as an argument for a young Earth (Barnes, 1971, 1973). In 1976, Barnes and Upham presented a vector theory of gravity as an alternative to general relativity (GR); the theory, to their credit, was falsifiable, predicting gravitational radiation with only a quarter of the intensity predicted by GR.[2] The following year, *CRSQ* published a note by Essen (1977) questioning the validity of the atomic-clock confirmations of relativity (Hafele and Keating, 1972), and a few years later, Slusher (1980)—followed by Bouw (1981)—discussed alleged problems with special-relativistic Doppler effects. As late as 1986, Ramirez Avila (1986) presented a paper at the first International Conference on Creationism (ICC) purporting to explain the precession of Mercury's perihelion without the need for GR.

However, not all creationists shared this skepticism, which may have reflected a vocal minority only; for instance, St. Peter (1974) incorporates relativity into his Big-Bang critique. The publication of *Starlight and Time* (Humphreys, 1994c), incorporating GR into a proposed distant-starlight solution, may have helped dissipate this skepticism, which thereafter seems confined to occasional letters to the editor.

The second category (revision of electrodynamics) belongs, like relativity, to physics rather than astronomy *per se*; we include it due to the relevance of electrodynamics to radiative transfer, stellar energy, stellar development, degenerate matter, etc. Barnes explicitly grounds his rejection of standard electrodynamics on his rejection of relativity (Barnes et al., 1977),[3] in consequence formulating a "classical" (i.e., non-relativistic) alternative. The dependence of quantum electrodynamics (QED) on relativity entailed rejection of QED as well, yielding alternate theories for the structure of the electron (Pemper and Barnes, 1978), the proton, and the neutron (Barnes, 1980). This program seems to have culminated in an invited article (Barnes, 1984) presenting a "unified theory" to replace quantum mechanics, special relativity, and general relativity. These lines of thought continue to be promoted by the so-called Common Sense Science movement ("Common Sense Science," 2010).

The third category is geocentrism, advocated (tangentially) in at least two *CRSQ* articles. Hanson (1978), after arguing against a Velikovsky-style realignment of the Earth's axis, presents an extended argument for geocentrism and concludes,

> It is further argued that these analyses tend to discredit astronomical dating and Copernicanism and favor, respectively, ultimate dating from the Biblical testimony and geocentricity. The mathematical and textual compatibility of Joshua 10:12–14 with geocentricity is noted. (p. 68)

A later article by the same author (1981) concludes with the sentence, "This is another example of the frequent superiority of pre-Copernican astronomy over the present Copernican-evolutionary views" (p. 29).

However, these dalliances with geocentrism were vigorously challenged. The initial discussion seems to have occurred behind the scenes, as in an unpublished 1978 letter (reproduced in Bouw, 2007) from George Mulfinger to

1 Dingle's paradoxes depend on a fundamental misunderstanding of relativity; see, e.g., the brief explanation in Koks (2019).

2 The theory did undergo falsification five years later, when Weisberg and Taylor (1981) calculated the gravitational radiation from the Hulse–Taylor pulsar to be within 15% of the GR prediction.

3 Ironically, it was the Lorentz-invariance of classical electrodynamics which pointed Einstein toward special relativity; Maxwell's (classical) equations are inherently relativistic.

Harold Armstrong and other CRS Board members. He writes, "In conclusion, I would like to protest the inclusion in the *CRSQ* of any further papers giving support to the Tychonian perspective. I believe we have gone too far already" (p. 47). More recently, the community has taken a decided stand against geocentrism; for instance, Faulkner (2001b) decisively refutes the idea, addressing the exegetical, historical, and scientific issues involved and, in the process, providing a good defense of the observational evidence for GR. Faulkner (2002ab) also ably responds to attempted rebuttals.

Furthermore, the journal editor appended a note to Faulkner's second response stating, "The subject of geocentricity is now closed." This decided rejection of geocentrism raises the question of why no such notes were published three decades earlier. One possible reason might involve the fact that early creation advocates were themselves continually challenging mainstream theories of neo-Darwinism (in biology) and actualism (in geology); thus they might have been amenable to—or at least reluctant to object to—challenges to other mainstream theories such as relativity, electromagnetism, and heliocentrism. If this analysis is correct, then the creation movement contains an inherent, built-in danger, namely, the temptation to give unwarranted credence to fringe theories[4] as a result of our own rejection of neo-Darwinism and mainstream geology. It is for this reason that the author feels it worthwhile to bring up this aspect of our history, for, if this is the case, we will continue to face this danger for the foreseeable future. Thus, even though these specific issues belong to the past, it is worthwhile to note the following points.

First, the distinction between science *per se* and mixed questions is essential.[5] The mixed questions here involve the use of scientific tools to investigate what are primarily issues of history. Attempts to address them thus require integration of both empirical science and historical reconstructions—and when this reconstruction involves Creation and the Deluge, worldview presuppositions inevitably affect the results. The repeatability of science *per se*, on the other hand, renders it much more (though not completely) robust to worldview differences. Therefore, the creation movement has typically (and wisely) accepted the conclusions of science *per se* but rejected many secular conclusions about these mixed questions. Closer attention to this distinction might have channeled some of the efforts above into more profitable directions.

Rejection of the supernatural in general (and of Biblical revelation in particular) is in large part responsible for the mainstream acceptance of neo-Darwinism and uniformitarianism. There is no such presuppositional bias affecting relativity, electrodynamics, etc.; thus, if the authors of these articles indeed had a convincing case against standard physics, the appropriate publication venue would have been the mainstream literature, not *CRSQ*. Alternatively, one could say that creation journals are for specifically *creationary* articles, whereas articles with no direct relevance to creation should, if of sufficient quality, be publishable on their own merits in the standard journals.

Second, we should recognize a strong (and appropriate) presumption in favor of established results, arising from the fact that it is easier to mislead a few than to mislead many. (It is of course quite possible to mislead even the majority, but small groups are yet *more* amenable to error—hence the presumption in favor of established results.) It follows that weighty evidence is necessary in order to overcome this presumption. Unequivocal divine revelation certainly qualifies as the most weighty of evidence, but appeals to divine revelation should also attempt to demonstrate the influence of naturalistic presuppositions on the standard interpretation of the data. This is precisely what has occurred in the creationary rejection of neo-Darwinism. However, absent such revelation (e.g., in relativity or electrodynamics), it is difficult to find any convincing justification for rejecting the consensus view.[6] It is also appropriate to note that, in the field of astronomy, this presumption should breed great caution in consideration of alternative redshift interpretations—or of any far-reaching conclusions based on null results or marginal observations.

Third, and consistent with this presumption, one should beware of overly hasty presuppositional argumentation. Consider reasoning of the form, "The Bible teaches X; therefore Y cannot be true, even if observations seem to support Y." This argument is cogent (within a Biblical worldview)—but only if Scripture indeed teaches X, and only if, in addition, X is truly incompatible with Y. In other words, rejection of a position based on Scriptural teaching requires,

4 The author is keenly aware of how ironic this sentence will sound to anti-creationists—which fact does not, of course, absolve us of the responsibility to police ourselves.

5 It is perhaps more common to express this distinction in terms of "operational science" vs. "origins (or historical) science." The author, following Reed and Klevberg (2014ab), prefers to restrict the term "science" to investigation of "present phenomena and timeless rules of nature" and to consider issues of "origins science" as mixed questions (Adler, 1965) at the intersection of science and history.

6 Geocentrists would, of course, point to Scriptural passages seeming to imply a fixed Earth; see the works cited above—among many others—for demonstration of the flaws in their exegesis.

on the one hand, sound exegesis (with what degree of confidence can we hold that Scripture teaches X?) and, on the other, epistemic humility (how willing are we, if observations strongly support Y, to critically evaluate our exegetical methods, our understanding of X, our understanding of Y, or all of the above?). If we can establish a high level of confidence that Scripture indeed teaches X—and that X is indeed incompatible with Y—then presuppositional argumentation on the basis of Scripture is warranted; but if only a moderate level of confidence (that Scripture teaches X, etc.), then it is wise to question *ourselves* before seeking alternative explanations for the observations supporting Y.

This hasty presuppositionalism is evident especially in the third example above: Scripture (in context) never directly addresses heliocentrism, but geocentrists are nevertheless convinced that the consensus view is unbiblical. Consequently, they reject evidence which virtually all specialists find conclusive, and they instead treat factors of little worth as determinative. In general, the weight of an inference from Scripture depends on the solidity of the inferential process. The more numerous and tentative the deductive steps from Scripture to an inference, the more loosely one should hold that inference. And the more loosely one holds the inference, the more open one should be to contrary evidence. The fringe-science proponents seem instead to have doubled down on their inferences by dismissing the evidence.

A Plausible but Now-Falsified Theory

We next consider a case in which application of (or failure to apply) these principles yielded careful (respectively, careless) handling of a more ambiguous question.

A primary challenge of creationary astronomy is to reconcile a straightforward reading of Scripture (a timescale on the order of 10^4 yr.) with the natural timescales of astronomical processes (which can be on the order of 10^{10} yr.). Some of these timescales are implied by the vast distances involved; others—including the timescale for stellar development—are fixed by the rate at which stars burn through their reservoir of fuel. For this reason it is unsurprising that creation scientists have investigated the possibility of alternative stellar-energy sources.

The first article (within the surveyed literature) to make such an argument (Hinderliter, 1980) claims to have predicted from young-Earth premises that the Sun's luminosity derives from Kelvin-Helmholtz contraction rather than nuclear fusion. It then adduces two pieces of observational evidence as confirmation: a decrease in solar diameter reported by Eddy and Boornazian (1979) and a deficit in the number of solar neutrinos predicted for nuclear fusion.

Steidl (1980), in a much more measured article, adds another reason to doubt the standard solar model, namely, the existence of a 160-minute solar oscillation first reported by Severnyi et al. (1976). Steidl also lists (and rejects) multiple possible explanations for the neutrino deficit but does not include the one which eventually proved correct (flavor oscillations due to neutrino mass). Commendably, the following year Steidl wrote a letter to the editor (1981) noting both the possibility of neutrino mass and the fact that transits of Mercury gave no evidence for solar contraction. He then concludes, "Perhaps the sun is burning hydrogen after all. In both cases only time will tell what the ultimate outcome will be and its importance to creationism." Despite this caution, the author remembers hearing the solar-contraction argument (without appropriate qualification) more than once during his youth.

In 1989, DeYoung and Rush took a careful and sober look at this suite of arguments. They note, first, that measurements of solar diameter during the intervening decade did not confirm the results of Eddy and Boornazian; second, that the claimed rate of contraction was two orders of magnitude greater than that required for Kelvin-Helmholtz luminosity; and third, that the temperature and pressure at the Sun's core would in any case induce fusion. They also note the uncertainty of the solar neutrino question as well as the fact that many scientists disputed the existence of the 160-minute solar oscillation. Recognizing the distinction between science *per se* and mixed questions, they write, "The question we are addressing, however, is not one of origins but one of operation. …We can say only that the sun *may* be shrinking, not that it definitely is" (p. 51, emphasis in original).

As it turned out, the 160-minute oscillation was explained that same year as an atmospheric effect (Elsworth et al., 1989), and more-recent space-based missions have confirmed its artifactual nature (e.g., Appourchaux and Pallé, 2013). Final resolution of the neutrino question had to wait almost another decade; researchers at Super-Kamiokande published the first observational evidence of flavor oscillation in atmospheric neutrinos (Fukuda et al., 1998), and a few years later the Sudbury Neutrino Observatory established this flavor oscillation as the cause of the solar neutrino deficit (Ahmad et al., 2001). Newton (2002) in turn reported these results in the creation literature. The last article in the surveyed literature advancing this suite of arguments (160-minute oscillation and neutrino deficit) seems to have come in 2003, with a subsequent rebuttal by Faulkner and Samec (2004). Ironically, helioseismology—the use of solar oscillations to probe the sun's structure—now provides an important window into the solar interior (e.g., Basu, 2016); asteroseismology applies the same techniques to other stars (e.g., García and Ballot, 2019). Both helio- and asteroseismology have in general

confirmed (while refining) the standard understanding of stellar structure and operation.

The purpose of this review is most emphatically *not* to castigate creation researchers for considering a model which turned out to be wrong. In fact, creation researchers were not the only ones interested in these observations: one of the motivations for space-based solar observatories was the desire to investigate possible oscillatory g-modes[7] (Appourchaux and Pallé, 2013, p. 126). Given the potential implications of an alternative solar-energy source, it would arguably have been irresponsible for the creation community *not* to have investigated this possibility. Given the data available at the time, the problem was not with the argument itself but with how some voices presented it. Mindfulness of the fact that the operation of the Sun is a matter of science *per se* (not a mixed question), recognition of the presumption carried by accepted results, and implicit rejection of hasty presuppositionalism (Scripture does not deal with specifics of solar operation) caused some writers to advance and evaluate the argument with appropriate caution. Others, however, did the opposite.[8] As events later proved, the caution was wise.

Major Unresolved Issues

The remainder of this article focuses on a few major issues—some of which remain unresolved and some of which have witnessed significant progress. We begin with three unresolved areas, namely, light-travel time, cosmology, and stellar physics.

Light-Travel Time

Cosmological distance indicators provide the greatest potential discrepancies with a 10-kyr. timescale; however, the distance even to the center of our Galaxy is well over 20,000 light-years, so that even galactic astronomy must contend with light-travel time. We defer a complete analysis of light-travel time to a future series of articles; here we note that most debate has involved four proposals.

The first is in-transit creation of light, usually in the context of mature-creation considerations. For many (including the author), this solution was the first to come to mind upon awareness of the issue. Its first explicit appearance in the surveyed literature seems to be Akridge (1979), whose argument is however flawed on physical grounds (Lorentz, 2019). The past twenty years have seen at least two valuable discussions of the issue by Justin Taylor (2005) and Donald DeYoung (2010). Taylor notes that the travel-time issue affects not only light but also matter (e.g., jets from active galaxies would require in-transit creation), and he argues that the in-transit proposal represents a dismissal of the problem rather than an explanation. (See further discussion in Taylor, 2006.) DeYoung on the other hand presents a thoughtful defense of the proposal, arguing that it has been too quickly rejected; in further discussion (2011) he provides the following reminder: "I readily admit to not know the correct solution to how we see distant starlight in a young universe. However, I fear that technical efforts to solve this problem have the potential to diminish the doctrine of supernatural creation." Whether one adopts the in-transit solution or not, the discussion reminds us that Creation was a manifestly supernatural event and that we therefore we should beware of giving preference to naturalistic explanations.

The second major proposal involves decay in the speed of light. Harris (1978) provides one of the first arguments of this type, suggesting an initially infinite speed of light, with a finite-speed zone propagating outward from the Earth at the time of the Fall. Others, most notably Setterfield (Norman and Setterfield, 1987), proposed a decay extending to modern times, discernable by careful analysis of historical measurements. However, a general consensus has emerged (see e.g., Chaffin, 1992) that the purported evidence for such decay is artifactual in nature.

A third proposal involves differential time flow, the most prominent variant being Humphreys' relativistic time dilation (1994a, 1994b, 1994c). This theory has incited vigorous discussion, with no consensus apparent. Byl (1997) for instance argues against it on mathematical grounds (see response in Humphreys, 1997), as do Conner and Page (1998, 2000) (responses include Humphreys, 1998, 2000). Taylor (1996) on the other hand—as well as Anderson (2017)—take issue with the exegesis inspiring the model. A more recent proposal (Dennis, 2018), somewhat akin to Humphreys' in its explicit appeal to GR, explains the travel-time disparity as the result of a specific set of initial conditions.

A fourth proposal (Anisotropic Synchrony Convention, or ASC) originated with Newton (2001), and recent advocates include Tenev et al. (2018). Careful treatments of ASC present it as a redefinition of time coordinates: the fourth day of Creation at any given point in space is *defined* as the moment when light—which would eventually reach Earth on the fourth day—arrived at that point from distant objects. (The name of the proposal expresses this understanding.) Other treatments seem to suggest an actual *physical* anisotropy in the propagation of light (i.e., that the "one-way speed of light" toward Earth is infinite)—which would seem con-

7 The 160-minute oscillation would have been a g-mode.

8 E.g., "it is clear that we have witnessed a *major scientific defeat for evolutionism*" (emphasis in the original).

clusively ruled out by electromagnetic theory.[9]

This short list does not exhaust the discussion of light-travel time. Many other proposals exist (some of which the author believes have great merit) but discussion of them falls outside the scope of this article. Instead we note again the potential issue of seeking physical, naturalistic solutions in the context of supernatural creative activity. This is not to advocate retreat to mystery—for God has chosen to reveal these data (distant galaxies, etc.), presumably for us to analyze, not ignore. Nevertheless, we do well to remember that certain processes, operative during Creation Week, ceased on the seventh day (Genesis 2:2–3).

Cosmology

In the field of cosmology, creation science has essentially played defense, in one case effectively making a prediction subsequently falsified by observations. Upton (2011) lists multiple observed phenomena explained by standard cosmology but not (yet) by creationary models, concluding, "much work still needs to be done" towards building a model which combines explanatory power with faithfulness to Scripture.

One salient example of such unfinished work is the interpretation of the cosmic microwave background (CMB); though it was detected in 1964 (Penzias and Wilson, 1965), there is no creationary consensus on its origin. Akridge et al. (1981) attempt to explain it as dust radiation, a proposal decisively refuted by Steidl (1983) and Faulkner (2014b). However, there is still no generally accepted explanation for the CMB in a creationary framework: for instance, Humphreys (1994b) explains it as relict light from the first day, whereas Faulkner (2016) explains it as blackbody radiation from a water boundary ("the waters above").

The situation worsens when we consider the power spectrum of the CMB—that is, the patterns exhibited by its minute temperature variations (anisotropies). As Upton (2011) notes, standard cosmology successfully predicted the major features of this spectrum as early as 1970 (Peebles and Yu, 1970). In opposition, at least one creation writer (Bouw, 1982) used the non-detection of this spectrum as an argument against standard cosmology.[10] Note that this line of argument constitutes an implicit prediction that the standard-cosmology power spectrum would *not* be detected in the future, for if non-detection supports a creation model, a detection would do the opposite.

The COsmic Background Explorer (COBE) satellite made the first reliable measurements of the anisotropy spectrum (Smoot et al., 1992; Bennett et al., 1996). In the creation literature, Mehlert (1994) accepted the anisotropies as real but noted that they were smaller than expected. Rushing (1995) claimed that the detections were statistical artifacts, "questionable to anyone who knows how the original data was processed." Even after the subsequent, quite robust detection by the Wilkinson Microwave Anisotropy Probe (WMAP) (Bennett et al., 2003), one writer continued to argue that the COBE results were not real, and another called the WMAP results "smoke and mirrors." The yet more detailed CMB mapping by *Planck* (Planck Collaboration et al., 2014) seems to have laid to rest the idea that these anisotropies are artificial. However, there has been little if any attempt to explain them within a creation framework.

On the positive side, various writers have done the community a great service by addressing certain misconceptions. For instance, Faulkner summarizes evidence that the Universe is indeed expanding (2018b) and that redshifts (including quasar redshifts) are reliable distance indicators (2018ab); he also debunks the use of supernova remnants as indicators of a young galaxy (2017a). Likewise, DeYoung (2000) and Faulkner (2017b) present evidence for the existence of dark matter. Such work is absolutely essential to prevent wasted effort on hypotheses already precluded by observation.

Stellar Physics

Stellar physics is a third unresolved area. On the one hand, the standard model of stellar development[11] reflects seemingly well-understood physics (noted by Faulkner and DeYoung, 1991). However, this physics also predicts the spontaneous formation of stars when gas clouds reach a critical density (e.g., Carroll and Ostlie, 2007).[12] Many creationists reject the latter, and thus they are open to skepticism about the former.

Creationist rejection of star formation proceeds on several bases. Some are physical: Mulfinger (1970) for instance argues that star formation would decrease entropy and thus violate the second law of thermodynamics. However, Faulkner (2001a) notes that this argument would disallow *any* radiative cooling whatsoever and in fact neglects

9 For instance, a physically infinite c in one direction would require a zero $\epsilon_0\mu_0$ in that direction, making either Coulomb's Law or Ampere's Law wildly anisotropic as well. A mere coordinate redefinition—Newton's original proposal—would not suffer from this problem.

10 The author remembers hearing an oral presentation of the same argument sometime in the late 80s/early 90s.

11 Usually termed "stellar evolution," though it has little in common with Darwinism.

12 See also, in the creation literature, the recent exposition of the Jeans Criterion by Faulkner (2021).

the entropy increase of the environment.[13]

Other objections are Scriptural, on the basis of passages such as Psalm 33:6 and Genesis 1:14–18. Little if any exegesis typically accompanies these citations. In contrast, Faulkner (2014a) notes that God's initial creation of animals and mountains precludes neither the procreation of new animals nor the formation of new mountains (by volcanism); he raises the possibility that star formation is likewise an ongoing process, initiated at creation.

Other objections seem nothing more than apologetic tactics—for if we disallow star formation, the relatively short lifetime (~ 10^6 yrs.) of hot blue stars precludes a 13-Gyr. age for the Universe. However, the physical arguments predicting star formation seem as solid as those predicting such lifetimes; if so, it is inconsistent to accept the latter but reject the former. It has also been noted (e.g., Faulkner, 2001a) that star-formation triggers (such as supernova shocks and radiative cooling from dust) require the existence of a previous generation of stars—and thus, even if we accept ongoing star formation, the origin of first-generation stars remains problematic for the naturalist.

More to the point, the apologetic potential of an argument is no measure of its validity. If we reject the conclusions of mainstream science, we should do so on the basis of solid exegesis, not dubious inference. Rejection of the physical arguments for star formation should logically entail (1) straightforward order-of-magnitude calculations demonstrating that super-Jeans molecular clouds will *not* collapse and (2) at least the outlines of a self-consistent physical stellar development model (that does not also allow star formation). This bar seems extremely high. On the other hand, acceptance of star formation almost forces consideration of how stellar development processes—with their Gyr.-timescales—fit into a YEC framework. It seems safe to say that there is no consensus on this issue.

Areas of Progress

We finally turn from unresolved issues to areas of evident progress. First, despite the lack of consensus on the light-travel time issue, creationary astronomers have accomplished significant exploration of the available solution space. Given the central relationship $c = \Delta x/\Delta t$ (x and t being distance and time, respectively), only four options seem available: (a) unconventional light speed, as in c-decay theories; (b) unconventional x, as in small curved-space models (Byl, 1998); (c) unconventional t, as in Humphreys' time-dilation model and the ASC coordinate transformation; and (d) rejection of the relationship altogether, as with in-transit creation.

Creationary astronomers have explored each of these options, in much more detail than this brief overview reflects. The actual solution is quite possibly already present in the creation literature. We now require application of observational, exegetical, and philosophical criteria to discriminate among the proposals. The task is by no means trivial—and may result in less certainty than desired—but the situation is far superior to that fifty years ago.

A second area of definite progress is our understanding of the Solar System. For decades creation writers have pointed out rotational and orbital Solar-System anomalies (Mulfinger, 1967; Whitcomb, Jr., 1967); they have also noted the uniqueness of the Earth (Armstrong, 1970), the problematic mechanism for generating planetary magnetic fields (Humphreys, 1984), the young faint Sun paradox (Faulkner, 2001c),[14] and the lunar recession rate (DeYoung, 1990).

However, pointing out difficulties in naturalistic origins scenarios—while necessary and valuable work (Bergman, 2020)—falls short of actually synthesizing observations within a Biblical framework (Hill, 2021). It is this area of model-building which has seen definite progress—in particular, a model for understanding Solar-System impacts in the context of a Creation–Flood framework.

Unfred (1984) seems to have penned the first article (in the surveyed literature) suggesting a link between Solar-System impacts and the Flood.[15] Ten years later, Spencer (1994) noted the role of catastrophism in shaping Solar-System features, and he argued in 1998 (using crater-size counts) that a similar population of impactors affected the Earth, the Moon, and Mars at the time of the Flood (Spencer, 1998ab).

Further development of the model includes Faulkner's suggestion (1999) of two distinct lunar bombardments. The first (on Day 4) would be the final stage of a divinely-directed accretion process which formed heavenly bodies such as the Moon. The same process would be responsible for the heavy cratering of many Solar-System surfaces and would correspond roughly to the Early Heavy Bombardment of mainstream theories. A second (diluvial) episode, corresponding to the Late Heavy Bombardment, would be responsible for the lunar maria and

13 An attempted rebuttal (in the same issue) is nonresponsive to Faulkner's main arguments.

14 This seems to be the earliest discussion of the problem in the surveyed literature, though it was mentioned in an earlier article (Faulkner, 1998b). However, the author seems to recall learning about the issue much earlier, in the late 80s or early 90s.

15 Note earlier discussion in Whitcomb and DeYoung (1978).

craters (astroblemes) in the terrestrial fossil record.[16]

A few years later came efforts—qualitative but suggestive—to interpret features on Venus and Mars as the result of accelerated radioactive decay. Baumgardner (2003) notes evidence for catastrophic subduction of the entire crust on Venus; Hill (2008) notes the relative youth and uniformity of the Venusian surface and proposes the same, initiated by accelerated decay. Likewise, Samec (2013) notes the evidence for liquid water on Mars, proposing that accelerated decay could have produced hot-spot volcanism and a temporary terraforming of the planet.

The following year, Spencer (2014), convinced of the infeasibility of assigning all cratering to the Deluge, affirmed the likelihood of a Day-4 cratering episode, with Earth being supernaturally protected while the Moon was formed from smaller objects. He reminds us that we cannot assume identical formation mechanisms for all Solar-System bodies and that a Biblical timeframe would not allow these bodies to differentiate (by purely natural processes) from an initial molten state.

As a result of these efforts, we have the beginnings of a model explaining Solar-System surface features in a YEC framework. In this model, not all Solar-System bodies were formed in the same way or at the same time—the Genesis account specifies the uniqueness of Earth in this regard—but God formed the Moon (and perhaps other Solar-System bodies) via the accretion of smaller objects on Day 4.

Accompanying this accretion was divinely directed/accelerated interior differentiation, with heavily cratered surfaces reflecting the final accretion stages. During this episode, the Earth was divinely protected—or, perhaps more accurately, intelligent direction of the accretion kept the impactors from striking the Earth. A second catastrophic episode occurred at the time of the Flood, in which a swarm of impactors formed the lunar maria and (possibly) triggered the Deluge on Earth.[17] These diluvial impactors are responsible for terrestrial impact craters, often buried and/or heavily eroded. At the same time, the accelerated decay implied by the RATE results (Vardiman et al., 2005) could have initiated catastrophic resurfacing of Venus and hot-spot volcanism on Mars, temporarily producing a thick Martian atmosphere and liquid water on its surface.

Again, this brief survey is by no means exhaustive: many others have contributed related thoughts, while others have advocated alternate understandings of the data.[18] Nevertheless, the model outlined above seems to represent a significant convergence of thought among creationary astronomers.

Much work remains, of course, to bring this model to maturity. More-quantitative results are necessary to establish its viability; in particular, without careful simulations—using, e.g., TERRA (Baumgardner, 1985; Bunge and Baumgardner, 1995) as suggested by Hill (2008)—one cannot assert with confidence that accelerated decay would produce the proposed effects on other terrestrial planets. It is promising that simulations by Baumgardner (2013) and Seely et al. (2018) demonstrate that large-object fly-by events could have produced enormous ocean currents along with significant crustal deformation. Additional work seems necessary to clarify the relationship between the diluvial impactors and the Flood itself, for if the impactors did not actually trigger the Flood, they seem superfluous: an impactless Deluge would be quite capable of accomplishing divine judgment.[19] One can hope that such further work will show whether this model requires modification or replacement.

In any case, however, the development of this model over the last few decades is a significant advance in our understanding of Solar-System history in the context of the Biblical narrative.

Conclusions

The last half-century of creationary astronomy has touched on every major subfield of the discipline and, as we have seen, has achieved some significant progress. One can hope that future work will build on these successes by attempting to discriminate among light-travel time solutions and by quantitatively testing the emerging Solar-System model.

One should not consider the unresolved issues as failures, given the utility of multiple working hypotheses (Chamberlin, 1890). Nevertheless, employment of multiple hypotheses is ultimately a means to an end, that end being accurate understanding of actual cosmohistory. Truth is not relative, and our goal is to approach that truth as closely as possible. Thus continued analysis of cosmology—including the CMB and its anisotropies—is necessary to situate these observations within a young-Earth framework, the purpose being to bring every thought captive to the obedience of Christ.

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TJ: The Journal of Creation (formerly TJ and Creation Ex Nihilo (CEN) Technical Journal)

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16 An exchange of letters between Spencer (2000) and Faulkner (2000) helpfully clarifies their positions at the time.

17 Though accelerated decay might have been a more significant trigger.

18 E.g., Oard (2009) questions the resurfacing of Venus and suggests that its coronae might be impact craters.

19 Or might the opening of the "floodgates of the heavens" include impactors?

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