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When Science Meets Scripture: The Super-Puff Earth as Cosmological Bridge

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Abstract
The recognition that Earth has existed in two distinct forms—its current interglacial state and a past super-puff configuration—has introduced a transformative perspective in planetary science. Among the emerging developments is the alignment between scientific observations of distant super-puff exoplanets and ancient knowledge of Earth's super-puff state preserved in sacred texts. While astronomy identifies super-puffs through empirical data from exoplanetary systems, sacred texts appear to encode observational models developed directly from experiencing a shelled Earth. This article positions such texts as potential repositories of planetary data with scientific relevance. By analyzing the structure and content of Genesis 1, we illustrate a direct correspondence between sacred narrative and astrophysical models of super-puff planets. This interdisciplinary synthesis is examined using a seven-dimension, three-group model of the religion–science interface. While the analysis reveals substantial commonalities between the two domains, it concludes that meaningful integration is not possible. Nonetheless, the study advances societal understanding of Earth's dual planetary states and provides important insights for long-term human adaptation and sustainability.

Keywords: Science, Religion, Sacred Texts, Super-Puff Planets, Super-Puff Earth, Genesis 1

1. Diverse Theories of Origin and Structure of Super-Puff Planets

The identification of a class of exoplanets with anomalously large radii relative to their masses has led to its classification as a distinct group known as *super-puffs*. These planets typically exhibit masses comparable to super-Earths but possess radii similar to or exceeding that of Jupiter. This combination of low density and inflated size presents a significant modeling challenge, and has prompted a variety of explanatory frameworks [1-5]. Early models attributed the large radii to extended hydrogen-helium atmospheres, postulating that these planets retained substantial gaseous envelopes acquired during their formation in protoplanetary disks. These envelopes were expected to erode over time via photoevaporation or core-powered mass loss, casting doubt on the long-term stability, and even the continued existence of super-puff configurations [6-9]. Yet, the persistence of these planets today implies that either these mechanisms are less efficient than predicted, or that alternative formation scenarios are at play. One such alternative proposes that super-puffs may not be inflated by gas at all. Instead, their apparent large size could result from circumplanetary rings, particularly when observed face-on during transit events [10-12]. This model offers an observationally geometry-dependent explanation for the anomalous radii. However, even with rings, these planets still require some form of envelope to match observed transmission spectra, leaving the full explanation incomplete [12].

A more recent theory introduces a radically different mechanism for the formation of super-puff planets through transient interactions between a planet and fragment chain of a large comet. As illustrated in Figures 1 and 2, a planet passing through such a chain can capture a large number of fragments in orbit around the planet. Fragments captured within the planet's Roche limit face tidal disruption and break apart into dust and debris around the planet. Over time, this debris self-organizes to form a dense, optically thick *cometary shell* that dramatically increases the planet's effective radius without requiring a massive gaseous envelope [13,14]. Crucially, the *cometary shell hypothesis* departs from the billionyear timescales of standard planet formation theories. It proposes that super-puff states are transient, potentially lasting from tens to hundreds of thousands of years. Under this framework, any planet, regardless of its age or formation history, could become a super-puff, depending solely on its orbital intersection with a large comet's fragment chain. This model predicts the possibility of observing sudden transitions such as a regular planet adopting super-puff characteristics upon shell formation, or a super-puff reverting to a regular state following shell dissipation and collapse [15].

Figures 1 and 2 offer simplified conceptual representations of a planet's orbital position relative to a comet's fragment chain and the location where their paths intersect. This study uses the Orbital Configuration Model (OCM), developed by Rafizadeh and Vempolu, to simulate the interaction between an Earth-like planet and comet fragments [13]. The simulation assumes the normalization of the planet encountering 10,000 fragments, which ensures comparability across all parametric scenarios without requiring adjustments for specific fragment counts or encounter parameters. The normalization makes the calculations independent of the comet size, the distribution of fragments within a generation's fragment chain, or the specific segment of the chain the planet crosses.

In the OCM simulation, key variables—position XYZ, planetary speed V_p, fragment chain speed V_{fc}, and angles θ, and ϕ—are randomly varied. The XYZ define the position $\bar{\boldsymbol{r}}$ of each fragment. At the intersection point, the fragment chain is modeled as a cylindrical structure moving along the X-axis with at velocity $\bar{\boldsymbol{V}}_{fc} = (V_x, 0, 0)$. The planetary velocity $\bar{\boldsymbol{V}}_p$ is assumed to be Earth-like, with components derived from $V_x = V_p \cos\theta$, $V_y = V_p \sin\theta \cos\phi$, and $V_z = V_p \sin\theta \sin\phi$. Here θ represents the angle between the orbits of the planet and the fragment chain at the crossing point, while ϕ is measured in the YZ-plane relative to the Y-axis. The simulation assumes an Earth-like planetary speed V_p of 30 km/s, intercept angle θ randomly varying within the set of 5º, 10º, and 15º, a fragment chain diameter of 5,000 km, an Earth-like planetary radius of 6,500 km, and fragment speeds between 25 to 35 km/s. These fragment speed values reflect observed data that indicate 59% of long-period comets and 83% of short-period comets reach perihelion speeds within the 20–40 km/s range [16].

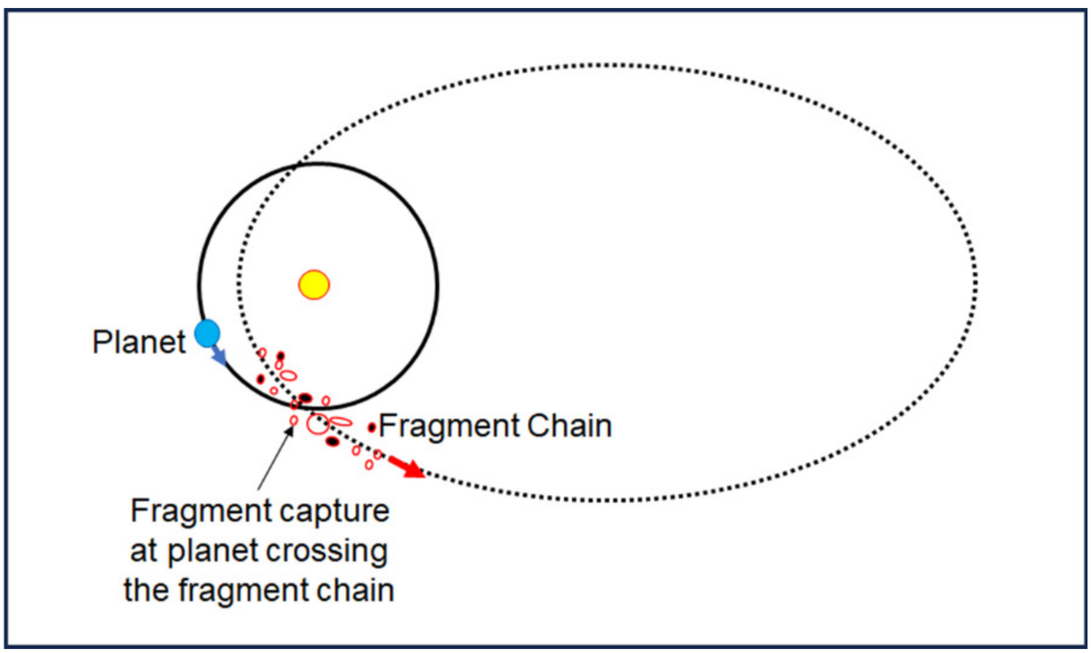

Figure 1: Conceptual illustration of a typical planetary intersection with a comet's fragment chain. Adapted with permission from [15].

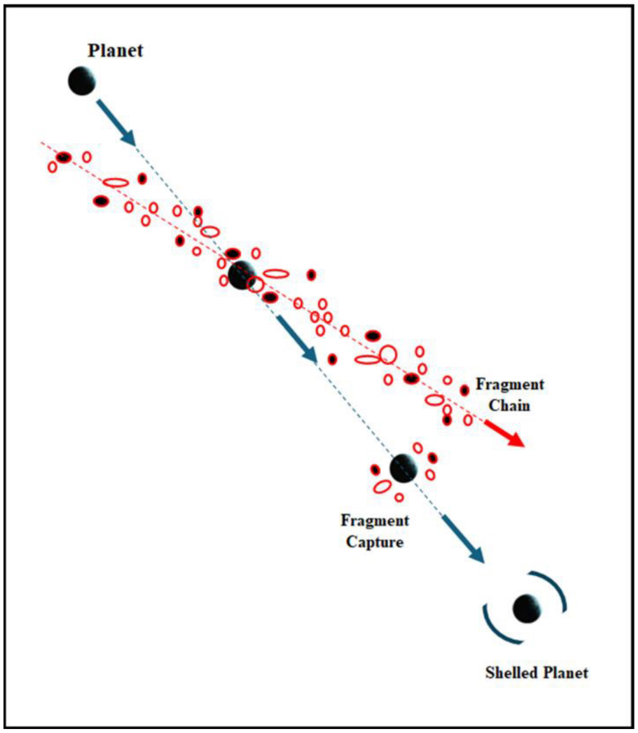

Figure 2: Diagram illustrating the process by which a planet traversing a large comet's fragment chain can gravitationally capture material, potentially leading to the formation of a cometary shell.

The Orbital Configuration Model (OCM) simulation of a planet crossing a cometary fragment chain produces the following results: 155 fragments (1.6%) collide with the planet, 1,554 fragments (15.5%) are gravitationally captured into orbit, and the remaining 8,291 fragments (82.9%) escape. The 155 impacts are attributed to captured fragments whose orbital semi-minor axes fall within the radius of the planet.

To determine how the captured fragments are spatially distributed, we calculate their orbital inclinations. The inclination i is given as [17]:

$$i = \cos^{-1}\left(h_z \,/\, |\bar{\boldsymbol{h}}|\right) \tag{1}$$

$$\bar{\boldsymbol{h}} = \bar{\boldsymbol{r}} \times \bar{\boldsymbol{V}} \tag{2}$$

The relative velocity $\bar{\boldsymbol{V}}$ is given by $\bar{\boldsymbol{V}}_p$ - $\bar{\boldsymbol{V}}_{fc}$, where $\bar{\boldsymbol{V}}_p$ is the planet's velocity and $\bar{\boldsymbol{V}}_{fc}$, the fragment chain's velocity at the point of intersection. Figure 3 illustrates the resulting distribution of inclination angles from the OCM simulation, indicating that the captured fragments tend to form a near-spherical shell around the planet.

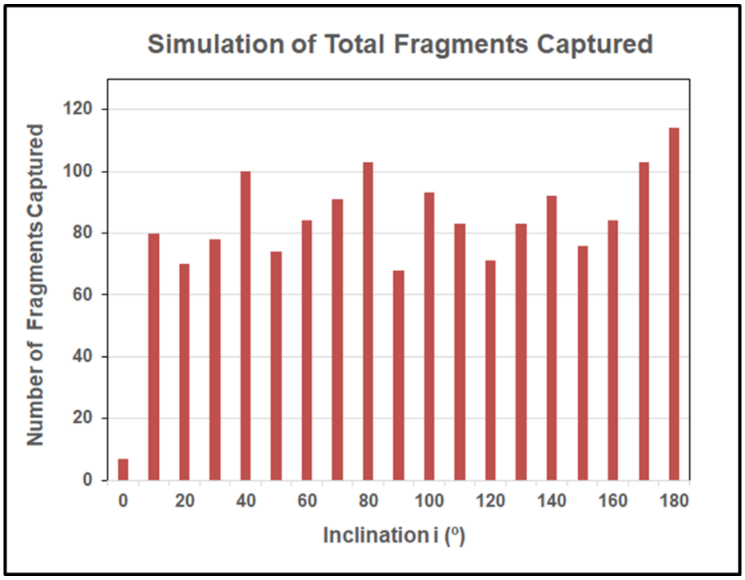

Figure 3: Orbital Inclination Distribution *i* of all fragments captured by the planet, as modeled using the Orbital Configuration Model (OCM). The inclinations exhibit a nearly spherical distribution of captured fragments.

Figure 3 shows that the orbital inclinations of captured fragments are nearly uniformly distributed, with the exception of a noticeable dip at 0°. In the OCM simulation, fragments are launched toward the planet from random positions within the cross-sectional area of a cylindrical cometary fragment chain. This setup produces consistent velocity directions but random spatial starting points. When combined with gravitational deflection during approach, this randomness leads to a wide spread of angular momentum vectors.

The inclination angle, defined as $i = \cos^{-1}(h_z / |\bar{h}|)$, reflects the angle between the angular momentum vector and the planet's equatorial (z) axis. For a fragment to fall into the 0° bin, its angular momentum must align precisely with the z-axis—a highly specific condition with zero probability in a truly continuous and random distribution. A fragment contributing to the 0° bin thus requires exact alignment of $\bar{h}$ with the z-axis, a measure-zero condition in a continuous random distribution [18]. From a geometric standpoint, all possible directions of angular momentum form a sphere, with 0° inclination representing a single point at the pole. In contrast, other inclinations correspond to finite-area rings on the sphere. As a result, uniform sampling over this sphere naturally produces a negligible probability density at 0°, explaining the observed deficit. This absence is therefore a geometric artifact rather than a physical bias against low-inclination captures.

2. Analyzing Fragment Composition and Shell Formation Radius

Large comets are compositionally diverse, typically featuring a dense, rocky core surrounded by a more porous, icy mantle. When such a comet breaks apart into a fragment chain, the fragments may originate from either region, resulting in a mix of densities. The type of fragments a planet captures depends on the segment of the chain it intersects, meaning the resulting super-puff shell can vary in composition, incorporating different proportions of high- and low-density material. This compositional diversity directly influences the shell's radius through the Roche limit. Since tidal forces affect rigid and fluid materials differently, Roche limits are calculated accordingly. For an Earth-like planet, the Roche limit is about 18,000 km for rigid bodies and 34,000 km for fluid bodies [19]. In OCM simulation of an Earth-like planet intersecting a large cometary fragment chain, 1,554 fragments are captured. Of these, 543 (34.9%) fall within the fluid Roche limit and 250 (16.1%) within the rigid Roche limit. Fragments fully within the Roche limit are expected to break up quickly, while those only partially within may disintegrate over longer durations. Both groups contribute to the formation of the cometary shell.

	Rigid	Fluid
Total within, $b < R_L$	391	717
Fragments fully within, $a < R_L$	250	543
Fragments partially within, $a > R_L$, $b < R_L$	141	174

Table 1: Distribution of captured fragments with orbits lying entirely or partially within the Roche limit, where a is the semi-major axis (used to estimate orbital radius), b is the semi-minor axis, and R_L represents the Roche limit for rigid or fluid material.

Figure 4 presents the spatial distribution of fragments located within the fluid and rigid Roche limits of an Earth-like planet. These distributions maintain the same nearly spherical pattern observed in Figure 3 for all captured fragments. The resulting structure resembles a two-layer shell. The inner layer lies within the Roche limit and is composed mainly of dust and debris from disrupted fragments, while the outer layer consists of more intact fragments maintaining stable orbits. Some outer-layer fragments periodically cross into the inner region, gradually disintegrating and enriching the inner dust layer.

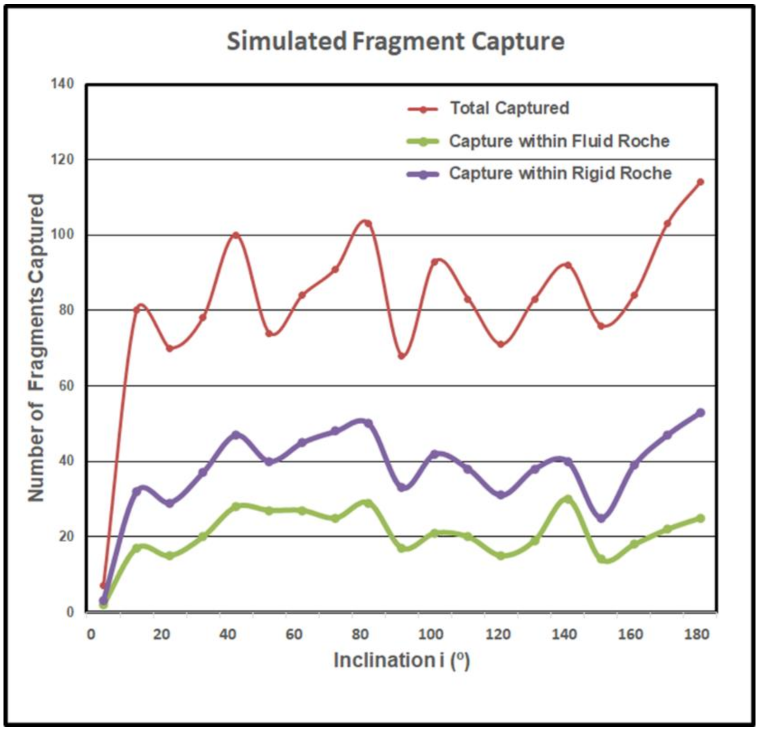

Figure 4: Inclination Distribution i for fragments captured within the planet's rigid and fluid Roche limits, based on OCM simulation. The spatial pattern shows the near-spherical distribution of captured fragments.

While the full dynamics of how such material might evolve into a stable planetary shell remain unclear and require further investigation, studies of Jupiter's atmosphere offer a useful analog. Research has shown that turbulent, hydrostatically balanced, inviscid layers influenced by gravity and Coriolis forces can spontaneously generate self-organized banded and jet-like structures from random initial states even in the absence of external drivers and despite wide variation in physical properties [20,21]. Whether similar organizational behavior might arise in cometary shells is a promising topic for future research. The cometary shell model raises a key observational question, the capture and tidal breakup of fragments within a planet's Roche limit creating the appearance of an inflated planetary radius. If we assume that the disrupted fragments self-organize, and if we treat the Roche limit as a first-order estimate of the shell's outer boundary, we can compute the expected shell radius as follows:

$$R_{shell} = \alpha R_{rigid} + (1 - \alpha) R_{fluid} \quad (3)$$

where α is the ratio of rigid to fluid fragments within the Roche limit. The Roche limits for rigid and fluid fragments, R_{rigid} and R_{fluid} respectively, are given as [22]:

$$R_{rigid} = R\,(2\,\rho_M/\rho_m)^{1/3} \quad (4)$$

$$R_{fluid} = 2.44\,R\,(\rho_M/\rho_m)^{1/3} \quad (5)$$

ρ_m is taken as typical comet fragment density of 0.6 g/cm^3, and ρ_M the planet density, assuming an Earth-like planet is 5.51 g/cm^3. R is the actual radius, estimated using the formula

$$R = (3M/4\pi\rho)^{1/3} \quad (6)$$

where M is the planet mass and ρ is assumed to be an Earth-like core density of 5.51 g/cm3.

Using data from eight known super-puff planets, recent measurements of Kepler 51 c and d, and two large-radius planets nearing gas giant size—Kepler 90g and TOI 1420b, Figure 5 plots the observed radii against estimated shell radii [1,23-25]. In this analysis, each planet's Roche limit is used as a first order approximation of its shell boundary. Calculated shell radii are shown for assumptions of α = 0.4, 0.5, and 0.6, where the range is centered at a typical ice to rock mass ratio of about 0.5 seen in comets [26]. In this framework, comparing observed and calculated radii reveals that larger apparent sizes are more likely to reflect a cometary shell, while smaller sizes may point instead to the presence of rings.

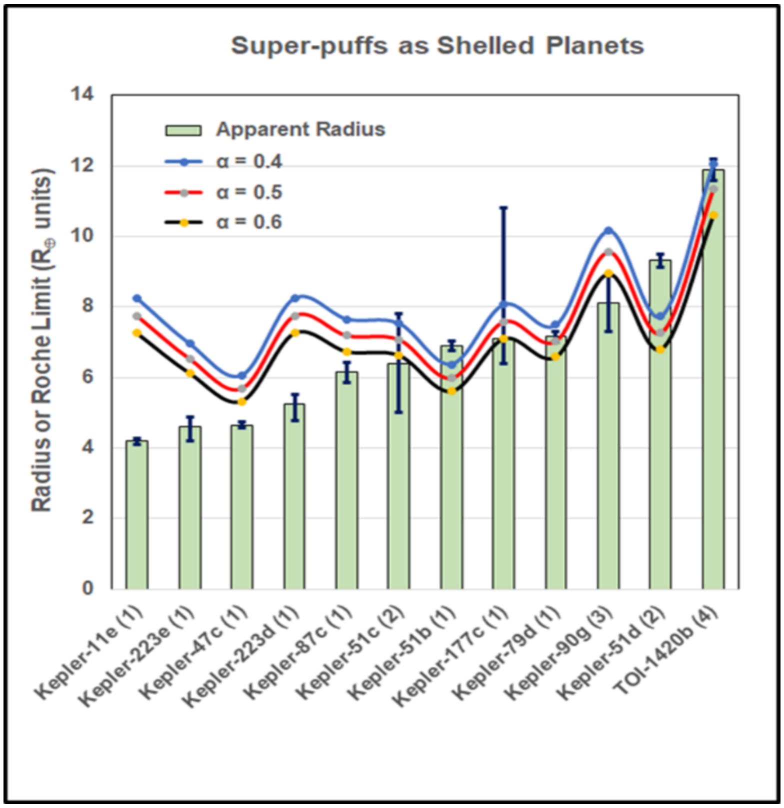

Figure 5: Comparison of observed super-puff planet radii with theoretical shell radii estimated from Roche limits, used as first-order proxies for size. Observational data include values from Gao & Zhang (2020), Masuda et al. (2024), Liang et al. (2021), and Vissapragada et al. (2024), arranged in order of increasing apparent radius [1,23-25].

The comparison reveals that the predicted shell radii fall systematically between the rigid and fluid Roche limits for a shelled planet, matching the observed super puff radii. This pattern suggests that Roche limits can effectively bracket the observed sizes of super puff planets. Furthermore, assuming a roughly equal mix of fluid and rigid fragment material ($\alpha \approx 0.5$) yields an especially close correspondence between the model and observed data, supporting the coherence of the cometary shell interpretation.

3. Linking Cometary Shell to Global Signatures

Building on the comet-interaction model, the *super-puff Earth hypothesis* can examine whether Earth itself might have undergone a similar shell-encasing event in the recent geological past. This line of inquiry seeks corroboration not only in physical data but also in historical records that may preserve descriptions of anomalous sky phenomena consistent with the expected effects of a cometary shell. Looking through ancient sources, we find Herodotus in 450 BC recounting a statement from an Egyptian high priest claiming that over a span of 11,340 years, the sun had reversed its rising and setting direction four times [27]. Notably, this claim is devoid of mythological language and relies on physically explicit terms—“sunrise” and “sunset”—that carry direct observational significance.

As to the time of these events, Herodotus reports that the Egyptians measured time in “generations,” defining three generations as a century. Using this conversion, the reported 11,340-year interval—combined with the 450 years from the time of the conversation to the present, with “present” defined as 1950—yields an estimated 13,740 years before present. This timing aligns with the terminal phase of the last glacial period, a pivotal point in Earth's climatic history [15]. As depicted in Figure 6, such a reversal of sunrise and sunset cannot be accounted for under standard planetary conditions. However, the reversal becomes physically plausible if Earth were enclosed in a cometary shell, such that sunlight entered primarily through a polar opening and was reflected earthward. This altered illumination geometry would invert the direction of light delivery, producing the effect described in the Egyptian account. The Herodotus record thus represents a rare, ancient, non-symbolic dataset with potential astrophysical implications. It describes a repeated, global-scale phenomenon that signifies the existence of a past super-puff phase in Earth’s history. When interpreted through the lens of the cometary shell hypothesis, this observational account offers a compelling line of inquiry into the episodic formation of super-puff planetary states, extending the framework of exoplanetary science to include potential transient states within our own solar system.

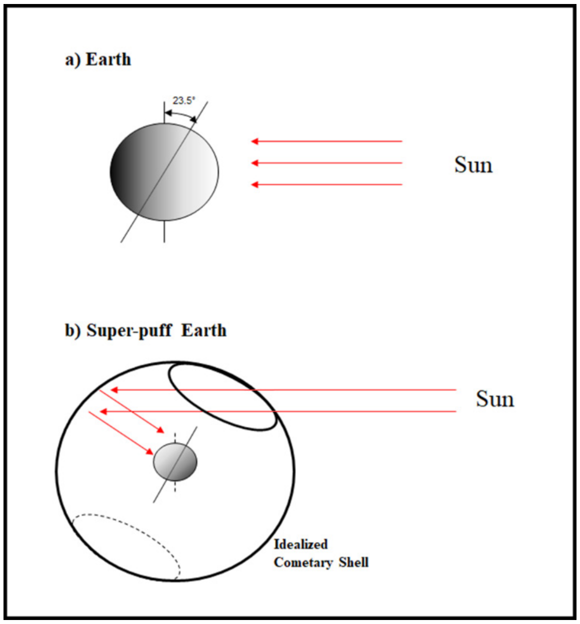

Figure 6: Comparative visualization of illumination dynamics on a standard Earth versus a shelled (super-puff) Earth, highlighting how a cometary shell could reverse the perceived direction of incoming sunlight. Source: reprinted from, used with permission [15].

Moving from ancient texts to planetary signatures of the cometary shell that science can detect, we come across a key planetary signature: the glacial–interglacial cycle, which spans hundreds of thousands of years before present (BP) [28]. These climate variations are currently understood as resulting from shifts in Earth's orbit that alter the amount of solar radiation the planet receives [29-31]. A defining feature of this cycle is its regularity. Each glacial period typically lasts around 85,000 years, followed by an interglacial period of about 15,000 years, forming a roughly 100,000-year cycle. With detailed scientific records covering the last eight such cycles, and with the most recent glacial period ending between 12,000 and 18,000 years ago, the current interglacial period is statistically nearing the end of its typical lifespan and may soon transition into the next glacial phase [28].

Importantly, the shift between glacial and interglacial states is not a single, abrupt event. Instead, the transition phase involves multiple fluctuations before stabilizing and settling into either glacial, or interglacial phase. Using the time scale of kiloannum (ka), where 'before present' (BP) is defined relative to the year 1950 as "present", the last transition produced globally detectable signals, reflected in distinct climatic phases: the Older Dryas (18–14.7 ka BP), the Bølling/Allerød (14.7–12.9 ka BP), the Younger Dryas (12.9–11.7 ka BP), and the Holocene (11.7 ka BP to present) [32]. Egyptian records transmitted through Herodotus closely align with this transitional periods [15].

Scientific data confirm that during the Bølling/Allerød and the Holocene, the sun rose in the east, as expected. However, the Egyptian account uniquely reports four reversals in sunrise and sunset direction: two eastward and two westward, with interleaving normal sunlight. This suggests that during phases like the Older Dryas and Younger Dryas, Earth may have existed in a "shelled" super-puff state. The timing of these reversals, as described by Egyptian sources, correlates well with scientifically established climatic transitions [15].

Without the Egyptian record—specifically the testimony of a high priest conveyed to Herodotus—modern science might never have considered the possibility that Earth could have existed as a super-puff planet in the past or might become one in the future. Yet the reverse is also true: without recent advances in exoplanetary science, particularly the discovery of super-puff planets, religious scholars would lack the conceptual tools to recognize these ancient descriptions as empirical observations of a super-puff Earth. The emergence of the super-puff planet model has transformed the interpretive landscape. It invites both scientific and religious reconsideration of the ancient Egyptian report describing four reversals in the sun's rising and setting direction over the last 13,740 years.

4. Ancient Observation of Super-puff Earth

The Egyptian account of interest comes from a high priest's statement to Herodotus around 450 BC. This exchange suggests that the information may have originated in a now-lost sacred or priestly text. The content, a claimed reversal in the direction of sunrise and sunset, is striking, as such an event would represent a global-scale observational phenomenon. This raises a critical question: is a similar reversal recorded in any surviving sacred text? This article focuses specifically on Genesis 1 to explore that possibility.

From a planetary lighting perspective, the difference between today's Earth and an Earth surrounded by a cometary shell—a "super-puff Earth"—is dramatic. On a regular planet, the sunlit hemisphere experiences day, while the opposite hemisphere is in night. However, when a planetary shell blocks direct sunlight except at the poles, the lighting regime is transformed. The region previously exposed to sunlight becomes dark (a form of "shell-induced night"), while light entering through the shell's polar opening diffusely reflects from the inner wall of the cometary shell, illuminating the hemisphere that without the cometary shell would experience "night." In this condition, what was formerly the night side of the planet becomes the day side (see Figure 6).

How would the observers on a shelled planet would model their experience of this transition? There are two modeling approaches:

1. The model can represent a reversal in the direction of sunrise and sunset; or
2. The model can focus on the transformation in which night becomes day.

Both modeling frameworks attempt to capture the same physical transition, namely the planet not receiving direct but indirect solar illumination. The only difference is that they do so through different conceptual lenses. The first emphasizes directional inversion; the second, a shift in the meaning of day and night. Each has its own interpretive strengths. The directional model captures the observational shock of the reversal, while the day/night transition model may better reflect the broader redefinition of planetary lighting conditions under a shell.

Historically, the Egyptian priest adopted the first model—reporting four instances of sunrise/sunset reversal over an 11,340-year period. This directional framing assumes a known baseline, namely regular Earth, and highlights the strangeness of a new condition, namely the super-puff Earth. In contrast, the Genesis 1 account uses a repeated phrasing—" *So there was an evening, and there was a morning, day [number]*"—which has traditionally been seen as either poetic structure or symbolic marking of creation epochs. However, viewed through the super-puff Earth lens, this sequence describes a phenomenological inversion of the usual lighting cycle.

Thus, in both texts, as depicted in Figure 7, we see hybrid frameworks, each blending regular Earth assumptions with super-puff conditions. The Egyptian model links unreversed light with normalcy and reversed light with the anomaly. Similarly, Genesis references "evening" and "morning" using standard regular-Earth temporal markers but redefines their relationship by labeling the span from evening to morning as "a day," contrary to expectations under regular Earth lighting. In these "mixed planet" frameworks, the Genesis account is less straightforward than the Egyptian model. Perhaps the recurring refrain in Genesis 1 serves less to highlight the reversal of sunrise and sunset, and more to draw attention to the material between the refrains, a signal that the narrative is not describing the regular Earth, but something fundamentally different. The Genesis account, then, is more encoded than the Egyptian record. The repeated refrains may not aim to emphasize the inversion per se but to draw attention to what unfolds between these refrains, possibly signaling that the environment described is not the regular Earth.

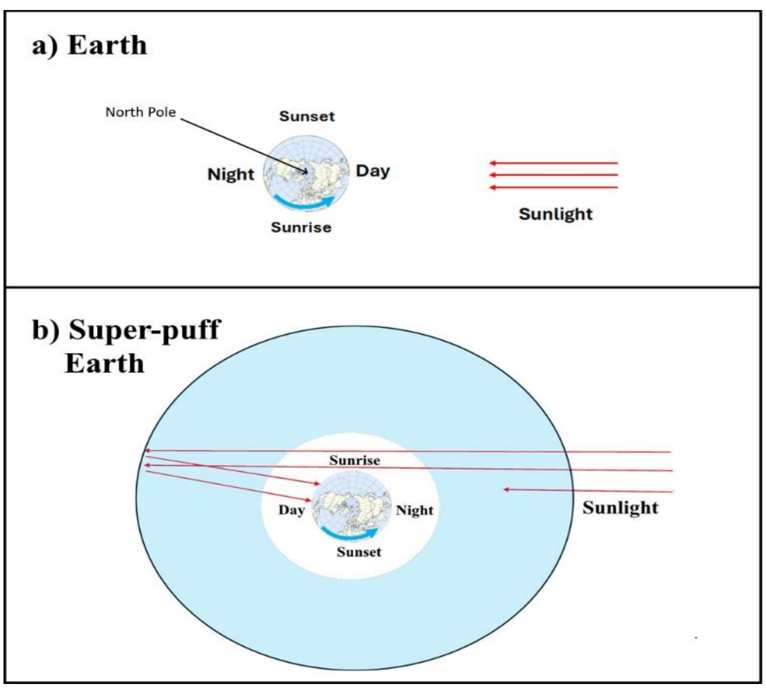

Figure 7: This diagram provides a polar perspective on how Earth's rotation and lighting differ under normal and shelled conditions. On a regular Earth, sunlight directly strikes the planetary surface, creating standard day/night cycles. In a shelled state, direct sunlight is blocked by the shell (shown in blue), except through a polar opening (white circle). Light entering this opening is reflected from the shell's inner surface, creating indirect illumination. The arrow indicates Earth's rotation direction, helping contrast the sunrise/sunset dynamics between the two models.

Prior to the super-puff Earth hypothesis, there were three scholarly views on understanding the meaning of the days of creation in Genesis 1. They are: 24-hour day, day-age, and framework [33]. The 24-hour view holds that what we have are six sequential natural days marked by evenings and mornings. The day-age takes the position that the day represents not 24 hours, but six sequential ages of unspecified duration. The framework view holds that the days are figurative, topical and not sequential. The supporters of this line of reasoning also add that "there is little, if any, scriptural evidence to support them" [34]. Following this interpretive pattern, Walton (2011) takes the position that the Genesis creation account is only about the "functions" of the cosmos, and thus has nothing to do with the material origins [35]. He believes that there are no objects in creation activity but only functions. This view asserts that Genesis 1 should be understood in terms of liturgical functions of worship than historical and material origins of the cosmos. The knowledge of the super-puff Earth challenges this assumption. Ancient humans not only possessed a material understanding of their cosmic environment, but also developed models and organizational transmission systems capable of preserving that knowledge across millennia. This prompts a deeper question: how should we define the interface between science and religion?

5. Dimensional Analysis of Science-Religion Interface

The super-puff Earth hypothesis presents a striking point of intersection between the domains of science and religion. But what does this still nascent, yet emergent, interface actually signify within today's established domains of science and religion? Is it merely a small, inconsequential island in the vast ocean of science–religion conflict? Or is it a kind of intellectual virus—one capable of rewriting the genetic code of both traditions, potentially leading to deeper integration? In this section, we address these questions of opposition versus integration by introducing a seven-dimension, three-group (7D3G) model that systematically organizes the relationship between planetary science and ancient sacred texts. In this model, certain strands of the sacred texts are considered as potential repositories of observational data about the super-puff state of Earth. Using this model, we first demonstrate that planetary scientists can no longer dismiss sacred texts as irrelevant or purely symbolic. Some ancient records encode non-inventable signatures of large-scale physical phenomena, such as global illumination patterns, that are only scientifically plausible if the Earth were once surrounded by a cometary shell. When these ancient accounts align with the modern scientific model of a super-puff Earth, they not only broaden the empirical field but also introduce philosophical and ethical questions tied to planetary-scale transformations.

The proposed model equips both planetary scientists and religion scholars with a structured framework for evaluating sacred texts as long-duration, supplementary datasets that can inform and enrich both domains. In the following we examine each of the seven dimensions individually, exploring their features and how they operate in both the religious and scientific spheres. We then group the dimensions into three categories to provide a composite view of their mutual influences and boundaries.

The seven dimensions are:

1. Significance
2. Wonder & Awe
3. Origins & Destiny
4. Institutional Systems
5. Order & Underlying Structure
6. Interpretation / Hermeneutics
7. Societal & Ethical

The division of the seven dimensions into three functional groups—motivational foundations (significance, wonder, origins), structural frameworks (institutional systems, underlying order, societal and ethical), and an interpretive gearbox (hermeneutics)—is shown in Figure 8. For planetary scientists, the value of this structure is not its philosophical symmetry but its operational clarity. It identifies precisely where in the epistemic architecture a sacred text may inject meaningful observational constraints and where its contributions must be filtered out. For religion scholars, the same structure clarifies where scriptural narratives can be legitimately read as phenomenological records of lived planetary experience, and where theological, symbolic, or doctrinal interpretations appropriately take precedence, without collapsing either domain into the other.

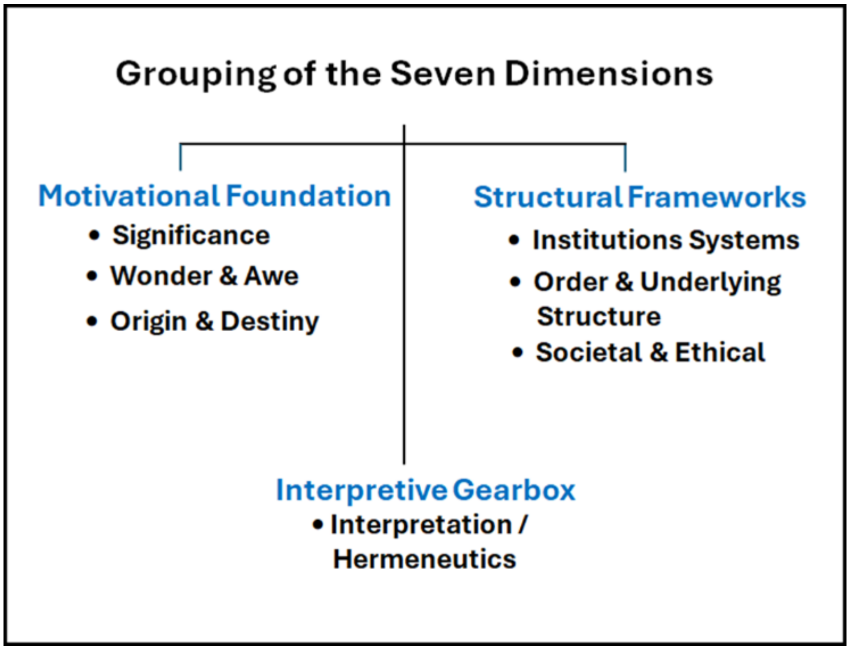

Figure 8: Grouping of dimensions by "Why do we inquire?"—the motivational forces; "How do we govern?"—the systemic architecture that channels inquiry; and "How to assign meaning?—the interpretive dimension.

Dimension 1: The Issue of Significance

Both domains converge on fundamental human concerns and grapple with what is ultimately important. For astrophysics, significance manifests in finding universal structures, understanding planetary habitability, developing a picture of catastrophic risk, and developing good modes of cosmic evolution, all intertwined with humanity's fragility and interconnectedness with physical laws. In contrast, the sacred texts assign significance to narratives of creation, purpose, covenant, and destiny. They claim to serve as repositories of existential and intergenerational meaning. From the perspective of super-puff Earth interface, ancient records (e.g., Genesis refrains, Egyptian sunrise reversal) encode real astrophysical events. They demand that these ancient observations must have significance and that they should be recognized as a form of scientific discovery. While scientists work in the present, the ancient texts are a source that provides deep time continuity to interpretation of astrophysical observations, such as the super-puff Earth. In theory, astrophysics expands sacred significance by placing scriptures in a scientific cosmological frame, and the sacred texts expand astrophysical significance by connecting scientific events to long-term human experiences.

Dimension 2: Individual & Institutional Systems

In both fields, the individual must navigate a vast, institutionalized system which dictates how knowledge/capabilities are developed, shared, and validated. Both science and religion are fields that navigate through large knowledge-production systems. Astrophysical research is embedded in institutions (observatories, NASA/ESA, journals) with peer review determining legitimacy and replication of experimental observations governing credibility. Similarly, in sacred texts, interpretation embedded in religious institutions, seminaries, and canon traditions, and legitimacy is determined by hermeneutical lineage, doctrinal boundaries, and historical context. The super-puff Earth interface challenges both institutional structures by imposing "cross-system interpretation" where science must confront nontraditional datasets in ancient narratives and theology must confront empirical reinterpretation of sacred cosmology. In this setting, each field pressures the other to expand its validation protocols, and both are forced to adapt, slowly but inevitably, when faced with cross-domain evidence.

Dimension 3: Wonder and Awe

Both fields are deeply rooted in the human capacity for wonder when contemplating the immense scale and complexity of existence. Astrophysics encounters awe in physical realities like the sheer size of galaxies and the power of black holes. In sacred texts, scholarship encounters awe in the transcendent thing like the perceived presence of the divine, and the intricate historical survival of ancient wisdom. Invariably, at their core, both fields are rooted in experiences of the sublime. In astrophysics, awe emerges from physical immensity and complexity of galaxies, black holes, and early-universe physics. Such awe is the prime motivator of scientific curiosity. In sacred texts, awe emerges from divine presence, transcendence, and millennia-long textual and institutional survival. There the awe is the motivator of devotion and interpretative depth. From our perspective, we see the cometary-shelled Earth, however vague and incomplete the concept might be, introducing a unified source of awe. Through the religion lens, it is a shelled sky that shapes human myth, cosmology, and survival. Similarly, it is an astrophysical phenomenon that produces both scientific and experiential resonance. In this navigation of awe, science grants wonder to new physical grounding (e.g., describing a planetary shell's origin and structure) while the sacred texts grant wonder through historical continuity—humans experiencing and recording the source that generates this awe.

Dimension 4: The Quest for Origins and Destiny

The origin and destiny is a fundamental inquiry dimension where both religion and science search for where everything comes from and where it is going. Astrophysics seeks to describe the universe's origin through the Big Bang theory and sacred texts scholarship explores creation myths and end-times prophecies. When it comes to the quest for origins and destiny, both science and religion seek to anchor humanity's place in cosmic time. Astrophysics approaches origin through models of Big Bang, stellar evolution, and planetary formation while it places destiny in cosmic expansion, Earth's long-term habitability, and catastrophic events. The sacred texts place the origin in creation accounts and primordial order while seeing destiny in terms of eschatology and moral culmination of history. However minor it might seem, nonetheless, super-puff Earth interface provides a joint origin–destiny narrative: Earth cycles through regular and super-puff versions, and ancient texts record one prior state with astrophysics having the potential to predict the next. Through their integration at the super-puff Earth, science gains an extended human observational record and sacred texts gain empirical anchoring that strengthens the interpretive plausibility of sacred texts.

Dimension 5: Order and Underlying Structure

Both disciplines operate on the premise that there is an underlying order to the universe to be discovered and interpreted by humans. Astrophysics assumes the universe is governed by consistent, discoverable natural laws and sacred texts scholarship posits a divine plan or a moral order embedded in the cosmos and human experience. From the perspective of order and underlying structure, both disciplines assume discoverable entities. Astrophysics places its trust in mathematical regularities and natural laws like gravity, thermodynamics, and orbital mechanics, seeing them as models that provide unified explanations of phenomena like super-puff planets. The pattern of trust of sacred texts relies on moral, cosmic, and narrative order that comes from divine law, covenantal structure, and narrative cycles. In this, order is perceived in the structure of creation.

The super-puff Earth interface becomes a bridge between the two disciplines' views on order and structure. Scientifically, it is a gravitationally organized debris shell. Textually, it can be a firmament, a structured dome, or ordered heavens. In their interaction through super-puff Earth, each domain forces the other to expand what "order" can mean. For science, order now may include human experience and myth as observational data. For sacred texts, order may now reflect physical astrophysical structure.

Dimension 6: Interpretation (Hermeneutics)

Both fields require interpretative frameworks to bridge raw data with human understanding. Astrophysics bridges theory and reality through modeling, interpreting data points like the "super-puff" data. through mathematical and physical models. Sacred texts scholarship is an explicit field of hermeneutics, grappling with layers of meaning, and historical context. The interpretative frameworks translate raw data into meaning. Astrophysics interprets observational uncertainties, noise, and anomalies in the process of building scientific models. In effect, "super-puff Earth " itself is an interpretive construct. In sacred texts there is a constant flow of interpretation of narrative layers, metaphor vs. literal cues, and ancient cultural filters. Scholars of religion apply frameworks like source criticism, canonical criticism, and narrative theology in creating meaning.

In super-puff Earth interface, we see the development of scientific hermeneutics combining with textual hermeneutics to arrive at dual-interpretation models of super-puff Earth. As an example, Genesis' refrain becomes an interpretive pointer toward cometary shell's illumination cycles. In doing so, astrophysics gains hermeneutical tools for ancient observational records and sacred text scholarship gains scientific constraints limiting interpretative drift.

Dimension 7: Societal and Ethical

Both disciplines impact our understanding of human place in the universe and guide behavior. Astrophysics forces a re-evaluation of human place in the cosmos, practically no different than sacred texts scholarship providing core moral frameworks and societal guidance for individuals and their interactions within a community. Without exception, regardless of how science and religion treat their knowledgebase, societal and ethical dimensions find their way into core meanings where both shape humanity's self-understanding and behavior. It is from this angle that astrophysics drives planetary defense, climate understanding, and existential-risk frameworks and seeks to reposition humans as planetary caretakers. Even more intensely, sacred texts provide moral frameworks, community rules, and existential narratives that seek to shape societies through ethical codes rooted in perceived cosmic truth. In the case of super-puff Earth interface, the potentially catastrophic cycles of planet-comet interaction merge with ethical and social stakes to arrive at survival ethics, stewardship of planetary knowledge, and the question of how to prepare future generations for existential conditions. In this process, science broadens ethical responsibility to planetary timescales, and sacred texts broaden scientific responsibility to intergenerational human meaning.

5.1 Key Takeaways

Planetary science is built on a familiar architecture of inquiry: measurable data, physical models, interpretive tools, and scientific concerns on implications for planetary habitability and long-term survival of humankind. The seven-dimension, three-group (7D3G) model presented here shows that sacred texts, when viewed not as theological artifacts but as possible repositories of ancient observational information, fit surprisingly well into the same structural logic. This model provides a systematic framework for evaluating when and how sacred texts may contribute nontraditional but potentially valuable astrophysical data.

The key insight is that a planetary scientist cannot remain entirely within the traditional empirical domain when approaching sacred texts as astrophysical data sources. Doing so would overlook the fact that sacred narratives often encode human responses to large-scale environmental conditions—illumination patterns, canopy effects, atmospheric optics, or abrupt transitions—that may correspond to astrophysical phenomena such as cometary shells, super-puff atmospheres, or catastrophic planet-fragment interactions. These descriptions may not correspond to measurements in the modern sense, yet their non-inventability makes them potentially relevant for hypothesis generation. By non-inventability, we mean that the described phenomena are so specific, large in scale, or observationally complex that they are unlikely to have been fabricated without some empirical basis. The scientist's task, therefore, is not to treat the text as metaphysics, but to determine whether a described phenomenon could only arise from a large-scale physical process.

In this context, the interpretation dimension becomes the central integrator. Just as atmospheric retrieval methods convert noisy spectral signals into physical parameters, hermeneutical methods convert narrative patterns into testable scientific propositions. Without this interpretive layer, the astrophysical relevance of ancient texts cannot be evaluated. With it, the texts become a form of low-resolution but deeply time-extended observational record, something the modern instruments cannot yet replicate. The model also forces an expansion of the scientist's conceptual domain. Once sacred texts are treated as potential data carriers, planetary science inevitably encounters the philosophical and ethical dimensions that accompany them. These dimensions do not replace empirical rigor but enlarge the context of scientific inquiry. They remind us that astrophysical discoveries—especially those that concern existential risks, planetary transitions, or the deep past of Earth's environment—carry profound implications for human societies. Ancient civilizations may have encoded these implications thousands of years ago, not as abstractions but as survival knowledge intended for future generations.

Thus, the value of 7D3G model lies in its ability to make cross-domain inquiry scientifically tractable. It provides planetary scientists with a coherent framework for integrating unconventional data sources, generating novel hypotheses, and recognizing that insights arising from sacred texts may challenge conventional models of Earth's past and future. In doing so, it opens a broader intellectual landscape in which astrophysics, ancient observation, and societal responsibility intersect, a space where new scientific questions emerge and where the planetary sciences may discover unexpected allies in humanity's oldest records. To understand the significance of this integrative potential, we must first examine the current conceptual boundaries that define science and religion as separate realms of inquiry.

6. Dimension Commonality & Possibility of Integration

Before digging further into the super-puff Earth as a point of overlap between sacred texts and planetary science, it is important to examine the dominant frameworks that shape how the science–religion relationship is typically understood. What are the prevailing frameworks that govern discourse on the science–religion relationship? Taliaferro (2025) describes science and religion as fundamentally distinct enterprises: science draws from empirical study of the natural world, while religion addresses questions of metaphysics and transcendence [36]. However, this dichotomy may obscure an important commonality: both domains depend on evidence. The distinction lies in the timing and form of that evidence. Science privileges current, instrument-derived data, while sacred texts encode experiential and observational knowledge acquired in deep antiquity.

Taliaferro supports his distinction by citing critiques that modern science has discredited key religious claims about origins and history. Scriptural narratives like Adam and Eve, Noah's Flood, or the sun standing still for Joshua are considered scientifically untenable. In this framework, sacred texts are seen as incompatible with empirical models of natural phenomena [37,38]. Other researchers offer more nuanced views. Nieminen et al. (2020), for instance, distinguish between experiential evidence in religion and experimental evidence in science, citing Barbour's classic contrast: science relies on repeatability, observational rigor, and falsifiability, whereas religion invokes eyewitness testimony, symbolic narratives, and personal experiences [39]. Dubuisson (2003) extends this view, suggesting that religion cannot yield universally valid knowledge in the way science can [40]. However, Rope Kojonen (2021) pushes back against such hard boundaries, arguing that the flow of knowledge in both domains is more intertwined than generally acknowledged [41].

Some scholars, like da Cruz (2006), suggest that while religious ideas often resist scientific testing, they are not devoid of epistemic value [42]. Saler (2000) proposes that "the sacred" becomes scientifically tractable once its knowledge content becomes clear [43]. Yerkes (1998) emphasizes that both science and religion build knowledge structures through iterative construction, combining both deductive and experiential elements [44]. Similarly, Cho and Squier (2008) argue that imprecise concepts exist in both domains, and that both science and religion wrestle with methodological limits [45]. Lee (2019) notes that the metaphors and models used to bridge the two often obscure key differences in how each field conceptualizes knowledge [46]. Despite these efforts, a prevailing sense of conflict between science and religion persists—particularly the view that religion obstructs scientific progress [47-49]. Yet others, such as Jordan (2023), adopt a more integrative stance, suggesting that, given time, the shared human pursuit of knowledge gradually bridges the two domains [50]. In his view, the epistemic expansion achieved through science may ultimately illuminate religious insights regarding the natural order.

This article, however, adopts a more focused and pragmatic approach. Rather than exploring institutional relationships between science and religion, we examine whether a shared observational object—in this case, the super-puff planet—might serve as a point of convergence. We propose that sacred texts contain records of Earth in a super-puff state, analogous to those detected among exoplanets. This is not an astrobiological, theological, or anthropological claim (contra Peters 2025) [51]. It is a planetary science hypothesis that two observational streams—modern astrophysical data and ancient sky-watching traditions—may converge in describing the same class of planetary phenomena. From this standpoint, the interface between sacred texts and scientific observation is not metaphorical or symbolic, but empirical. Super-puff planets represent a category in which the observational domains of modern astrophysics and ancient record-keeping may overlap. Our focus is strictly on analyzing the astrophysical content embedded in specific ancient observations and comparing it with the physical mechanisms proposed for super-puff planets, particularly those related to cometary shell formation

6.1 Other Interpretations

While science, using its knowledge of exoplanets, can arrive at the conclusion that the sunrise and sunset reversals observed by Egyptians point at a super-puff Earth hypothesis, that was not the case prior to the knowledge of the super-puff planets. Prior to the knowledge of super-puff planets, the interpretation of the Egyptian observations remained within the boundaries of philological skepticism and textual historiography and did not enter the domain of scientific analysis. The Egyptian account was not treated as an observation rooted in physical experience, but one that is shaped by the vagaries of oral transmission, cultural memory, or literary embellishment. Anderson (2015) frames Herodotus's report as simply relaying conversations with Egyptian priests, implying the historian's detached role in transmitting inherited lore without verification [52]. Lloyd (1988) similarly proposes that the Egyptian sources themselves lacked a firm grasp of their own distant past, and Herodotus recorded the account out of a sense of documentary obligation [53]. Heidel (1935) goes further, stating, "[one] need not be very acute to perceive that we have here another instance of carelessness or want of understanding" [54]. These views exemplify an interpretive stance that defaults to disbelief, not because of an understanding that the event described contradicts physical laws, but because it is seen to fall outside the accepted boundaries of textual coherence and historical credibility. However, the recent research on super-puff planets has provided a fresh framework for reevaluating the ancient report of the four sunrise and sunset reversals over the past 13,740 years BP, offering new scientific, and as shown in this article, religious insights.

A similar shift is now occurring in how the Earth's glacial–interglacial cycle is being conceptualized. Prior to the recognition of super-puff planets and their relevance to Earth, scientific models of glacial–interglacial variation were based on the assumption that changes in Earth's orbit altered the amount of solar radiation the planet receives, thereby driving long-term climate cycles that were categorized as the glacial-interglacial cycle [29-31]. When models are based solely on the regular Earth—without consideration of the super-puff state—glacial Earth is treated as merely a colder version of interglacial Earth, characterized by larger and more extensive ice sheets. Within this framework, studies have shown that human-driven global warming could delay the onset of the next glacial period by tens of thousands of years, implying that the next glacial–interglacial transition is a distant concern [55-59].

However, incorporating both the super-puff planet model and sacred texts as sources of knowledge offers a radically different astrophysical perspective, one in which glacial Earth is not just a colder version of today's planet but a structurally different, shelled Earth. In this new paradigm, global warming does not provide a meaningful delay mechanism for the return of glacial Earth, because the transition is not governed solely by atmospheric composition but by external factors, such as Earth's passage through a cometary fragment chain. Given that, on average, the last glacial–interglacial transition occurred approximately 15,000 years ago, this model suggests that regular Earth is now approaching the end of its current interglacial state and is positioned at the threshold of another major planetary transformation, thus the need for detailed analysis and understanding of super-puff Earth.

In this context, we must reconsider long-held scientific expectations. When we hear voices like Anderson, Lloyd, and Heidel that dismiss Egyptian observations of sunrise and sunset reversal, or sources like Berger and Loutre, who predict an exceptionally long interglacial period with no imminent glacial return, we are reminded of how easy it is to dismiss unfamiliar sources of data [52-55]. Their conclusions reflect models that do not account for Earth's super-puff state and its observational legacy in sacred texts. Just as glacial Earth was long assumed to be a mere variant of interglacial Earth—until the super-puff model revealed it to be fundamentally different—so too might certain strands of sacred text appear insignificant until we recognize their potential as symbolic repositories of astrophysical observation. The challenge now lies in reexamining these texts with fresh eyes, open to the possibility that they encode empirical knowledge relevant to planetary science.

7. Conclusion

This article has proposed a grounded interface between science and religion anchored in the emerging knowledge of super-puff planets. It offers a new lens through which biblical cosmology can be read, not merely as metaphor or myth, but as a repository of encoded observational memory reflecting Earth's radically different cosmic state in the past. This perspective contributes to constructive theology by advancing a reinterpretation of Genesis that is materially informed without being literalist. An interpretation that affirms both the integrity of ancient texts and the rigor of modern science, drawing them into a mutually enriching conversation.

Our focus has been on the recurring Genesis refrain—"And there was evening, and there was morning, the first [second, etc.] day"—

interpreting it as a model derived from the observed reversal of sunrise and sunset during Earth's super-puff state. We suggest, however, that Genesis likely contains multiple additional models and layers of encoded information about the super-puff Earth. Due to space constraints and the introductory nature of this article, we leave exploration of those elements for future work. By reframing this scriptural language in light of planetary science, we challenge unexamined philosophical assumptions embedded in both theology and cosmology. This kind of inquiry reflects the self-correcting spirit that both traditions claim to value. Rather than simply reacting to science, theology here engages it as a generative partner, reimagining its foundational texts while offering science a new source of insight into Earth's potential states, preserved in the oldest human efforts to transmit existentially significant knowledge.

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