https://doi.org/10.65166/ntw6fc81

Journal of Frontier Science and Futures
Volume I, Issue 1, July 2026
https://journal.ijhba.com/index.php/jfsf
https://slsipress.com

Editorial

Disciplined Imagination at the Frontiers of Science

Dr. William Dela Cruz[1]

[1]Austin Independent School District, United States

Abstract

The inaugural issue of *Frontier Science and Futures* brings together ten articles examining scientific questions situated at the boundaries of established knowledge, technological possibility, human adaptation, and speculative inquiry. The contributions address planetary mythology, quantum mechanics, geohazards, interstellar exploration, quantum entanglement, spaceflight-associated mitochondrial dysfunction, Mach-effect propulsion, psychological sustainability during long-duration missions, extended-reality learning, and the epistemological role of unseen entities in scientific explanation. Although these subjects differ in disciplinary orientation and evidentiary maturity, they share a concern with how science responds to phenomena that are difficult to observe, explain, predict, or operationalize. This editorial argues that frontier scholarship requires a balance between imagination and methodological restraint. Speculative models, emerging technologies, and unconventional hypotheses can contribute to scientific advancement when their evidentiary status is clearly identified and when conceptual possibility is not presented as empirical confirmation. The articles in this issue collectively demonstrate that scientific frontiers are not defined solely by novelty. They are defined by the disciplined examination of uncertainty, the integration of knowledge across fields, and the willingness to distinguish established findings, provisional interpretations, and future-oriented possibilities.

Keywords: *frontier science; futures studies; quantum science; space exploration; scientific inference; emerging technologies; geohazards; interdisciplinary research.*

The establishment of Frontier Science and Futures reflects a central characteristic of scientific inquiry: knowledge advances by moving toward questions that remain incompletely answered. Scientific frontiers emerge wherever existing explanations encounter anomalies, measurements reveal unresolved patterns, technologies create previously inaccessible environments, or new theoretical frameworks challenge conventional assumptions.

Frontier research, however, is not synonymous with unrestricted speculation. Its value depends on the disciplined treatment of uncertainty. A proposition may be historically influential without being scientifically validated. A mechanism may be theoretically conceivable without being experimentally demonstrated. A technology may be promising without yet being operationally feasible. A conceptual framework may be useful even when some of its components remain beyond current empirical verification.

The ten articles in the inaugural issue occupy different positions along this continuum. Some examine well-established experimental phenomena, such as quantum interference and entanglement. Others synthesize emerging biomedical, psychological, and educational research. Several consider future-oriented technologies and exploratory

frameworks whose feasibility remains uncertain. One investigates the historical transformation of a planetary narrative from astronomical conjecture into contemporary digital mythology. Another examines how scientists reason about entities that cannot be observed directly but may nevertheless be inferred from their explanatory consequences.

Collectively, these contributions establish an appropriate intellectual foundation for a journal concerned with both science and futures. They demonstrate that inquiry at the frontier requires not only imagination but also epistemic clarity: a clear distinction among evidence, interpretation, hypothesis, analogy, extrapolation, and myth.

Planetary Narratives, Scientific History, and Digital Cosmology

"Planetary Myth in the Digital Age: Tracing the Maldek Narrative from 18th-Century Astronomy to Viral Cosmology," by Ramon George O. Atento, Andrea Gwyneth Atento, and Leah F. Quinto, examines the historical development and digital circulation of the Maldek narrative. The subject occupies an unusual intersection of astronomy, intellectual history, mythology, and contemporary media culture.

The idea of a missing or destroyed planet between Mars and Jupiter has appeared in various forms since early attempts to explain the numerical spacing of planetary orbits and the later discovery of the asteroid belt. Although modern planetary science does not recognize Maldek as an established astronomical body, the narrative has persisted within esoteric traditions and, more recently, within online cosmological discourse.

The article's significance lies not in treating the Maldek story as established planetary history but in examining how scientific conjectures can be transformed into cultural narratives. Ideas may migrate from preliminary scientific hypotheses into popular mythology, where their evidentiary limitations are gradually obscured. Digital platforms accelerate this process by allowing speculative claims to be reproduced, simplified, and detached from their historical origins.

This inquiry therefore contributes to scientific literacy. It demonstrates the importance of distinguishing between the history of an idea and the empirical validity of the idea itself. It also reveals how contemporary cosmological myths can acquire authority through repetition, visual representation, and algorithmically amplified circulation rather than through scientific verification (Atento et al., 2026a).

Quantum Strangeness and the Limits of Classical Intuition

Two articles address foundational and emerging questions in quantum science.

"The Double-Slit Experiment: Two Centuries of Confirmed Strangeness, Frontier Advances, and the Future of Quantum Science," by Ramon George Atento, revisits one of the most influential experimental arrangements in modern physics. The double-slit experiment occupies a central position in the history of wave theory and quantum mechanics because it demonstrates interference behavior that cannot be adequately explained through ordinary classical intuitions about localized particles.

The experiment's enduring importance arises from the relationship among measurement, probability, interference, and physical description. Variations of the experiment have been conducted using photons, electrons, atoms, and increasingly complex systems. These experiments have strengthened the empirical foundations of quantum theory while continuing to generate debate regarding interpretation.

The article situates the experiment within both its historical development and its continuing scientific relevance. It reminds readers that the strangeness of quantum mechanics is not based merely on philosophical imagination. It is grounded in reproducible experimental patterns. Interpretations may differ, but the empirical phenomena requiring interpretation remain scientifically established (Atento, 2026a).

A related contribution, "From 'Spooky Action' to Scalable Resource: A State-of-the-Field Thematic Review of Quantum Entanglement Science, 2015–2025," also by Ramon George Atento, examines the development of entanglement from a foundational puzzle into a potential technological resource.

Quantum entanglement once appeared primarily as a challenge to classical conceptions of locality, separability, and physical realism. Contemporary research increasingly examines its practical relevance to quantum communication, distributed quantum systems, sensing, computation, cryptography, and network architecture. The

transition from conceptual paradox to technological resource is one of the defining developments of modern quantum science.

Nevertheless, scalability remains a major challenge. Laboratory demonstrations do not automatically translate into stable, affordable, and widely deployable systems. Decoherence, error correction, transmission loss, environmental control, interoperability, and engineering complexity continue to shape the field's development. By reviewing research from 2015 to 2025, the article presents entanglement as both an established physical phenomenon and an emerging technological capability whose long-term applications remain under development (Atento, 2026b).

Together, these two articles illustrate an important principle of frontier science: conceptual strangeness does not imply scientific weakness when the underlying phenomena are repeatedly supported by experiment. At the same time, experimental confirmation of a phenomenon should not be confused with the immediate feasibility of every technology proposed on its basis.

Geohazards, Systems Integration, and National Preparedness

"From Myth to Metric: Apolaki Caldera, Compounding Geohazards, and the Case for an Integrated Early Warning Framework in the Philippines," by Ramon George Atento, Leah F. Quinto, and Cherry Ann Marie Espelita, shifts the issue's focus from cosmic and quantum scales to terrestrial risk.

The Apolaki Caldera has attracted scientific and public interest because of its scale and location within a geologically active region. Discussions of large geological formations can easily become sensationalized, particularly when scientific terminology is interpreted without adequate attention to geological timescales, current activity, measurement limitations, and hazard probability.

The article advances a more policy-relevant approach by emphasizing the transition from dramatic narrative to measurable risk. Its focus on compounding geohazards recognizes that disasters rarely emerge from isolated variables. Seismic activity, volcanic processes, submarine landslides, tsunami exposure, infrastructure vulnerability, population concentration, communication failures, and institutional coordination may interact in ways that amplify consequences.

An integrated early warning framework must therefore connect scientific monitoring with governance, communication, community preparedness, emergency logistics, and interagency decision-making. The contribution is especially relevant to the Philippines, where exposure to multiple natural hazards requires systems capable of integrating diverse forms of information rather than treating each hazard independently (Atento et al., 2026b).

Interstellar Exploration and the Architecture of Autonomy

"Ariadne's Thread in Deep Space: A Conceptual Framework for AI-Driven, Self-Sustaining, and Communication-Anchored Interstellar Exploration," by Ramon George Atento and Leah F. Quinto, considers the organizational and technological requirements of exploration beyond the immediate limits of human spaceflight.

Interstellar missions would confront distances and communication delays that make continuous Earth-based control impractical. Any credible long-duration architecture must therefore include high levels of autonomy, fault detection, adaptive decision-making, resource conservation, maintenance capacity, and communication resilience.

The article's use of Ariadne's thread as a conceptual metaphor is particularly appropriate. In the classical myth, the thread preserves orientation within a complex and dangerous environment. In deep-space exploration, communication systems may serve a comparable function by maintaining informational continuity among spacecraft, autonomous systems, mission archives, and human operators.

Artificial intelligence could assist in navigation, anomaly detection, scientific prioritization, repair planning, resource allocation, and mission adaptation. Yet autonomy also introduces significant governance questions. An AI system operating far from Earth would need clear decision boundaries, verifiable objectives, redundancy, and mechanisms for resolving conflict among competing mission priorities.

The framework should therefore be understood as a conceptual architecture rather than a claim that interstellar exploration is presently achievable. Its contribution lies in identifying the systems-level requirements that future

mission designers would need to address if exploration were to extend across extreme distances and timescales (Atento & Quinto, 2026).

Biology and Psychology Beyond Earth

Two articles examine the human consequences of prolonged exposure to space environments.

"Mitochondrial Dysfunction as a Convergent Mechanism in Spaceflight-Associated Pathology: Implications for Countermeasure Development," by Leah F. Quinto, Ramon George Atento, William Dela Cruz, Joel Morcilla, and Charmaine O. Castañeda, examines mitochondrial dysfunction as a possible unifying mechanism across multiple physiological effects associated with spaceflight.

Space environments expose the human body to microgravity, radiation, altered circadian rhythms, confinement, stress, and changes in physical activity. These conditions may affect cardiovascular regulation, muscle mass, bone density, immune function, metabolism, oxidative balance, and neurological processes. The article's focus on mitochondria is significant because mitochondrial function is closely related to energy production, cellular signaling, oxidative stress, apoptosis, and tissue adaptation.

A convergent-mechanism perspective may help researchers move beyond treating each spaceflight-associated condition as an entirely separate problem. If mitochondrial disruption contributes to multiple pathological pathways, then interventions targeting mitochondrial resilience may have broader protective potential. However, countermeasure development will require careful experimental validation, dose-response analysis, biomarker identification, and differentiation among short-duration, long-duration, and deep-space exposures (Quinto et al., 2026).

"The Psychology of Distance: Isolation, Confinement, and Psychological Sustainability in Space Analogs and Long-Duration Missions," by Ramon George Atento, addresses the behavioral and psychological dimensions of extended missions.

Distance in space is not merely geographical. It changes the structure of communication, support, authority, privacy, conflict management, and perceived rescue possibility. Crews operating under conditions of isolation and confinement may experience stressors related to monotony, restricted social contact, limited environmental variation, workload, disrupted sleep, interpersonal tension, and delayed communication.

The concept of psychological sustainability is therefore more comprehensive than the absence of diagnosable illness. It concerns whether individuals and teams can maintain judgment, motivation, emotional regulation, cooperation, and mission effectiveness over extended periods.

Research conducted in Antarctic stations, undersea habitats, isolation chambers, simulated spacecraft, and other space analogs provides important evidence, although no terrestrial analog can reproduce every feature of an actual deep-space mission. The article highlights the need to integrate crew selection, habitat design, communication protocols, behavioral support, autonomy, leadership structures, and conflict-management systems into mission planning (Atento, 2026c).

Together, the biological and psychological contributions demonstrate that human space exploration cannot be treated as an engineering problem alone. Mission feasibility depends on the sustainability of the human organism and the human group.

Propulsion at the Boundary of Theory and Demonstration

"From Crystals to the Cosmos: A Theoretical, Material, and Futures Assessment of Mach-Effect Propulsion," by Ramon George Atento and Andrea Gwyneth Atento, examines one of the more contested areas represented in the issue.

Mach-effect propulsion proposes that transient variations in inertial mass might be produced under specific conditions and potentially used to generate propulsive effects without conventional reaction mass. The concept has attracted interest because, if validated and scalable, it could have significant implications for space propulsion. However, the mechanism remains scientifically disputed, and reported experimental effects require independent replication, rigorous error analysis, and exclusion of conventional explanations.

The article's combination of theoretical, material, and futures perspectives is appropriate for a subject whose long-term significance depends on unresolved empirical questions. Material properties, piezoelectric behavior, resonance, thermal effects, electromagnetic interactions, vibration, measurement sensitivity, and experimental design all influence the interpretation of reported results.

In this context, futures assessment should remain conditional. It is reasonable to examine the consequences of a technology if its underlying mechanism were validated, but such examination must not be mistaken for evidence that validation has already occurred. The article therefore occupies an important place in the inaugural issue by demonstrating how a journal of frontier science should approach controversial technologies: with openness to investigation, but without relaxing the standards of reproducibility and evidentiary scrutiny (Atento & Atento, 2026).

Extended Reality, Presence, and Learning

"Presence, Cognitive Load, and Learning in Extended Reality: A Thematic Analytical Review," by Ramon George Atento, Leah F. Quinto, Andrea Gwyneth Atento, Victor Jolo Maranan, and Charmaine O. Castaneda, examines the educational implications of extended-reality environments.

Extended reality encompasses virtual, augmented, and mixed-reality technologies that alter how learners interact with information, environments, simulations, and other participants. One of the field's central concepts is presence: the subjective experience of being situated within a mediated environment.

Presence may enhance attention, emotional involvement, spatial understanding, and experiential learning. However, greater immersion does not necessarily produce better learning. Highly complex or stimulating environments may increase extraneous cognitive load, distract from instructional objectives, or overwhelm learners with unnecessary sensory information.

The relationship among presence, cognitive load, and learning is therefore not linear. Effective extended-reality design requires alignment among technological features, learner characteristics, instructional goals, task complexity, assessment methods, and accessibility requirements. The article contributes to a more measured understanding of immersive learning by resisting technological determinism. Extended reality is not inherently superior to conventional instruction; its value depends on pedagogical design and contextual appropriateness (Atento et al., 2026c).

Unseen Entities and the Logic of Scientific Inference

The issue concludes conceptually with "What Fills the Missing Equation? Unseen Entities, Scientific Inference, and the Search for Order," by Ramon George Atento.

Science frequently reasons from observable effects to entities or mechanisms that cannot be directly observed. Historical examples include atoms before direct imaging, microorganisms before adequate microscopy, planets inferred from orbital perturbations, and subatomic particles inferred from tracks, decay products, or statistical signatures.

Such inference is indispensable, but it is also vulnerable to error. An unexplained observation does not guarantee that the proposed unseen entity is real. Competing explanations may fit the same evidence, measurements may be incomplete, and theoretical assumptions may shape what investigators expect to find.

The scientific legitimacy of an unseen entity therefore depends on more than its ability to fill a conceptual gap. Stronger justification arises when a hypothesis explains multiple observations, generates novel predictions, survives attempts at falsification, remains consistent with established evidence, and outperforms alternative explanations.

This article provides an epistemological framework that connects many contributions in the issue. Quantum states, planetary histories, geological structures, deep-space architectures, physiological mechanisms, psychological risks, and proposed propulsion effects all involve forms of inference. What distinguishes scientific inference from unconstrained speculation is not the visibility of the proposed entity but the quality of the evidence and reasoning supporting it (Atento, 2026d).

Establishing the Journal's Intellectual Direction

The inaugural issue establishes *Frontier Science and Futures* as a venue for scholarship that crosses disciplinary boundaries and examines phenomena at different levels of evidentiary maturity. This breadth is intellectually productive, but it also creates a responsibility to identify the status of each claim.

Established experimental findings should be distinguished from interpretive debates. Emerging technologies should be differentiated from mature applications. Conceptual frameworks should be identified as frameworks rather than validated systems. Historical myths should be analyzed without being converted into scientific facts. Controversial hypotheses should be examined without being prematurely endorsed or dismissed.

The journal's role is not to promote novelty for its own sake. Its role is to create a scholarly environment in which unconventional questions can be investigated using transparent reasoning, appropriate evidence, methodological discipline, and critical dialogue.

The articles in Volume 1, Number 1 suggest three commitments for the journal's continuing development.

First, frontier inquiry must remain interdisciplinary. The most consequential scientific problems increasingly cross the boundaries of physics, biology, psychology, engineering, education, information science, governance, and philosophy.

Second, futures thinking must remain conditional and evidence-sensitive. Exploring what may become possible is valuable, but the path from possibility to feasibility, and from feasibility to implementation, must be explicitly examined.

Third, scientific imagination must be disciplined by epistemic humility. Researchers should remain open to new explanations while recognizing uncertainty, methodological limitations, and the possibility of error.

The Editorial Board extends its appreciation to the authors, reviewers, editors, and publication personnel who contributed to the establishment of *Frontier Science and Futures*. Their work has made possible an inaugural issue that ranges from the historical construction of planetary myths to the technological and human requirements of interstellar exploration.

Volume 1, Number 1 represents an invitation to investigate what lies beyond current explanatory, technological, and disciplinary boundaries. The future of science will depend not only on asking bolder questions but also on developing better methods for determining which answers deserve to be believed.

References

Atento, R. G. (2026a). The double-slit experiment: Two centuries of confirmed strangeness, frontier advances, and the future of quantum science. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/d9wm1y40

Atento, R. G. (2026b). From "spooky action" to scalable resource: A state-of-the-field thematic review of quantum entanglement science, 2015–2025. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/se20ge78

Atento, R. G. (2026c). The psychology of distance: Isolation, confinement, and psychological sustainability in space analogs and long-duration missions. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/1z6bd817

Atento, R. G. (2026d). What fills the missing equation? Unseen entities, scientific inference, and the search for order. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/a2pvvr92

Atento, R. G., & Atento, A. G. (2026). From crystals to the cosmos: A theoretical, material, and futures assessment of Mach-effect propulsion. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/pfav8b78

Atento, R. G., & Quinto, L. F. (2026). Ariadne's thread in deep space: A conceptual framework for AI-driven, self-sustaining, and communication-anchored interstellar exploration. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/w703kr86

Atento, R. G., Quinto, L. F., & Espelita, C. A. M. (2026). From myth to metric: Apolaki Caldera, compounding geohazards, and the case for an integrated early warning framework in the Philippines. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/zv9wg323

Atento, R. G., Quinto, L. F., Atento, A. G., Maranan, V. J., & Castaneda, C. O. (2026). Presence, cognitive load, and learning in extended reality: A thematic analytical review. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/ss92y378

Atento, R. G. O., Atento, A. G., & Quinto, L. F. (2026). Planetary myth in the digital age: Tracing the Maldek narrative from 18th-century astronomy to viral cosmology. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/tp425r71

Quinto, L. F., Atento, R. G., Dela Cruz, W., Morcilla, J., & Castañeda, C. O. (2026). Mitochondrial dysfunction as a convergent mechanism in spaceflight-associated pathology: Implications for countermeasure development. *Frontier Science and Futures, 1*(1). https://doi.org/10.65166/ty692t56