On the Inherent Limitations of Physical Laws in Explaining Origins: A Foundational Critique of Modern Science

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Abstract

Modern physical theories excel at describing the evolution of physical systems through well-defined mathematical laws. However, these laws fundamentally presuppose initial conditions and a structure of observables that they do not themselves explain. In this paper, we argue that current science—while successful in predicting and manipulating nature—is inherently incapable of addressing the question of origins: the origin of the cosmos, life, or even fundamental quantities like mass, charge, and spin. Measurement in science is intrinsically comparative, not absolute, further highlighting a deep epistemological limitation. We critically analyze this structural limitation of scientific methodology and argue that without recognizing these boundaries, attempts to resolve origin-related mysteries remain philosophically and methodologically incomplete. We conclude by calling for a broader paradigm that includes metaphysical, phenomenological, or consciousness-based perspectives to complement scientific inquiry.

1 Introduction

Contemporary science has achieved extraordinary success in modeling and predicting the behavior of natural systems. From the equations of Newtonian mechanics to the principles of quantum field theory, science provides deterministic or probabilistic laws that evolve physical states over time. However, these laws presuppose something critical: an initial state. This means that scientific laws are evolution rules, not origin mechanisms.

As Stephen Hawking noted, even a so-called "theory of everything" would leave unanswered the question of why it exists or why it takes a specific form [1]. In the same vein, Roger Penrose has emphasized that our best physical theories rely on unexplained initial conditions and arbitrary parameters [2]. These concerns point to a fundamental blind spot in science: the inability to explain the origin of the very framework within which it operates.

This paper explores the epistemological and metaphysical implications of this observation. We argue that physical laws are incapable—in principle—of explaining origins, including those of space, time, mass, charge, spin, and life. By highlighting the relativistic and comparative nature of all measurement, we further demonstrate that even our most basic physical concepts are conventionally defined rather than ontologically grounded.

2 Laws of Physics as Evolution Rules

In both classical and quantum physics, the structure of theory takes the form:

$$\text{Final State} = \mathcal{E}(\text{Initial State})$$

where $\mathcal{E}$ is an evolution operator governed by differential equations or probabilistic transitions. For example:

- In Newtonian mechanics:
  $$\frac{d^2\mathbf{r}}{dt^2} = \frac{\mathbf{F}}{m}$$
  requires initial position and velocity.
- In quantum mechanics:
  $$i\hbar\frac{\partial}{\partial t}\psi(\mathbf{r}, t) = \hat{H}\psi(\mathbf{r}, t)$$
  evolves a given wavefunction $\psi(t_0)$ to later times.

These laws are powerful in predicting the future once the present is known. However, they are silent on where the initial state came from. The laws do not "know" the initial state—they only evolve it.

3 Origin Questions Beyond the Reach of Science

Several profound questions remain outside the explanatory power of physical law:

- **Why does the universe exist at all?**
- **Why do particles have mass, charge, and spin?**
- **Why do physical constants have the values they do?**

- **How did life originate from non-life?**
- **What is the origin of consciousness?**

While cosmology and biochemistry attempt to model origins, they inevitably assume preconditions: spacetime, quantum fields, chemical substrates, or probabilistic laws. Thus, they shift the mystery rather than solve it.

4 Measurement as Comparison, Not Comprehension

Physical quantities such as mass, length, and charge are not defined absolutely but through standards and comparisons:

- Mass is defined by fixing one object (e.g., a kilogram prototype) and measuring all other masses in relation to it.
- Distance is defined operationally (e.g., via the speed of light).
- Charge is quantified through conventions based on electromagnetic interactions.

This reveals an important epistemological limitation: science does not explain what mass *is*, only how to measure it relative to a defined standard. As such, even fundamental concepts in physics are devoid of intrinsic meaning and rely on relational or operational definitions.

Philosophical and Structural Unity of Classical and Quantum Mechanics in HDI

Although quantum mechanics is widely regarded as a departure from classical mechanics due to its probabilistic structure and wavefunction-based formulation, this distinction vanishes under the Hidden Deterministic Interpretation (HDI) [5].

Just as classical mechanics requires initial conditions—such as position and velocity—to evolve a system deterministically, quantum mechanics under HDI also requires an initial state, including a hidden variable (specifically, the global phase of the wavefunction), to evolve deterministically. The Schrödinger equation, then, is not a probabilistic evolution law but a deterministic one whose predictability appears incomplete due to our ignorance of this hidden variable.

In this view, the apparent randomness in quantum measurements stems not from an inherent indeterminacy of nature, but from a lack of knowledge of the hidden deterministic parameters. Once these are accounted for, the quantum-to-classical transition occurs seamlessly, and classical laws emerge naturally as macroscopic approximations of an underlying quantum determinism.

Thus, from the HDI standpoint, classical and quantum mechanics are not merely philosophically indistinguishable in their dependence on initial conditions—they are structurally unified in how they function. The difference lies only in the level of accessibility of their respective deterministic variables.

5 Toward a Broader Framework

Recognizing these limits opens the door to complementary modes of understanding:

- **Phenomenology**, which explores lived experience as primary.
- **Spiritual traditions**, which suggest that origins are accessible only through direct inner realization.
- **Consciousness-first theories**, which propose that matter arises from mind, not the other way around [4].

Rather than dismiss these approaches as unscientific, we might view them as offering insights into domains where science reaches its boundary.

6 Conclusion

Modern science provides a remarkably effective tool for understanding how the universe evolves, but it is fundamentally incapable of explaining why the universe exists, why it has the properties it does, or where its structures originate. Measurement is comparative, not explanatory. Laws are evolutionary, not generative. Origins remain a mystery because they lie outside the reach of any system that depends on initial conditions and operational definitions. Recognizing this limitation is the first step toward a deeper, more holistic inquiry—one that may require the integration of science, philosophy, and consciousness.

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[5] See author's ResearchGate and Academia pages for related preprints https://www.researchgate.net/profile/N-Gurappa/research; https://cutn.academia.edu/NGurappa