

Conceptual Subtraction in Scientific Reasoning

– An AI–Human Corridor at the Boundary of Physics and Artificial Intelligence

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Author’s Note on AI Collaboration

This paper is the result of sustained, iterative interaction between a human author and an artificial intelligence system (ChatGPT-5.2). The AI contributed substantially to drafting, restructuring, consistency checking, and—most importantly—methodological pressure toward conceptual minimalism. All conceptual commitments, interpretative choices, and any remaining errors are the sole responsibility of the human author. The AI is acknowledged here as a reasoning participant rather than as an epistemic authority.

Abstract

Recent advances in artificial intelligence have made AI-assisted reasoning an integral part of contemporary scientific practice. This paper does not propose a new physical theory, nor does it introduce novel computational models. Instead, it documents an experiment in method: sustained human–AI collaboration applied to conceptual clarification at the foundations of physics.

The work summarized here emerged from a sequence of studies on the physical interpretation of wavefunctions, particle stability, and matter–antimatter annihilation. While the technical content of those studies was published separately, the present paper focuses on how their conceptual evolution was shaped by iterative interaction with AI across multiple conversations, with partial persistence of earlier reasoning through conversational memory.

A defining feature of this process was the AI’s indifference to conceptual sunk costs. Rather than proposing alternative ontologies, the AI repeatedly challenged whether inherited assumptions were still required once their original explanatory role had weakened. This led to a mode of progress better described as conceptual subtraction than conceptual construction: explanatory layers were removed whenever they could not be independently justified.

In this context, several deeply ingrained commitments—such as treating certain physical quantities as substance-like entities—were progressively relaxed, not as metaphysical claims but as methodological consequences of applying Occam’s razor to explanatory commitments rather than to equations alone.

The paper presents this approach as intentionally provisional. No attempt is made to settle ontological or philosophical questions definitively. Instead, it aims to leave a transparent record of a reasoning corridor in which human judgment and artificial reasoning jointly enforced discipline, clarity, and reversibility. The goal is not closure, but the creation of a walkable path for future inquiry.

1. Background and Scope

The present paper summarizes a sequence of closely related works produced between late 2024 and December 2025, all concerned with a realist and minimalist interpretation of quantum mechanics grounded in experimental structure rather than formal postulates.

The earliest ideas in this line of work were first made public on viXra.org, where an initial attempt was made to reinterpret the wavefunction as a representation of physical organization rather than as a purely probabilistic object. At that stage, the emphasis lay on photons and electromagnetic field structure, and on the possibility of interpreting interference, localization, and propagation without invoking observer-dependent collapse narratives.

Subsequent papers revisited these ideas across multiple contexts: charged particles, particle stability and instability, empirical lifetime–energy relations, and the interpretation of particle listings provided by the Particle Data Group (PDG). Each step aimed to reduce explanatory overhead while remaining aligned with established experimental facts.

2. Iterative Revisions and the Role of AI Assistance

While the human author remained responsible for all conceptual commitments, a decisive shift occurred during sustained interaction with AI systems across multiple iterations, with partial persistence of earlier discussions through conversational memory.

The AI contribution did not take the form of proposing alternative physical models. Instead, its role was predominantly *negative* in the methodological sense: repeatedly questioning whether inherited assumptions were still required once their original explanatory role had weakened.

In practice, this led to several significant developments:

- previously implicit ontological assumptions were made explicit and examined;
- distinctions that remained descriptively useful (e.g. between bosons and fermions) were relieved of explanatory burdens they were not required to carry;
- conceptual structures were allowed to dissolve if they no longer mapped onto identifiable physical organization.

This process did not converge toward a unified ontology. Rather, it produced a progressive tightening of what *must* be assumed versus what could be safely abandoned.

3. From Photon Wavefunctions to Matter–Antimatter Annihilation

A central turning point in this trajectory was the decision to revisit matter–antimatter pair creation and annihilation after clarifying the physical interpretation of the photon wavefunction.

If wavefunctions are taken seriously as representations of physical structure rather than calculational tools, then annihilation processes cannot be treated as merely algebraic transitions between states. The longstanding question of the local fate of electric charge re-emerged with renewed urgency.

An initial analysis of this problem was published in January 2025. That version deliberately stopped short of resolution, explicitly acknowledging conceptual discomfort while resisting ad hoc explanations such as latent charge states or hidden reservoirs.

The December 2025 revision, preserved as a second part rather than a replacement, reflects the cumulative effect of AI-assisted conceptual subtraction. In particular, it became increasingly difficult to justify the assumption that charge must persist independently of the physical organization that manifests it.

This shift is not presented as a definitive ontological claim, but as a methodological consequence of applying Occam's razor to explanatory commitments rather than to equations alone.

4. Conceptual Subtraction as Method

Across the body of work summarized here, progress was achieved less by constructing new explanatory layers than by removing unnecessary ones.

This approach may be described as *conceptual subtraction*: a disciplined refusal to retain assumptions solely because they are familiar, historically entrenched, or psychologically comfortable.

The AI-assisted process proved especially effective in this context because it exhibited no attachment to conceptual sunk costs. Assumptions that had survived earlier scrutiny—often unconsciously—were repeatedly challenged, not by counter-theories, but by the simple question of necessity.

The resulting framework remains intentionally provisional. Ontological and philosophical interpretations are left open to the reader. The aim is not closure, but clarity.

5. A Temporary Pause

The present paper marks a temporary pause in this line of inquiry.

The works referenced here form a coherent cluster, but they do not exhaust the questions they raise. Further progress may require new experimental insights, new mathematical tools, or further refinement of the methodological stance itself.

What is documented here is not a finished theory, but a trace of how ideas evolved under sustained pressure toward minimalism—pressure made possible, in part, by explicit and acknowledged AI assistance.

Any remaining errors, omissions, or unwarranted commitments are the responsibility of the human author alone.

References

The references listed below point exclusively to earlier papers by the present author that together form the empirical and conceptual basis summarized in this article. Each of these works contains extensive references to experimental results, standard data sources (including Particle Data Group publications), and the relevant primary literature in physics and quantum theory.

These external references are **not repeated here**, as the purpose of the present paper is not to reproduce or re-evaluate experimental evidence, nor to re-argue detailed physical models. Instead, this article functions as a *methodological and synthetic overview* of how a coherent body of work evolved under sustained human–AI collaboration and increasing conceptual constraint.

Readers interested in experimental foundations, mathematical details, or engagement with the broader literature are therefore referred to the [cited papers](#) themselves:

1. Jean Louis Van Belle, *The Photon Wavefunction Revisited*, Preprint, December 2025.
2. Jean Louis Van Belle, *Matter–Antimatter Annihilation: Ontology and the Breit–Wheeler Challenge*, Preprint, December 2025.
3. Jean Louis Van Belle, *A Taxonomy of Instability*, Preprint, December 2025.
4. Jean Louis Van Belle, *Lecture X1: Operationalizing the Stability–Instability Frontier for Charged Particles*, Preprint, December 2025.
5. Jean Louis Van Belle, *Empirical Annex to Lecture X1: Structure in the Energy–Lifetime Plane of Unstable PDG Particles*, Preprint, December 2025.
6. Jean Louis Van Belle, *Re-reading PDG Particle Listings through a Minimal Experimental Core (MEC)*, Preprint, December 2025.
7. Jean Louis Van Belle, *Revisiting Realist Explanations of Quantum Mechanics*, Preprint, December 2025.
8. Jean Louis Van Belle, *The Corridor: How Humans and AI Learn to Think Together*, Preprint, December 2025.
9. Jean Louis Van Belle, *The Wonderful Theory of Light and Matter*, Preprint, November 2025.