

ZEROLOGY: Fundamental Theory of Difference

Research Manifest

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Introduction: In Search of the Origin of Reality For over a year, I have been developing **Zerology** — a fundamental theory of difference that proposes a new approach to the most basic questions of physics: why does something exist instead of nothing? Where did reality come from? How can all the observed complexity of the universe be derived from one structural condition?

In the spirit of full scientific transparency, I am transitioning to an open publication mode, sharing successive chapters of the theory as they are finalized. I present here the main assumptions and goals of the project, inviting the scientific community to critical analysis and collaboration.

Motivation: Searching for Minimal Foundations Contemporary fundamental physics faces the challenge of unification. String theory postulates additional dimensions, loop quantum gravity introduces discrete spacetime structure. Each approach adopts its own structural assumptions, often not entirely explicit.

Zerology proposes a different path: instead of adding new structures, we seek the absolute minimum assumptions necessary for any theory. Then we show how from this minimum plus one condition — the possibility of differentiation — all the complexity of reality emerges.

Methodological Transparency Every fundamental theory, whether it admits it or not, must adopt certain assumptions. Zerology makes them fully explicit:

1. **Minimal logic** — principle of contradiction, basic rules of inference
2. **Iterative structure** — possibility of repetition and succession
3. **Basic distinguishability** — possibility of distinguishing “this” from “that”
4. **Linguistic framework** — minimal conceptual structure for formulating theorems

These assumptions are not arbitrary — every alternative theory must adopt them, explicitly or implicitly. They constitute a universal, minimal foundation for any attempt to describe reality.

Main Thesis: Differentiation as Physical Foundation I propose that the most basic structural condition of reality is **the possibility of differentiation** — the ability to introduce any distinctions. This is not a being, not a process, not a relation, but a condition for the possibility of all beings, processes, and relations.

Key Theorem of Zerology **Differentiation is not only a necessary but also SUFFICIENT condition for the emergence of all observed complexity of reality.** From this one structural condition, without additional assumptions or mechanisms, one can derive both existence and nothingness, space and time, matter and energy, physical laws and mathematical structures.

Why differentiation? It fulfills three criteria of fundamentality:

1. **Irreducibility:** Every attempt to find something simpler already assumes differentiation
2. **Self-explanation:** Difference differs from the absence of difference — it confirms its own nature
3. **Generativity:** All structures of reality can be derived from differentiation

Differentiation is something where all inference, reduction, causality, and possibility of exploration “turns back.” It is indeed an insurmountable absolute, simultaneously accessible within arm’s reach in our everyday experience.

Key Innovations of Zerology *Perspectival Nature of Existence and Nothingness*

In Zerology, existence and nothingness are not opposing states, but two perspectives on differentiation:

- **Existence:** perspective of actualized differentiation
- **Nothingness:** perspective of non-actualized differentiation

Both are equivalent and mutually defining, solving the classical problem of “why something instead of nothing.” In Zerology, we introduce an attempt to change the paradigm of interpreting reality. If this succeeds, observed phenomena and laws of nature should become unified and completely obvious. Existence and non-existence become manifestations of a common condition.

Primary Rhythm δ_0 From the dialectic of perspectives emerges the first concrete structure:

$$\delta \rightarrow 0 \rightarrow \delta \rightarrow 0 \rightarrow \dots$$

where: δ is the act of differentiation, 0 is the trace of difference, \rightarrow represents structural (not temporal) succession.

I present a rigorous proof that this is the minimal structure capable of manifesting differentiation. Moreover, it creates an infinite structural generator that is the basis of all beings, which thanks to infinite generativity emerge freely without any limitations.

Hierarchy of Emergence I show step by step how successive levels emerge from the primary rhythm:

1. Interfering rhythms \rightarrow relations
2. Network of relations \rightarrow space
3. Condensations of rhythms \rightarrow matter
4. Organization of rhythms \rightarrow energy and dynamics

Each level emerges naturally from the previous one, without additional assumptions. Since the work focuses on describing and reproducing pure emergence and avoiding arbitrary parameters, even if they resulted from observations, the rhythm of Zerology’s emergence also follows the same laws. Hence we decide on structurally consistent publication, from primary difference to increasingly complex structures, while maintaining full caution and rigor of inference.

New Directions Arising from the Paradigm The rhythmic structure of Zerology naturally leads to exploration of concepts that in traditional physics are assumed a priori:

Harmony as Generator of Locality: Change of perspective — spatial locality is not fundamental, but emerges from resonances between rhythms. When rhythms interfere constructively, what we observe as spatial “proximity” arises.

Forcelessness of Fundamental Physics: Radical shift in description — “forces” are not fundamental interactions, but tendencies of rhythmic systems toward certain configurations. Gravity becomes a tendency toward harmonization of rhythms, electromagnetism — toward their polarization.

These directions are not speculations, but natural consequences of the adopted paradigm, which will be developed in subsequent chapters with full mathematical formalism.

Predictions and Falsifiability Zerology offers testable predictions in relational terms:

1. **Discreteness of space-time** — not in the metric sense, but as fundamental granularity of relations resulting from the δ_0 structure
2. **Relations between fundamental constants** — we predict specific numerical relations resulting from rhythmic organization

The theory will be falsified if:

- A simpler structure than differentiation is found
- It is shown that differentiation is not a sufficient condition
- The impossibility of deriving known physics is demonstrated
- A phenomenon irreducible to the organization of differences is discovered

Publication Schedule and Invitation to Collaboration **Publication Plan:**

- **July 2025:** Chapter 1 — Primary Difference
- **August 2025:** Chapter 2 — Emergence of Rhythm
- **September 2025:** Chapter 3 — From Rhythm to Relations
- **January 2026:** Chapter 4 — Space as Network
- **May 2026:** Chapter 5 — Time and Matter

Naturally, developmental work may influence the plan for subsequent chapters and revise their scope.

I invite collaboration in the areas of:

- Analysis of presented assumptions
- Suggestions regarding mathematical formalism
- Indication of potential weaknesses in the approach
- Proposals for verification experiments
- Cooperation in developing the theory

I am aware that fundamental ideas may be developed in parallel by different researchers. I see this as a tremendous opportunity. If you are working on similar issues — whether from the perspective of differentiation, rhythms, or emergence — I invite you to contact me. Zerology can benefit from different perspectives and approaches. I propose creating an open research group where we will jointly develop the theory for the good of science and reaching the limits of reality.

Unique Features of the Approach Zerology is distinguished by several aspects:

1. **Complete explicitness of assumptions** — nothing is hidden or left unsaid
2. **One sufficient condition** — differentiation as complete foundation of reality
3. **Physical concreteness** — we offer relational predictions, not just interpretations
4. **Mathematical rigor** — formalism based on category theory
5. **Openness to falsification** — we clearly define conditions for refutation
6. **Compatibility** — we will attempt to show how known theories emerge as effective descriptions in appropriate limits

Relation to Other Approaches Recently, works exploring the role of differentiation in various contexts have appeared. Although differentiation as a concept appears in various philosophical contexts, Zerology is the first to attempt developing a complete physical theory with concrete, mathematical derivations and testable predictions.

Zerology develops this topic toward fundamental physics, offering:

- Mathematical formalization of rhythmic structures
- Concrete mechanisms of emergence of reality levels
- Testable experimental predictions
- Full methodological transparency

Each approach has its value and purpose. Zerology focuses on building a falsifiable physical theory from minimal assumptions.

Philosophical Implications Although Zerology is a physical theory, it also has deeper consequences:

1. **Relationalism** — things are nodes in a network of differences, not substances
2. **Processuality** — “to be” is “to participate in the rhythm of differentiation”
3. **Emergentism** — complexity emerges naturally from simple conditions
4. **Unity** — matter and consciousness are different organizations of the same process

Zerology is not a hypothesis about the world. It is a reconstruction of necessity: it shows that if we allow difference to emerge, the entire structure of reality follows from its internal dynamics. We need no external laws, overarching principles, or metaphysical assumptions. We need only one act: difference as such.

I present Zerology as a proposal for a research program in fundamental physics. I do not claim to have all the answers — on the contrary, I am aware of the enormity of challenges. I believe, however, that an approach based on minimal assumptions and maximum transparency can open new paths in the search for the foundations of reality.

I invite discussion, testing of predictions, and joint development of the theory. Only through open collaboration and ruthless verification can we approach understanding the origin and nature of reality.