EN_34: Open Questions and New Research Pathways

Résumé

Il énonce les questions ouvertes que le cadre suggère comme futures voies de recherche. Il souligne que le proton est le seul cas où le rayon holographique R_{VED} coïncide avec le rayon observable, ce qui en fait une sonde topologique de l'univers holographique H(2). Il propose de développer la théorie des représentations de l'isomorphisme inverse ($S^1 \to 3S + T$), la spectroscopie atomique complexe (atomes multiélectroniques), la quantification complète du redshift comme $dt \to -dz$, la dérivation rigoureuse de Bell à partir du cadre, et la recherche sur l'origine des trous noirs primordiaux. Le cadre est une fondation ouverte, non un système clos, et chaque question ouverte est une invitation à la communauté scientifique.

The Proton as a Topological Gateway to the Holographic Universe

Author: Víctor Estrada Díaz
Framework: Einstein-VED
DOI: 10.5281/zenodo.17172925
Web: https://estradad.es

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1. Introduction: The Framework That Opens Questions, Does Not Close Them All

The Einstein-VED framework has proven to be internally coherent, highly predictive, and consistent with observations across multiple scales: from the proton radius (99.95% agreement with CODATA) to the formation of the first stars (confirmed by JWST), through the neutron mean lifetime, the proton magnetic moment, isotope stability, and galactic dynamics (Gaia).

However, like any honest scientific framework, it **recognizes its limits and opens questions**. This document does not intend to answer them, but rather to **state them clearly** and point to directions for future research.

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2. The Proton as a Unique Case of Holographic Equality

2.1. The Universe as H(2) Holography

In the Einstein-VED framework, the universe is a **holographic surface H(2)** with only **2 degrees of freedom** (documents EN_00 and EN_11). All of reality in 3S+T (three spatial dimensions + one temporal) is a projection from this two-dimensional surface.

2.2. The Holographic Radius R_{VED}

For any confined mass, we define the **holographic radius** as the radius of the circle S^1 isomorphic to the wave contour in 4D space:

$$R_{\mathrm{VED}} = \frac{n\hbar}{Mc}$$

This radius is inversely proportional to mass: **the greater the mass, the smaller R_{VED}**.

2.3. The Exception: The Proton

In general, the observable radius in 3S+T (the one we measure experimentally) **is not equal** to R_{VED}. The difference depends on the number of cycles n and on how information is projected from H(2).

The only known exception is the proton:

$$R_{\mathrm{VED}}^{\mathrm{proton}} = R_{\mathrm{proton}}^{\mathrm{CODATA}} = 0.841\ \mathrm{fm}$$

2.4. Interpretation

Why does this happen? Because the proton has $n = 4$, the minimum integer number of cycles for stable confinement in 3S+T (three spatial cycles + one temporal cycle). This configuration:

- **Maximizes the holographic radius** for a given mass.
- **Minimizes distortion** in the projection from H(2).
- **Is the simplest possible form of information** in the universe.

For any other mass ($n > 4$, or neutrons with $n = 4 + \delta$), the holographic radius R_{VED} is **smaller** than the observable radius. The additional information is stored in internal modes (such as the 22 nucleon modes) that are not fully projected onto the measurable radius.

2.5. The Proton as a Topological Probe of the Universe

The proton is, therefore, the maximum possible holographic radius of matter. It is the fundamental building block of observable

reality, the privileged access point to the underlying holographic geometry.

This is the reason we can measure G and $\hbar$ from the proton, and why the **"mass paradox"** (constants do not depend on mass, but we need a mass to calculate them) finds its resolution: **the proton is the mass that maximizes holographic projection, the clearest window into H(2).**

This fact opens the door to the **topological study of the universe** using the proton as a natural probe. The topology of H(2) and its relationship to S^1 in 4D is a completely new field of research that the Einstein-VED framework makes possible.

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3. Other Open Questions

3.1. The Origin of Primordial Supermassive Black Holes

The Einstein-VED framework does not explain — and does not intend to explain — the origin of primordial supermassive black holes. It is a recognized limit. Nor does the standard model provide a satisfactory explanation. See document EN_33: The Origin of Primordial Supermassive Black Holes.

3.2. The Complete Metric in $\mathbb{C}^4$

The framework defines the fundamental metric in $\mathbb{C}^4$, but does not fully develop the representation theory of the inverse isomorphism ($S^1 \to 3S + T$). This is an open field for mathematicians and theoretical physicists.

3.3. Complex Atomic Spectroscopy

The framework explains hydrogen ($n = 137$) but has not yet developed the complete spectroscopy of multi-electron atoms (helium,

heavier atoms). The principle is established (each electron occupies an orbital defined by an integer n_i), but the corresponding perturbation theory is missing.

3.4. The Cosmological Constant and Dark Energy

The framework demonstrates that $\Lambda = 0$ algebraically, and that dark energy does not exist (EN_31). However, a complete quantification of redshift as a projection of the temporal arrow ($dt \to -dz$) remains pending.

3.5. Dark Matter

The framework demonstrates that dark matter is unnecessary (Gaia data, EN_15, EN_18_GENESIS). But the fact that the scientific community has not yet institutionally accepted this error is a sociological problem of science, not a physical one. The open question is: **how long will it take the community to recognize that Gaia data have falsified the dark matter hypothesis?**

3.6. Rigorous Derivation of Bell^{\prime}s Inequalities

The framework is consistent with quantum correlations (entanglement as access to the same spacetime origin), but a rigorous derivation of Bell^{\prime}s inequalities from the framework, explicitly showing their compatibility, is missing.

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4. Invitation to the Scientific Community

> The Einstein-VED framework is not a closed system. It is a **foundation upon which to build**. Every open question is an invitation to research, not a weakness.
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> I invite the scientific community to: 1. **Develop the representation theory** of the inverse isomorphism ($S^1 \to 3S + T$) 2. **Extend spectroscopy** to multi-electron atoms 3. **Formalize the quantification of redshift** as

$dt \to -dz$ 4. **Derive Bell's inequalities** from the framework 5. **Investigate the origin of primordial supermassive black holes** 6. **Explore the topology of the universe** using the proton as a holographic probe

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5. Conclusion

The Einstein-VED framework has solved concrete, verifiable problems. But, like any good theory, it **opens more questions than it closes**. That is not a failure. It is the sign that it is alive.

The proton, the most studied particle in physics, turns out to also be the **topological window into the holographic universe**. It is the maximum of the projection from H(2), the point where information manifests with minimal distortion.

Einstein's program is not complete because we have answered everything. It is complete because we have found the right questions.

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