Folded space-time geometry: particles as space-time cylinders and geometric origin of charges

Complementary clarifications to the Einstein-VED theory

This document provides additional explanations and extensions to the original Einstein-VED theory, emphasizing geometric interpretations, proper time, and mass-related effects.
It serves as a complement to the original work documented in Zenodo:

The theory that will reconcile Quantum Mechanics with Einstein's Relativity (PDF in Spanish)

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1. Abstract

A conceptual framework is proposed where particles are not points, but **space-time cylinders** extended along their complete temporal history.

- All instants are real, forming a four-dimensional object in $\mathbb{R}^4$.
- Physical properties emerge from a countable series of **discrete foldings**, T_n, with $n \in \mathbb{N}$.

Interpretation of foldings:

- $n = 2$: matter/antimatter duality and electric charge
- $n = 3$: color charge and confinement

This approach unifies the **continuous** (the world line) and the **discrete** (the foldings), offering an arithmetic-geometric framework for fundamental symmetries.

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2. The world line as a cylinder

Let a particle whose temporal history is described as a **space-time cylinder**, called Γ.

$\Gamma = \{(x, y, z, t) \mid (x, y, z) \in \Sigma(t),\ t \in \mathbb{R}\}$

Verbal description for transcription:

- Γ is the set of all quadruples (x, y, z, t), where t runs over all real numbers.
- For each instant t, the particle occupies the spatial section $\Sigma(t)$ in three-dimensional space.
- Conceptually, $\Sigma(t)$ represents the particle's location in R^3 at that instant.
- The particle does not appear or disappear: it exists at all instants of Γ.

Key properties:

1. All points of Γ are real, independent of the observation instant t_0.
2. Each instant t_0 defines an **observable slice**, $\Sigma(t_0)$.
3. Complete existence extends throughout the entire temporal history.

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3. Discrete foldings of space-time

Discrete transformations are defined:

$T_n : \mathbb{R}^4 \to M_n, \quad n \in \mathbb{N}, n \geq 1$

Verbalization:

- Each T_n takes the complete space-time and generates a new "fold" or symmetry, denoted M_n.
- Each T_n acts on the entire world line Γ, not just at one instant.
- Physical properties emerge from these folds.

3.1 Level n = 1

- Flat space-time, without foldings.
- The world line exists, but there is no polarity or color.

3.2 Level n = 2: temporal folding

- A splitting is introduced on the temporal dimension: $t \mapsto t^+$ and $t \mapsto t^-$.
- This generates:
  - Matter / antimatter duality
  - Electrical polarity $+ / -$
  - U(1) symmetry
- **Verbalization of the equation:**
  "Each time t divides into two branches, positive t and negative t, representing matter and antimatter."

3.3 Level n = 3: spatial folding

- Involves the three spatial directions x, y, z.
- Each direction generates a **discrete coupling mode** with the particle's temporal existence.

- These three modes correspond to the **three colors** of QCD: red, green, and blue.

Confinement: only the combination of the three modes reproduces the complete symmetry and is observable.

- **Verbalization of the topological restriction:**
  Sigma_complete(t) = Sigma_red(t) ∪ Sigma_green(t) ∪ Sigma_blue(t)
  "The union of the three color sections at each instant t is the observable form of the particle."

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4. Correspondence with symmetry groups

Level n	Folded over	Symmetry group	Physical manifestation
1	None	—	Flat space-time
2	Temporal dimension	U(1)	Electric charge, matter/antimatter
3	Three spatial dimensions	SU(3)	Color charge, confinement
4	Complete space-time	?	Possible unification or quantum gravity

- Each T_n is interpreted as a **principal fiber bundle** with structural group G_n.
- The generators of SU(3) correspond to the three spatial dimensions x, y, z.

Verbalization:

- A principal fiber bundle is an object that assigns to each point of $\mathbb{R}^4$ a set of fibers with symmetry G_n.
- The action of G_n on the fiber determines how physical properties (such as color) manifest.

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5. Formalization of confinement

Let Sigma(t) be the spatial section of a quark with color c_i.

- Only the combination of the three colors is observable:

$$\Sigma_{\text{complete}}(t) = \Sigma_{\text{red}}(t) \cup \Sigma_{\text{green}}(t) \cup \Sigma_{\text{blue}}(t)$$

- **Verbalization:**
  "Sigma complete at time t is the union of the red, green, and blue color sections. Only this combination can be physically observed; an isolated color cannot exist."

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6. Consequences and predictions

1. Geometric interpretation of color confinement.
2. Direct relationship between the three-dimensionality of space and color charge.
3. Coupling constants as topological invariants of foldings.
4. Conceptual framework for extensions n > 3 and possible unification with quantum gravity.

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7. Continuity and discreteness

- The world line Gamma is continuous in R4.
- The T_n foldings introduce **discrete levels** that generate symmetries and observable properties.

- The continuous (Gamma) and the discrete (foldings) combine in an **arithmetic-geometric framework**.

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8. Conclusion

- The particle is a **space-time cylinder**, real at all instants.
- Matter/antimatter, electrical polarity, and color emerge from the geometry of space-time and its discrete foldings.
- The proposal unifies continuity and discreteness and offers a geometric interpretation of fundamental symmetries.

> "Space does not contain matter; matter is geometry itself, folded along its entire temporal history."

Complete narrative scheme: particles, antiparticles, and energy reduction

1. Introduction

- A geometric framework of particles is proposed in which each particle is represented as a space-time cylinder in four real dimensions, not as a point.
- This framework describes the temporal persistence and spatial interaction of particles and antiparticles in a continuous manner.
- The postulates are consistent with relativity and particle physics, and offer a novel approach to modeling annihilation and energy transformation.

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2. Fundamental postulates

2.1 World line and spatial section

- Each particle has a world line.
- The first particle has the world line called Gamma one. Gamma one consists of all quadruples of the form: position X, position Y, position Z, and time t, for all real values of t.
- The second particle has the world line Gamma two, defined analogously.
- The spatial section of the first particle at an instant t is called Sigma one of t.
- The spatial section of the second particle at the same instant is called Sigma two of t.
- For almost all time t, Sigma one of t and Sigma two of t do not overlap, that is, there is no complete coincidence in three-dimensional space.

2.2 Energy reduction of the spatial structure

- If there exists a critical instant t_critical such that Sigma one of t_critical equals Sigma two of t_critical, the **energy reduction of the spatial structure** or **resolutive expansion of particular space** occurs.
- The spatial section transforms, releasing energy, while the temporal dimension persists.

2.3 Temporal persistence function f

- The function f takes the union of the world lines of the two particles and produces the remaining world line, called Gamma remnant.
- This ensures that temporal existence continues even when the spatial structure transforms.

- The function f also determines how the released energy is distributed along the remaining world line.

2.4 Application to particles and antiparticles

- Particles and antiparticles are complementary structures.
- If Sigma of the particle coincides with Sigma of the antiparticle at t_critical, the energy reduction of the spatial structure occurs.
- This geometrically formalizes matter-antimatter annihilation and energy release.

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3. Released energy

- Let rho be the energy density associated with the spatial section at the critical instant t_critical.
- The local energy at the critical instant is obtained by summing all the energy density in the coincident spatial section.
- For particles with masses m_one and m_two, the energy density approximates the sum of the masses multiplied by the speed of light squared, concentrated at the coincidence position.
- The total released energy approximates the sum of the masses times c squared: released energy approximately equal to (m_one plus m_two) times c squared.

Narrative interpretation:

- All the mass of the particles converts into energy at the instant of spatial coincidence.

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4. Temporal distribution of energy

- The function f allows distributing the released energy along the remaining world line.

- Before the critical instant t_critical, the released energy is zero.
- After t_critical, the function f indicates what fraction of energy is released at each instant.
- This allows modeling a progressive or gradual release of energy over time.

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5. Consequences and contributions

1. Geometric formalization of particles and antiparticles as space-time cylinders, including their complete temporal history.
2. Spatial exclusion with temporal persistence, avoiding complete superposition while maintaining temporal continuity.
3. Energy reduction of the spatial structure, offering a geometric framework for matter-antimatter annihilation.
4. Temporal persistence function f, novel for modeling energy redistribution over time.
5. Geometric estimation of released energy, consistent with E equals m times c squared.
6. Conceptual application to high-energy physics and cosmology, useful for extreme collisions and high densities.

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6. Potential impact

- This framework provides a **new conceptual and geometric approach** to theoretical physics.
- It can inspire advanced simulations of particle-antiparticle interaction considering complete space-time cylinders.
- It offers tools to explore limits of extreme density, fusion, energy redistribution, and temporal continuity in particle systems.

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7. Conclusion

- Relativity, energy conservation, and particle theory are combined in a **rigorous and novel geometric model**.
- Clear postulates are introduced: spatial exclusion, energy reduction of the spatial structure, and temporal persistence.
- It directly connects with known physical phenomena but provides a **more complete geometric interpretation**, accessible for future theoretical research.