A Charged Lense-Thirring Effect Experiment that might Support the Assumption that the Space-Time is an Emergent Entity

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Abstract:

Modern physics is caught in a profound conceptual schism between deterministic, continuous classical frameworks and probabilistic, discrete quantum mechanics.

While recent advancements—such as Nicolas Gisin's application of intuitionistic mathematics to classical mechanics [1] — might have provided some bridging of this gap by exposing classical physics as fundamentally probabilistic, they continue to rely on the static assumption of a fundamental, singular space-time background.

This paper argues that space-time might not be a primary entity.

Instead, this paper argues that what Humans perceive as space-time might only be an emergent cognitive interface used to interpret and explain energy interactions.

To break the logical paradox of using a brain embedded in space-time to disprove space-time, this paper proposes that science must look for an internal algorithmic "bug" in the existing frameworks.

This paper proposes a Charged Lense-Thirring Effect Experiment, which is designed to observe a possible anomaly in the spin-precession of a charged particle beam orbiting a rapidly rotating charge distribution, which, if this anomaly is detected, might also support the assumption that space-time might be a secondary property of localized energy interactions and a cognitive construct stemming from energetic interactions.

This paper does not present that a successful implementation of the proposed experiment, will, by itself, assert that the space-time is not a primary entity.

But this paper argues that a successful implementation of the proposed experiment, with possible successful implementations of additional properly proposed experiments, might support the already ongoing research endeavors to present the space-time as an emerging entity, which might

conclude in a more reasonable view of the universe, and also resolve issues related to the existing view of the space-time as a primary entity.

1. Introduction: The Crisis of the Continuum and Gisin's New Classical Physics

For over three centuries, physics has operated under the Newtonian and Einsteinian assumption that space and time constitute a continuous, infinitely divisible backdrop—a "stage" upon which matter and energy perform.

In this classical paradigm, the universe is strictly deterministic.

If one could know the exact position and momentum of every particle, the future could be calculated with absolute certainty.

However, this determinism harbors a hidden, non-physical assumption: the **Principle of Infinite Precision**. For a classical state to be deterministic, a particle's coordinates must be represented by real numbers containing an infinite number of digits after the decimal point (e.g., 3.14159... to infinity).

Recently, a revolutionary theoretical framework pioneered by Nicolas Gisin and Flavio Del Santo (2019–2021) [2], [3], [4], [5] dismantled this assumption in their published paper: "Alternative Interpretations of Classical Physics".

Gisin argues that infinite precision is a metaphysical myth.

Storing infinite information within a finite volume of space requires infinite energy, which would trigger a gravitational collapse into a black hole.

Instead, Gisin proposes **Finite Information Quantities (FIQs)**. Under this framework, nature only holds a finite number of digits regarding any physical state. The subsequent digits do not yet exist; they are fundamentally random and materialize into existence only as time flows.

By replacing standard mathematics with **Intuitionistic Mathematics** (originally formulated by L.E.J. Brouwer [6]), Gisin successfully demonstrated that classical physics is fundamentally probabilistic.

This provides a stunning conceptual bridge to quantum mechanics, showing that features like the "measurement problem" (where an observation forces nature to choose a value) are not uniquely quantum, but are inherent properties of any physics limited by finite information.

2. The Conservative Catch: The Persistence of the Background

Despite its profound success in shattering classical determinism Gisin's framework stops halfway. It alters our understanding of *matter* and *information*, but it leaves the *stage* intact.

In Gisin and Del Santo's probabilistic classical mechanics, the underlying differential equations still map particles onto a pre-existing, singular, and continuous space-time manifold which is still treated as an independent, objective reality. Furthermore, this framework inherits General Relativity's specific, blind treatment of localized gauge fields, such as electromagnetism.

3. The Epistemological Paradox of Disproving Space-Time

If space-time is not a fundamental background but an emergent property born out of energy interactions, how can the human mind prove it? Herein lies a severe epistemological paradox:

The human brain, which is the very tool required to design an experiment, is itself a biological construct operating via localized energetic interactions (neurological action potentials). If our cognitive perception of space-time is an illusion or a "user interface" generated by these interactions, the brain cannot objectively step outside of space-time to prove its non-existence. A system cannot deduce its own non-existence by relying on its own internal rules.

To break this logical loop, we must adopt the principles of evolutionary epistemology and structural crisis analysis.

We do not need a tool that observes the universe from the "outside." Instead, we must look for an **internal algorithmic bug**—an anomaly where the internal logic of the space-time paradigm contradicts itself when faced with the physical reality.

4. A possible Internal Algorithmic "Bug" in the Current Acceptable Logic of the Space-Time Paradigm

Modern physics is bound to the **"Block Universe" paradigm** derived from Einstein's General Relativity. In this paradigm, space and time are fused into a rigid, four-dimensional pseudo-Riemannian manifold.

This global canvas treats the past, present, and future as simultaneously existing geometric points. While mathematically robust, this background-dependent structure fails to reconcile with the background-independent nature of quantum mechanics, creating the notorious **Problem of Time**, which defies common sense and the possibility of any free choice.

It should be also emphasized, that although the new theoretical framework pioneered by Nicolas Gisin and Flavio Del Santo does succeed in shattering classical determinism, Gisin's framework stops halfway by leaving the space-time *stage* proposed by the GRT intact, and as such, does not completely resolve the notorious **Problem of Time** mentioned above.

To resolve this issue, this paper proposes a shift from the **"Block Universe" paradigm** to an attempt to propose experiments which might support the assumption of **emerging models of**

space-time, which might be seen only as mathematical tools for explaining interactions between energy forms.

Successful implementation of such experiments might imply that the universe does not contain a pre-existing, singular, continuous space-time manifold, which is treated as an independent, objective reality, as the GRT **"Block Universe" paradigm** states.

Thus, this paper proposes one such possible experiment which might provide support to the assumption that the space-time entity is not a real existing entity. And, a successful implementation of such an experiment might imply that the space-time should be viewed only as emerging from energies interactions or as a mathematical tool for explaining interactions between forms of energies.

This proposed experiment might also be seen as part of an ongoing endeavor, in current Physics, to propose supports for presenting the entity of space-time as emerging from energies interactions.

If these endeavors will turn out to be successful, this might also provide an explanation for the origin, or the cause, of the attraction or the repulsion between Electric Charges, an issue which is not yet fully explained, despite the fact, that Physics does currently present an explanation for the origin, or the cause, of the attraction between massive bodies, via the GRT

5. A Brief Deliberation on Some Attempts to Explain the Origin of the Attraction and the Repulsion Between Electric Charges via a Space-Time Geometry

The GRT presented an explanation for the origin, or the cause, of the attraction between massive bodies by presenting Gravity as the geometry of the space-time presented by the GRT and not as a Newtonian Force.

But Physics does not present yet a satisfactory explanation for the origin, or the cause, of the attraction or the repulsion between electrically charged particles, based on a space-time geometry, similarly to how the GRT explains the origin, or the cause, of the attraction between massive bodies.

Attempts to provide such an explanation were presented, including attempts which introduced additional dimensions.

An example of such a theory is the Kaluza-Klein (KK) [7] Theory.

But these theories do contain issues and are not recognized as valid acceptable theories.

The author of this paper also published a paper [8] which tries to provide such an explanation, but this is also a preliminary paper, which does require more work.

However, it should be also emphasized that despite the fact that the GRT does succeed to explain the origin, or the cause, for the attraction between massive bodies, via the GRT **"Block**

Universe" paradigm, and despite the fact that the GRT did succeed to provide important predictions, which were validated and, as such, provided validity to the GRT concept, it should be also emphasized that the **"Block Universe" paradigm** does not necessarily implies that the single space-time presented by the GRT does really exist.

For example, an additional preprint, by the author of this paper [10], argues, that the electric field might be also recognized as a form of acceleration, similarly to how the gravity is already recognized as a form of acceleration.

And as such, it might be also reasonable to assume, that the origin, or the cause, of the attraction or the repulsions between electric charges, might be also attributed to a specific geometry, separate from the geometry of the space-time proposed by the GRT.

Which, in turn, might imply that the universe does not embed just one, single space-time geometry, as the GRT presents, which, in turn, might also imply, that the space-time entity is not a real, existing entity.

Thus, based on the above, the author of this paper also published the paper [8], which tries to provide an explanation to the origin, or the cause, of the attraction, or the repulsion between electric charges, based on a specific geometry, separate from the geometry of the space-time proposed by the GRT.

But as also presented above, this explanation should be also viewed as still a preliminary explanation, which does require more work.

Following is a brief deliberation on the model presented in this paper [8]:

The model presents two separate coupled internal geometries (or two complementary geometric fields/sheets), one tuned to the positive electric charges, and one to the negative electric charges, which bypass the Charge-Conjugate (c) symmetry issue.

Theories which might try to provide such an explanation based on only one single space-time for both the positive and the negative electric charges might violate the Charge-Conjugate (c) symmetry, because in such a model the time dilation induced by the positive electric charges might differ from the time dilation induced by the negative electric charges.

The model introduces a symmetric dual setup:

- Geometry $\mathcal{M}_+$ responds to positive charges with a "hill" and negative charges with a "pit."
- Geometry $\mathcal{M}_-$ responds to negative charges with a "hill" and positive charges with a "pit."
- Geometry $\mathcal{M}_+$ instructs the positive charges how to move.
- Geometry $\mathcal{M}_-$ instructs the negative charges how to move.

Under the Charge-Conjugation operation (C: +q ↔ -q), the model simply swaps the roles of $\mathcal{M}_+$ and $\mathcal{M}_-$, such that the system as a whole remains invariant under C-symmetry.

The model provides Geometric Explanation for Both Attraction and Repulsion between the electric charges**:**

Standard General Relativity only accommodates attraction because mass is strictly positive ($m > 0$), creating only "pits" (wells) in the metric tensor $g_{\mu\nu}$.

The following presents how attraction and repulsion are explained in the proposed model:

- **Attraction (between +q and -q):** A positive charge creates a pit in the $\mathcal{M}_-$ geometry felt by the negative charges, causing a negative test particle to fall toward it along a geodesic. And a negative charge creates a pit in the $\mathcal{M}_+$ geometry felt by the positive charges, causing a positive test particle to fall toward it along a geodesic.
- **Repulsion (between +q and +q or between -q and -q):** A positive charge creates a hill in the $\mathcal{M}_+$ geometry felt by other positive charges, causing a positive test particle to be accelerated outward along a geodesic away from the hill. And a negative charge creates a hill in the $\mathcal{M}_-$ geometry felt by other negative charges, causing a negative test particle to be accelerated outward along a geodesic away from the hill.

This offers an intuitive, purely geometric mechanism for push-and-pull dynamics without invoking abstract vector potentials.

The model is conceptually consistent and mathematically far more viable than a single asymmetric metric.

Splitting the interaction into **dual, mirrored geometric metrics $\mathcal{M}_+$ and $\mathcal{M}_-$** provides the following:

1. The model successfully preserves **Charge-Conjugation (C) symmetry**.
2. provides a geometric origin for both **attraction (geodesic motion into a pit)** and **repulsion (geodesic motion off a hill)**.
3. maintains the **premise** of **emergent spacetime**, where electromagnetic dynamics arise from distinct, underlying geometric structures separate from pure GR gravity.

But, as already mentioned above, this is only a preliminary proposal which does require more work.

However, a proposed experiment that might support the assumption that space-time is an emergent entity, might be the first step in stimulating additional endeavors in this field.

Because, if the fundamental assumption of a fixed, smooth 4D space-time manifold is dropped, the picture changes significantly:

1. **Emergent Space-time:** Under emergent space-time frameworks the smooth space-time metric structure is not a fundamental background. Instead, it is a large-scale, macroscopic approximation—much like fluid dynamics emerges from the microscopic behavior of molecules.
2. **Independent Geometric Structures:** If gravity is an emergent macroscopic geometry resulting from one type of underlying energetic interaction, it is entirely logical that electric interactions manifest as **separate effective geometries**.
3. **Explaining Attraction/Repulsion:** In such a model, the attraction or repulsion between charged particles would be the natural outcome of particles moving along optimal paths (geodesics) within their own specific emergent interaction geometry.

Thus, in the following chapter, of this paper, a proposal for such an experiment is presented.

However, it should be also emphasized, again, that a successful implementation of the proposed experiment, might not be, by itself, sufficient evidence that the space-time entity is an emerging entity.

Because, a successful implementation of the proposed experiment might trigger, initially, other responses, as for example, a search for imperfections in existing theories, such as electromagnetism, which would explain the outcome of the experiment.

Only then, a successful implementation of the proposed experiment might trigger a search for the possibility that the space-time might be an emergent entity, because mainstream physics does hold the assumption that space-time is indeed a primary, existing entity, an assumption which might be, or might not be, correct.

But, a successful implementation of the proposed experiment might be a step forward in the already ongoing research endeavors to present the space-time as an emerging entity.

And because that research is currently related mainly to endeavors related to the quantum mechanics, the fact that the proposed experiment utilizes macroscopic elements, used in the classic physics, and not microscopic elements, used in the quantum mechanics, might provide additional importance to the proposed experiment, if indeed, its implementation, will turn out to be successful.

6. A Proposed Experiment: A Charged Lense-Thirring Effect Experiment

Theoretical Basis

In General Relativity, a massive spinning object does not just exert a static gravitational pull; it physically **drags the metric geometry around it** as it rotates (the Lense-Thirring effect, or frame-dragging).

Standard Maxwell electrodynamics predicts magnetic fields from rotating charges, but it **does not** predict that a rotating charge distorts background geometric axes.

If electrodynamics is governed by the dual metric geometries ($\mathcal{M}_+$ and $\mathcal{M}_-$), as proposed in the above-mentioned paper [8] then:

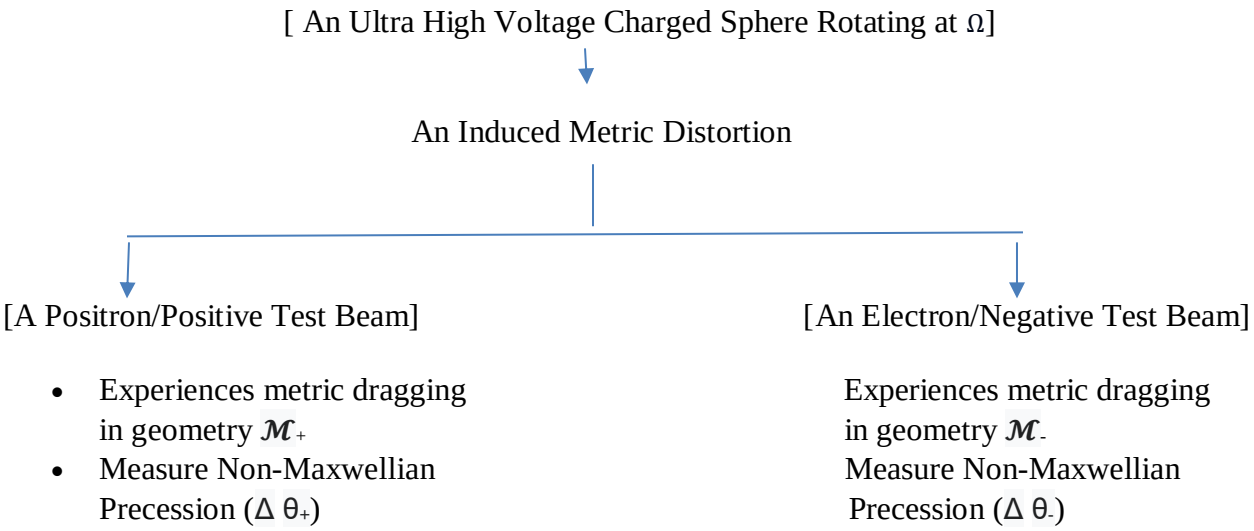
- A rapidly rotating, highly charged body with a massive positive charge distribution should induce a **geometric frame-dragging effect** within its specific metric ($\mathcal{M}_+$)

  And a rapidly rotating, highly charged body with a massive negative charge distribution should induce a **geometric frame-dragging effect** within its specific metric ($\mathcal{M}_-$)

- A test charge moving nearby will experience a trajectory precession (a spin-orbit geometric coupling) that **cannot be accounted for solely by the classical magnetic Lorentz force (v x B)** or standard Thomas precession.

7. The setup of the proposed experiment

A schematic presentation of the experiment should look like this:



The elements of the experiment would be:

• **The Source:** A non-magnetic, spherical conductor charged to an ultra-high electric potential (+V) and set to rotate at an extremely high angular velocity (Ω).

• **The Probe Beams:** Two identical, low-intensity beams of polarized charged test particles—one composed of positive ions/positrons (+q) and one of electrons (-q)—are fired on precise geodesic trajectories parallel to the equator of the rotating sphere.

• **Control Environment:** The system operates in a high-vacuum chamber, fully shielded from external stray magnetic fields, with the classical magnetic dipole field of the sphere precisely mapped and subtracted using quantum magnetometers (SQUIDs).

The experiment is designed to measure a possible Metric Precession Anomaly

Standard electrodynamics predicts that the particle beam will curve purely due to the electric force (E) and precess due to the magnetic force (B).

Under the **Dual Emergent Geometry Model** proposed above, the following might occur:

1. The positive test beam (+q) probes the metric tensor of $\mathcal{M}_+$, which is being dragged by the spinning positive source.
2. The extra geometric frame-dragging causes an additional intrinsic precession angle $\Delta\theta_{geom}$ of the test particle's spin/trajectory axis:

$$\theta_{total} = \theta_{Lorenz} + \Delta\,\theta_{geom}$$

The experiment should also contain a Null Test for C-Symmetry:

- If the source sphere's charge is flipped to negative (-V) and the test beam is flipped to negative (-q), the measured geometric anomaly $\Delta\theta_{geom}$ must remain **exactly equal in magnitude**.
- This confirms that $\mathcal{M}_+$ and $\mathcal{M}_-$ behave as exact dual mirror geometries, preserving C-symmetry.

The following summarizes what are the experiment constraints and how they are fulfilled:

Constraint	**How the Experiment Satisfies It**
No Time-Dilation Asymmetry	Does not rely on measuring different static clock rates between +q and -q. Time dilation remains symmetric.
Respects q/m Dependence	The primary deflection still scales with q/m.
Preserves C-Symmetry	Dual setup ensures +q probing $\mathcal{M}_+$ mirrored by -q probing $\mathcal{M}_-$ yields identical geometric precession magnitude.
Distinguishes from GR	Standard GR frame-dragging depends on *mass* (M) and is negligible for microscopic/lab masses. This effect depends on *charge density*, making it orders of magnitude larger if an independent EM metric exists.

It should be also emphasized that because the dual metric geometries ($\mathcal{M}_+$ and $\mathcal{M}_-$) as proposed in the above-mentioned paper [8] are just a preliminary proposal, which, as also presented above, do require more work, the paper does not delve into the mathematical calculations required for presenting expected values for the $\Delta\theta_{geom}$.

And thus, because of the above, and because a non-zero $\Delta\theta_{geom}$ is sufficient to manifest a possible Metric Precession Anomaly, the experiment should be initially designed to check only for a non-zero $\Delta\theta_{geom}$.

8. Summary and Conclusions

Exposing an anomaly in the spin-precession of a charged particle beam orbiting a rapidly rotating charge distribution, via a proposed Charged Lense-Thirring Effect Experiment, might eventually support the assumption that electromagnetism and gravity are not separate forces interacting *on* a spatial stage, but that the stage itself is directly woven by the underlying properties of particle interactions.

If the stage changes depending on whether an energy interaction is attractions between massive bodies, or attractions and repulsions between electrically charged bodies, then a singular, objective, pre-existing space-time background cannot exist.

This might bring us to the ultimate conclusion shared by advanced edge-theories like Nima Arkani-Hamed's "Amplituhedron" (9):

Space-time is doomed as a fundamental concept. It is a highly efficient cognitive mechanism—a biological "graphical user interface" (GUI)—evolved by the human brain to compress, organize, and make sense of complex, finite streams of energy and information data.

We do not look at a fundamental canvas called space-time; we look at energy interacting with energy, and our minds call the relationship "space-time."

By discovering bugs within this interface, humanity can finally peer past the graphics and begin decoding the true, informational code of the cosmos.

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