# LAYERS OF MOTION, LOGIC, AND REALITY: A STRUCTURAL CRITIQUE OF SR, GR, AND THE PARALLEL LAW OF EXCLUDED MIDDLE



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ABSTRACT. This paper explores the foundational assumptions of Special and General Relativity through the lens of the Parallel Law of Excluded Middle (PLEM). It reinterprets SR as a theory of constant logic within a single subworld and GR as the traversal across subworlds with varying local logic. It argues that global topological constructs such as manifolds and intersections inherently belong to the universe-level structure, not individual subworlds — thereby questioning the hidden assumptions of symmetry and continuity in physics.

#### 1. Introduction

Modern physics is built on a framework of elegant mathematical structures — but beneath these structures lie philosophical assumptions that often go unexamined. Special Relativity (SR) and General Relativity (GR), two pillars of twentieth-century physics, are celebrated for their predictive power and internal consistency. Yet both theories embed silent assumptions about symmetry, space, time, and logic itself.

This paper proposes a deeper lens for examining these assumptions through the Parallel Law of Excluded Middle (PLEM) [3–5] — a logical principle that challenges the universality of classical truth within layered structures of reality. PLEM distinguishes between propositions that are true within a logical subworld and those that require a broader universe-level perspective to evaluate.

We argue that Special Relativity assumes symmetry by treating all observers as existing within a single subworld. However, in the PLEM framework, this subworld is not truly symmetrical due to the failure of the Law of the Excluded Middle (LEM). General Relativity, by contrast, involves transitions between subworlds—introducing curvature and acceleration—which makes asymmetry unavoidable. This asymmetry holds both in the PLEM framework and in the traditional interpretation of GR, though for different reasons.. The differential smoothness of GR masks this logical shift, but the shift is real.

By bringing PLEM into dialogue with SR and GR, we expose a structural asymmetry at the heart of modern physics. This is not a flaw in the equations, but a conceptual detour from truth — a compromise made to preserve consistency at the cost of foundational clarity.

This paper does not seek to overthrow relativity, but to offer a new interpretation of its boundaries — and to show how logical architecture shapes our understanding of motion, time, and the universe itself.

This paper does not rely on novel calculations or physical predictions, but on a structural and logical analysis of the relativistic framework as formalized in Einstein (1905, 1915) [1,2]

Key words and phrases. Parallel Law of Excluded Middle (PLEM); Special Relativity; General Relativity; Logical Symmetry; Subworlds; Structural Truth; Curved Logic; Foundations of Physics.

and Minkowski (1908) [6]. Standard geometric interpretations follow the formalism found in texts such as Wald (1984) [7].

## 2. The Logic of Subworlds: A Brief Review of PLEM

We begin by recalling the core insight of the Parallel Law of Excluded Middle (PLEM): in a layered universe, truth is not absolute but structurally dependent. A proposition does not necessarily possess meaning or decidability within a single subworld — such assumptions reflect the classical Law of Excluded Middle (LEM). Instead, meaning emerges through the structure of movement among subworlds. A proposition may become meaningful only when viewed from the broader universe, where logical layers intersect.

In this framework, logical laws such as LEM apply only when both a proposition and its negation are grounded in the same logical layer. Each subworld is governed by its own internally consistent logic. When movement is accompanied by acceleration — as in General Relativity — it signals a transition among subworlds, thereby initiating a change in logical context. This structural shift is at the heart of PLEM: movement through the universe is not merely physical but logical, reshaping what can be said, known, or decided at each stage.

## 3. Symmetry, Invariance, and Flatness in Special Relativity

Special Relativity (SR) is founded on the principle that the laws of physics are the same in all inertial frames — that is, frames moving at constant velocity relative to one another. The mathematical formalism that expresses this principle is given by the Lorentz transformations, which relate spacetime coordinates between two inertial observers:

$$x' = \gamma(x - vt), \quad t' = \gamma \left(t - \frac{vx}{c^2}\right)$$
  
 $x = \gamma(x' + vt'), \quad t = \gamma \left(t' + \frac{vx'}{c^2}\right)$ 

Here,  $\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$  is the Lorentz factor, and it remains the same in both directions of the

transformation. This reciprocity reflects a deep structural assumption of SR: that spacetime is globally symmetric and flat.

This flatness is encoded in the Minkowski metric:

$$ds^2 = -c^2 dt^2 + dx^2 + dy^2 + dz^2$$

The invariance of  $ds^2$  under Lorentz transformations ensures that all inertial observers agree on spacetime intervals. In geometric terms, this confirms that the metric structure of spacetime is unchanged across frames — a sign that the physical world remains logically and structurally consistent.

From the perspective of the Parallel Law of Excluded Middle (PLEM), such invariance implies that SR is fully contained within a single subworld, where both physical and logical rules remain constant. No logical transitions occur — no crossing of layers — because acceleration, which would signal movement among subworlds, is absent. Within this subworld, LEM holds: every proposition and its negation are structurally comparable, and the space of logical possibilities appears flat, binary, and symmetrical.

But here lies a deep structural dependency:

The validity of Special Relativity depends on the logical symmetry of the subworld — and that symmetry is guaranteed only if LEM holds within it.

LEM assumes that for any proposition P, either P or  $\neg P$  must be true — this requires a logical space where both are well-defined and equally grounded. Such symmetry is not merely logical but structural: it ensures that truth-values form a complete, mirror-opposed pair. If, however, a subworld fails to satisfy LEM, it implies that this binary symmetry is broken. And when that happens, the foundational symmetry underlying Lorentz invariance — and thus Special Relativity itself — collapses.

In short, the flatness and symmetry of spacetime in SR correspond to the logical flatness and symmetry of the subworld's truth structure. This connection between geometry and logic — between Minkowski invariance and LEM — reveals that Special Relativity is not merely a physical theory but also a logically symmetric framework, valid only within the bounds of subworlds where structural symmetry holds.

# 4. Acceleration, Curvature, and Structural Asymmetry in General Relativity

General Relativity (GR) replaces the global flatness of Special Relativity with a more nuanced geometry: local flatness and global curvature. According to the equivalence principle, every infinitesimal region of spacetime can be treated as locally Minkowskian — a small-scale echo of the flat, symmetric subworld of SR. In these local frames, the familiar Lorentz invariance and logical coherence of SR temporarily hold.

But these locally flat patches are not isolated; they are stitched together across a curved manifold where the global metric varies from point to point. Acceleration — which is absent in SR — now becomes central. It reflects not only physical deviation from inertial motion but also logical transition: movement across subworlds, where internal logics may differ. In this context, the symmetry assumed in SR no longer holds globally.

From the perspective of the Parallel Law of Excluded Middle (PLEM), this transition has deep logical consequences. Each locally flat region corresponds to a subworld where LEM may be valid — that is, where every proposition P is either true or false because both P and  $\neg P$  are grounded in the same logical layer. But across the manifold — that is, in the universe as a whole — such symmetry is no longer guaranteed.

In PLEM, truth is structural and local. A proposition P may be true in one subworld, or  $\neg P$  may be true in another, but this does not imply that  $P \vee \neg P$  holds in the universe unless there is a common logical ground. The global disjunction fails to hold when P and  $\neg P$  are not simultaneously meaningful in the same logical layer.

This breakdown of global LEM reveals the asymmetry of the universe under GR. While GR tolerates geometric asymmetry through curvature, PLEM exposes the corresponding logical asymmetry: the universe is not a single flat logical space, but a layered structure of meaning, stitched together by acceleration and transition. Just as geodesics curve through spacetime, propositions curve through logic, changing their decidability as they move across subworlds.

Thus, General Relativity does not collapse under PLEM — it mirrors it. GR becomes the physical expression of PLEM's layered logic:

A universe built from subworlds that are locally coherent but globally asymmetric — in both geometry and truth.

## 5. The Hidden Collapse of General Relativity Under PLEM

While General Relativity (GR) accommodates global asymmetry through curvature, it still relies on a deeper assumption: local symmetry. Each local patch of spacetime — defined by the equivalence principle — is modeled on the symmetric, flat logic of Special Relativity. In doing so, GR assumes that the Law of Excluded Middle (LEM) holds locally: that within each inertial frame, every proposition is either true or false, grounded in a single coherent logic.

But the Parallel Law of Excluded Middle (PLEM) exposes a structural vulnerability: if even a local subworld lacks the logical symmetry required for LEM, then the foundational logic of GR disintegrates. The tensorial equations, the continuity of the metric, the structure of spacetime itself — all become ill-defined if the logic of each patch is no longer decidable. What once appeared as local flatness becomes a false projection of global asymmetry.

In this light, GR does not merely reflect the layered universe of PLEM — it depends on an assumption that PLEM ultimately denies. When LEM fails locally, General Relativity collapses. Geometry becomes structurally unstable. The universe is no longer a smooth manifold stitched from symmetric frames, but a shifting landscape of logical discontinuities, where even spacetime loses its universal meaning.

## 6. PLEM AND THE STRUCTURAL CONTRADICTION IN GR

In classical General Relativity, the manifold is treated as a smooth, global object stitched together from locally Minkowskian patches. Each patch assumes a consistent internal logic, mirroring the symmetry of Special Relativity. The Einstein field equations are formulated within these local frames, assuming decidability of physical and logical structure — that is, assuming LEM holds.

But from the perspective of the Parallel Law of Excluded Middle (PLEM), this process conceals a structural contradiction. The local patches — or subworlds — are logically coherent only in isolation. The global manifold, however, belongs not to any subworld but to the universe as a whole. It is a construct of layered logic, where transitions between patches encode not just curvature but logical discontinuity. The global solution to the Einstein field equations thus emerges in a space where logical symmetry no longer holds.

PLEM reveals that GR relies on local symmetry to define its equations, but depends on global asymmetry to solve them. This exposes an internal inconsistency: the manifold is built from symmetrical frames, yet its solution lives in an asymmetrical universe.

#### 7. Structural Critique: The Loop of Assumption in Relativity

Special Relativity begins by assuming symmetry — both physical (equivalence of inertial frames) and logical (validity of LEM). From this, it derives Lorentz invariance, the cornerstone of flat spacetime. Minkowski then reformulates this as a geometric unity of space and time — a formalization that still rests on the same underlying assumption of logical symmetry.

General Relativity extends this framework by assuming that every local region of spacetime is Minkowskian — effectively importing the logic and geometry of SR into every patch. But the global manifold GR constructs from these local pieces is curved, asymmetric, and no longer preserves the original assumptions that grounded each patch.

This progression creates a structural loop:

- Symmetry is assumed,
- Then encoded geometrically,
- Then used to build a theory whose global form abandons symmetry.

The Parallel Law of Excluded Middle (PLEM) reveals this loop not just as a contradiction, but as a deeper architectural detour — a compromise embedded in the very logic of the theory. GR inherits its local consistency from SR, but projects that local logic onto a universe whose global structure invalidates the very symmetry that gave rise to it.

In PLEM terms: relativity begins in a subworld, formalizes its logic, and then stretches that logic beyond its valid layer — creating a universe whose geometry no longer reflects its logical ground.

# 8. Toward a Deeper Foundation: PLEM and the Architecture of Physical Reality

If truth is not absolute but layered, and if physical theories operate within and across these logical layers, then physics must evolve beyond geometric formalism. It must develop tools that recognize logical displacement as a structural part of physical motion. The invariance of  $ds^2$  in General Relativity is preserved locally — not because truth is global, but because movement in GR occurs across subworlds, where local logic remains stable under constraint. These transitions are governed by the smoothness of the manifold, but not by a unified logical frame.

The Parallel Law of Excluded Middle (PLEM) offers a new lens through which to understand this:

Every coordinate transformation is not merely a shift in observer perspective — it is a change in logical grounding.

The structure of spacetime, under this view, is inseparable from the structure of truth. Geometry is not only curved — it is logically layered. What GR expresses mathematically, PLEM completes conceptually: a vision of the universe as a landscape of local symmetries embedded in global asymmetry, where logic itself bends along with space and time.

#### 9. Conclusion

This paper has explored the foundational asymmetry embedded in modern physics through the lens of the Parallel Law of Excluded Middle (PLEM). Special Relativity operates entirely within a flat logical subworld, where symmetry and LEM hold. General Relativity constructs a curved manifold by assembling such subworlds — but this global structure lacks the logical unity assumed in its local formulation. The differential geometry of GR ensures smoothness, but not truth continuity.

By recognizing truth as structural and layered, PLEM reveals that the logical assumptions of relativity are not universally valid, but locally constrained. This is not a rejection of relativity, but a conceptual deepening — a shift from geometry alone to the architecture of logic that underlies it. The deeper unity between physics and reasoning may not be found in further unification of physical forces, but in understanding how motion, curvature, and meaning emerge through transitions across logical layers.

Relativity, when viewed through PLEM, becomes not just a physical theory, but a story of how logic travels — curved, stitched, and transformed through the manifold of existence.

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