Symmetry Breaking as Homeostasis: Extrinsic Gravity and the Dialectical Architecture of Fundamental Forces

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Abstract: The Standard Model is often celebrated as a nearly complete account of the strong, weak, and electromagnetic interactions, lacking only gravity. Yet a closer examination of cosmic evolution suggests that the emergence of these forces presupposes global conditions not derived from the internal dynamics of quantum field theory. The symmetry-breaking transitions of the early universe required a coherent spacetime geometry, a regulated cooling trajectory, stable vacuum structure, and causal connectivity across cosmological scales. These features are ordinarily treated as background conditions within which the Standard Model operates. This paper argues that such background coherence may be interpreted as reflecting an antecedent gravitational principle—extrinsic gravity—understood not as an additional force, but as a pre-geometric, homeostatic regulator consistent with a CPT-symmetric cosmology. Section 2 revisits the standard narrative of force differentiation to show how symmetry-breaking transitions presuppose global stability conditions. Section 3 reframes this emergence through a Hegelian dialectical lens, highlighting the structural movement from undifferentiated unity to articulated multiplicity. Section 4 then shows that the Weyl tensor already contains an intrinsic two-sided decomposition into self-dual and anti-self-dual parts, and that a variational principle enforcing their indistinguishability drives the Weyl tensor to vanish, selecting conformal flatness with Minkowski space as the stabilized representative. Taken together, the argument suggests that the Standard Model functions within a broader theoretical horizon that includes antecedent spacetime coherence not contained within its formal Lagrangian. Extrinsic gravity names this deeper regulatory structure, offering a unified interpretation of cosmological symmetry breaking, geometric stabilization, and the two-sided architecture of physical law.

Keywords: Cosmological Evolution, CPT symmetric Universe, Extrinsic Gravity, Gauge Groups, Hegelian Dialectic, Homeostasis, Minkowski Space, Standard Model, Two-sidedness, Wely Tensor.

1. Introduction

Smith (2025) has reconstituted general relativity from a two-sided regulation that stabilizes classical curvature dynamics in a CPT symmetric universe. That prior effort involved the Ricci part of curvature. In the present paper, the same approach will be followed with the Weyl part of curvature to show a two-sided regulation that stabilizes conformal structure and supports early-universe coherence.

The Standard Model is often celebrated as a nearly complete account of the fundamental interactions, lacking only gravity. Yet this omission is not merely a missing piece of the puzzle—it hides a structural dependency that becomes visible only when we examine how the strong, weak, and electromagnetic forces actually *emerged* in the early universe. These forces did not arise spontaneously from internal dynamics. Their differentiation required a globally coherent environment: a regulated cooling trajectory, stable vacuum states, and a causal structure capable of coordinating symmetry breaking across the entire cosmos.

These conditions do not arise from within the dynamical content of the Standard Model itself. Rather, they presuppose an antecedent spacetime structure and cosmological framework within which the Standard Model operates.

This paper argues that these background conditions point to a deeper principle: an extrinsic gravitational regulator that precedes spacetime geometry and unites the two sides of a CPT-symmetric universe (cf., Boyle, Finn, and Turok, 2018; Smith 2021). Earlier attempts to describe this structure (e.g., Smith 2019) were limited by an incomplete understanding of CPT indistinguishability and the two-sided nature of physical description. With the matured framework of two-sidedness and extrinsic homeostasis, the emergence sequence becomes clearer: the universe's developmental unfolding depends on a regulatory principle that is not contained within the Standard Model but is implicitly presupposed by it.

Section 2 revisits the standard narrative of cosmic evolution (e.g., Chaisson 2001)—not to defend any particular cosmological model, but to show how the strong, weak, and electromagnetic forces require an extrinsic regulator to stabilize their symmetry-breaking transitions. Section 3 reframes this emergence through a Hegelian lens, revealing the dialectical structure underlying the differentiation of forces. Section 4 then shows that the Weyl tensor already contains an intrinsic two-sided decomposition into self-dual and anti-self-dual components, and that a variational principle enforcing their indistinguishability drives the conformal curvature to vanish, selecting Minkowski space as the stabilized background.

Taken together, these sections develop a single thesis: the Standard Model depends on what it formally excludes. Its forces emerge within a cosmological setting whose global coherence may be interpreted as reflecting an antecedent extrinsic gravitational principle—pre-geometric, homeostatic, and two-sided—that regulates the universe's earliest transitions.

This paper does not claim that the Standard Model and general relativity fail to describe early-universe dynamics. Rather, it argues that the existence of a globally coherent classical background is presupposed by these descriptions and may itself admit a deeper variational interpretation. This framework does not replace standard cosmological dynamics but offers a variational reinterpretation of the antecedent coherence those dynamics presuppose.

2.1 The Early Universe as Undifferentiated Symmetry

Immediately after the Big Bang, the universe existed in a state of extreme temperature and density. Under such conditions, the distinctions between forces dissolve. What we now call the strong, weak, and electromagnetic interactions were unified within higher symmetries. In this primordial state, the universe resembled the “undifferentiated state”: a domain in which distinctions exist only in potential, not in actuality.

But this unity was unstable. As the universe expanded and cooled, symmetry breaking occurred in a precise sequence:

- Gravity decouples first (Planck epoch).
- The strong force separates from the unified interaction (GUT epoch).
- The electroweak force later splits into the weak and electromagnetic forces (electroweak epoch).

Each transition marks a developmental step — a differentiation of structure from unity.

Yet these transitions did not occur arbitrarily. They required global constraints: a controlled cooling rate, a coherent causal structure, and stable vacuum states. Physics presupposes a background of classical coherence that is not derived from first principles.

One may argue that general relativity supplies the necessary expansion dynamics. However, the present argument concerns not the dynamical equations themselves but the deeper question of why a coherent classical background exists at all. It is also worth noting that general relatively neither privileges nor uniquely defines an intrinsic geometry because even general relativity is found consistent with a two-sided homeostatic balancing in a CPT symmetric universe (Smith 2025). We might wonder how many of the resting conflicts in the theoretical gestalt representing physics must be left unresolved before something extrinsic is permitted in spacetime?

This is the first sign of an extrinsic regulator.

2.2 Symmetry Breaking as a Homeostatic Process

Symmetry breaking is not merely a mathematical operation. Symmetry breaking describes emergence, but homeostatic regulation may support emergence and may only become fully apparent after the movement is complete (see Section 3.4). This emergence is a physical phase transition in the vacuum structure of the universe. Like all phase transitions, it requires:

- a background geometry,
- a monotonic cooling trajectory,
- stable attractor states,
- and a global regulator that ensures coherence across the entire system.

These conditions were not generated by the strong force itself but arose within the global dynamics of spacetime, which can be interpreted here as expressing an antecedent regulatory structure. These are gravitational phenomena.

But here is the key point: the gravitational influence that regulates symmetry breaking is not the same as the geometric curvature described by Einstein.

Einsteinian gravity is the *trace* of matter and energy on spacetime. It is the “intrinsic gravity” that appears inside the universe as curvature. But the regulator required for symmetry breaking is deeper. It must:

- precede spacetime geometry,
- operate universally on all fields,
- maintain coherence across the entire early universe,
- and stabilize transitions between vacuum states.

This is what is called extrinsic gravity — the middle-term that unites the two sides of a CPT inversion and makes differentiation possible.

2.3 The Emergence of the Strong, Weak, and Electromagnetic Forces

With this regulatory background in place, we can now examine how each force emerges.

2.3.1 The Strong Force: First Differentiation

Around 10^{-36} seconds after the Big Bang, the universe cooled enough for the Grand Unified symmetry to break. This transition separated the strong force from the electroweak interaction.

The strong force’s emergence required:

- a stable vacuum state,
- a controlled cooling rate,
- and a coherent causal structure across the universe.

While these may be explained by general relativity and thermodynamics, the existence of a classical, globally coherent spacetime background is not derived from quantum field theory itself.

2.3.2 The Electroweak Force: A Unified Middle Stage

For a long interval, the weak and electromagnetic forces existed as a single electroweak interaction. This unified force depended on the Higgs field being in a symmetric, high-energy state.

Again, the stability of this state required global regulation.

2.3.3 Electromagnetism and the Weak Force: Final Differentiation

At around 10^{-12} seconds, the Higgs field acquired a nonzero vacuum expectation value. This broke electroweak symmetry and produced:

- the photon (massless → electromagnetism),
- the W and Z bosons (massive → weak force).

Electromagnetism, in this sense, is not a primitive force. It is the *residual symmetry* left over after the weak force becomes massive. Its existence depends on:

- the Higgs field choosing a direction in field space,
- the stability of that choice,
- and the global coherence of the vacuum.

Once again, these conditions are not generated within the Standard Model's internal dynamics but presuppose antecedent background conditions, which this framework interprets as expressions of an extrinsic regulatory principle.

2.4 Why the Standard Model Depends on What It Excludes

The Standard Model is defined on a fixed spacetime background. It presupposes:

- a coherent geometry,
- a stable vacuum,
- a monotonic cooling trajectory,
- and a causal structure that allows fields to propagate.

The Standard Model does not attempt to derive these conditions from within its own formal structure; rather, it assumes them as antecedent features of the spacetime framework in which it is formulated.

This is the contradiction now identified: The Standard Model formally excludes gravity, yet conceptually depends on an extrinsic gravitational regulator hinted at in Section 4.

The regulator is not the geometric gravity of Einstein. It is the deeper, pre-geometric principle that:

- stabilizes symmetry breaking,
- unites the two sides of a CPT-symmetric universe,
- and provides the homeostatic balance that allows differentiation to occur without collapse.

It is the middle-term of the two-sidedness: the constraint that makes structure possible.

2.5 Extrinsic Gravity as the Missing Middle-Term

If we take this distinction seriously, we can articulate the architecture of the early universe as follows:

- Undifferentiated state: unified forces, maximal symmetry.
- Differentiated state: strong, weak, and electromagnetic forces.
- Middle-term: extrinsic gravity — the regulator that ensures stable transitions.

This middle-term:

- is present “all along,”
- precedes spacetime geometry,
- governs the conditions under which forces emerge,
- and is implicitly assumed by the Standard Model even though it is not included in it.

In this sense, extrinsic gravity is not a force among forces. It is the precondition for forces — the homeostatic regulator that makes the universe’s developmental sequence possible.

3.1 A Hegelian Reading of the Emergence of the Fundamental Forces

The early universe, in its first instants, presents a picture of extraordinary simplicity: a state of extreme temperature and density in which the distinctions familiar to us—forces, particles, even spacetime structure—are not yet articulated. Modern physics describes this primordial condition through the language of unified gauge symmetries, while Hegelian philosophy describes the same structural moment as *pure being*, a unity without internal differentiation. Although these frameworks arise from different traditions, they converge in their treatment of emergence: both see differentiation not as an external imposition but as an internal unfolding of a unity that contains within itself the seeds of its own articulation.

This Section explores the emergence of the strong, weak, and electromagnetic forces through the lens of Hegel’s dialectic, showing how the symmetry-breaking sequence of the early universe can be understood as a movement from pure unity to determinate difference and finally to a self-mediated, articulated totality.

3.2 Pure Unity: The Primordial Gauge Symmetry as Hegel’s “Being”

In many Grand Unified Theories, the earliest phase of the universe is described by a single, simple gauge group—such as SU(5), SO(10), or E_6—governing all interactions. At the highest energies, this unified symmetry admits no internal distinctions: the forces we now treat as separate are merely different aspects of a single, undifferentiated structure.

This is the cosmological analogue of Hegel's *pure being*: immediate, unarticulated, and without determinate content. Pure being, in Hegel's logic, is not a blank nothingness but a fullness so complete that no distinctions have yet emerged. Likewise, the unified gauge symmetry is not empty; it is a plenitude of potential interactions, all of which are latent within the undifferentiated whole.

Yet pure being cannot remain in this state. Its very indeterminacy is unstable. In Hegel's account, pure being passes over into *determinate being* through the act of negation—the first moment of differentiation. In physics, this corresponds to the first symmetry breaking.

3.3 First Negation: The Emergence of SU(3) as Determinate Difference

As the universe cools, the unified symmetry undergoes spontaneous symmetry breaking. The first major differentiation in many models is the emergence of the strong interaction, governed by the gauge group $SU(3)_C$. This is the moment when the primordial unity negates itself, producing a determinate structure that stands out from the undifferentiated whole.

In Hegelian terms, SU(3) is the first *moment of otherness*. It is the first articulation of the original unity into a specific, determinate form. The remaining electroweak symmetry, $SU(2)_L \times U(1)_Y$, persists as a residue of indeterminacy—still unified, still lacking internal differentiation.

This stage is not a conflict between SU(3) and the electroweak unity; rather, it is the internal self-differentiation of the original whole. The unity has negated itself by producing a determinate moment, while leaving behind a remainder that must undergo its own negation.

The universe now contains a dual structure: a determinate force (the strong interaction) and an undifferentiated electroweak unity. This is the first negation.

3.4 Second Negation: Electroweak Differentiation and the Articulated Totality

The second major symmetry breaking occurs when the Higgs field acquires a nonzero vacuum expectation value. This event differentiates the electroweak unity into two distinct interactions: the weak force, mediated by massive W and Z bosons, and electromagnetism, mediated by the massless photon.

This is the *negation of the negation* in the Hegelian sense. The residue of indeterminacy left after the first negation now differentiates itself, producing its own determinate moments. The electroweak unity, which had remained internally undifferentiated, now articulates itself into SU(2) and U(1) as distinct structures.

The result is the fully articulated gauge structure of the Standard Model:

$SU(3)_C \times SU(2)_L \times U(1)_Y$.

This is not a mere collection of independent forces. It is a *self-mediated totality*, a differentiated unity in which each component retains the trace of the original whole. The strong, weak, and electromagnetic interactions are not separate “things” but differentiated expressions of a deeper unity that has unfolded itself through successive negations.

It is at this final level that homeostatic balancing is most apparent as the duality identified with the first negation is resolved by the second negation where the duality turns into a triadic relationship. However, balancing also had to play a role to underwrite spacetime according to this interpretation.

In Hegel’s language, the universe has moved from pure being, through determinate difference, to a unity that preserves difference within itself. The forces are not accidental products of cooling; they are the articulated form of a deeper logical and structural necessity.

3.5 The Dialectical Logic of Symmetry Breaking

What makes this mapping more than a metaphor is the structural parallel between Hegel’s dialectic and the mathematics of gauge symmetry:

- Unity contains difference implicitly.
  The unified gauge group contains SU(3), SU(2), and U(1) as latent substructures.
- Negation is internal*.*
  Symmetry breaking is not imposed from outside; it arises from the internal dynamics of the fields.
- The negation of the negation restores unity at a higher level.
  The final gauge structure is a differentiated unity that preserves the original symmetry in transformed form.
- Difference is not destruction but articulation.
  Each force is a determinate expression of the same underlying structure.

In this sense, the Standard Model is not merely a catalog of forces but the final articulation of a dialectical process that began in the earliest moments of the universe.

4. The Homeostatic Balance of Spacetime

Extrinsic gravity is defined operationally as the variational principle that enforces conformal matching between CPT-conjugate sectors (e.g., Smith 2025). In this section, this same meaning applies, but will relate to the Wely tensor rather than Ricci.

If geometry is a two-sided language as described by Smith (2010), with intrinsic curvature and extrinsic coordinate structure forming a dialectic, then meaning arises only when both sides are present. This is precisely what can be geometrically described happening with 4-dimensional spacetime: Weyl tensor has 10 degrees of freedom; curvature splits into Ricci (matter) and Weyl (free gravitational field); gravitational waves exist; causal structure becomes nontrivial; and curvature can propagate independently of matter. None of this is available for dimensions less than 4. If there are dimensions higher than 4, it is probably a completely different scale of existence that is well beyond today's physics and is better presented as metaphysics that is unexplored and also well beyond the scope of the present paper. The special role of four dimensions in supporting independent Weyl curvature suggests a structural resonance with the proposed two-sided balancing. This dimensional resonance is suggestive rather than deductive.

The Weyl tensor is particularly interesting because it is the part of curvature that is free of matter and represents the freely propagating, nonlocally constrained sector of intrinsic geometry, making it malleable to extrinsic influences. The 4-th dimension is the first dimension where: geometry can have internal tension; curvature has independent structure; the metric can express both intrinsic and extrinsic aspects; and the dialectic between matter (Ricci) and free geometry (Weyl) becomes meaningful.

Smith's (2010) philosophical argument — that meaning arises only when geometry has a two-sided structure (intrinsic/extrinsic, covariant/contravariant, metric/connection, Ricci/Weyl) — is actually mirrored in the algebraic structure of curvature.

As previously noted, the Standard Model and quantum field theory do not include gravity, but both take for granted a 4-dimensional spacetime that represents a stabilized a Minkowski background. The Ricci part of curvature is taken as null because gravity is on a scale that is well removed from the Planck scale. However, the Weyl part of the curvature is still relevant because flat spacetime is only taken for granted. It remains necessary to show how the Weyl tensor might be mathematically involved with the hypothesized two-sided balancing.

The Wely tensor vanishes if and only if the spacetime is conformably flat, Minkowski is a special case of this. There is a well-known action, $s_{weyl} = \int dx^4 \sqrt{-g}\, C_{abcd}C^{abcd}$, where C_{abcd} denotes the Wely tensor. The variation of s_{weyl} gives the Bach tensor. Minkowski (and more generally conformably flat metrics) solve the vacuum equations of this theory.

The action, s_{weyl}, can now be manipulated in principle and turned into something that demonstrates two-sidedness in a variation that penalizes both nonzero Weyl curvature and mismatch between the two hypothetical Weyl structures. However, this misses the dual pre-spacetime imprints that are already present in one Weyl tensor and it is better to work with those imprints directly.

In four dimensions, C_{abcd} can be viewed as a linear operator on the six-dimensional vector space of 2-forms, $C\colon \wedge^2 \rightarrow \wedge^2$. Because the Hodge star operator $\star$ acting on 2-forms satisfies $*^2 = -1$ (in Lorentzian signature, complexified), the space $\wedge^2$ decomposes into two irreducible three-dimensional eigenspaces of self-dual and anti-self-dual 2-forms, $\wedge^2 = \wedge^2_+ \oplus \wedge^2_-$. As shown clearly in Gursky's (1998) analysis of conformal geometry, the Weyl tensor commutes with the Hodge star and therefore preserves this splitting, yielding a block-diagonal decomposition $C = C_+ \oplus C_-$. The two blocks C_+ and C_- are symmetric, trace-free linear operators on $\wedge^2_+$ and $\wedge^2_-$, respectively, each carrying five independent degrees of freedom. Thus, the Weyl tensor is intrinsically two-sided: its conformal curvature naturally separates into dual, irreducible components associated with the self-dual and anti-self-dual sectors of the pre-spacetime 2-form representation space.

Because C_+ and C_- inhabit inequivalent irreducible subspaces, there is no natural identification between them. A condition of indistinguishability therefore cannot be implemented as equality, but instead as the absence of any invariant quantity that distinguishes the two sectors. The only configuration satisfying this requirement is one in which both sectors vanish. In other words, the only way the two dual sides can be made indistinguishable (and thus invariantly paired) is for the entire Weyl tensor to vanish, which is precisely the condition for conformal flatness. Once the conformal factor is fixed, Minkowski space emerges as the stabilized representative of this class. This observation shows that one does not need to introduce two separate Weyl tensors to model a two-sheeted or two-sided ontology: the deeper duality is already present in the intrinsic decomposition $C = C_+ \oplus C_-$. The self-dual and anti-self-dual sectors constitute the pre-spacetime dual structure, and the homeostatic balancing principle acts directly on this built-in two-sidedness to select the flat background required by the Standard Model.

If one instead varies over spacetime metrics, nothing more than the standard Weyl action s_{weyl} is required, since its integrand $C_{abcd}C^{abcd}$ naturally decomposes into the sum of squared norms $\|C_+\|^2 + \|C_-\|^2$. Extremizing this action therefore drives both irreducible sectors to zero, providing a direct variational realization of the homeostatic principle: the geometry relaxes to conformal flatness precisely because the two intrinsic sides of the Weyl tensor become indistinguishable. This drives the system toward conformal flatness and admits Minkowski space as a stable representative solution. This realization is structural and interpretive, not a claim of fundamental completion.

5. Conclusion

The emergence of the strong, weak, and electromagnetic forces is often described as a sequence of spontaneous symmetry breakings driven solely by the internal dynamics of quantum fields. Yet a closer examination reveals that these transitions depend on global conditions the Standard Model does not attempt to supply within its own formal scope and instead treats as antecedent background structure.

Stable vacuum states, coherent causal structure, and a regulated cooling trajectory are all prerequisites for differentiation, not consequences of it. The early universe required a principle capable of coordinating these transitions across both sides of a CPT-symmetric cosmos.

This paper has argued that such coordination is the work of extrinsic gravity: a pre-geometric, homeostatic regulator that stabilizes symmetry breaking and unites the two sides of a two-sheeted universe. The Standard Model formally excludes gravity, but conceptually depends on this extrinsic regulator to make its own structure possible. In this sense, extrinsic gravity is not an additional force; it is the *middle-term* that allows forces to emerge at all.

The Hegelian analysis of Section 3 clarifies this developmental logic. The universe's earliest moments are not a chaotic fragmentation but a lawful unfolding from pure unity to determinate difference and finally to a differentiated totality that preserves the unity within itself. The gauge structure of the Standard Model—SU(3) × SU(2) × U(1)—is the articulated form of this dialectical movement. The physics does not merely resemble the logic; it *instantiates* it.

Section 4 then shows that this two-sided logic is not only philosophical but geometrical. The Weyl tensor, with its ten degrees of freedom, is the natural carrier of the extrinsic side of curvature. The apparent flatness and coherence of spacetime are not primitive facts but the result of a deeper symmetry-completion process acting on the freely propagating geometric degrees of freedom. The Weyl tensor encodes a latent dual structure revealed by Hodge decomposition, and a higher-order constraint—interpretable as a generalized CPT-like symmetry enforced by a middle-term—removes any invariant distinction between its complementary sectors. The resulting vanishing of the Weyl tensor yields conformal flatness as an emergent, homeostatic state. This does not claim uniqueness; it demonstrates consistency. A homeostatic balancing principle is compatible with the flat background the Standard Model assumes but does not explain.

Because two-sidedness is self-restraining—limited to the provisional range where intrinsic and extrinsic structures must be balanced—it does not constitute a theory of everything. Instead, it restores a mode of inquiry that mirrors first-person experience: meaning arises only when two sides are held in tension, neither collapsed nor absolutized. The same logic appears across scales, from cosmology to cognition, from geometry to Friston's (2010) free-energy principle. Its recurrence is not speculative metaphysics but a deductive recognition of a structural pattern that becomes self-evident once articulated. Once this mode of inquiry becomes reinforced and also rediscovered in great abundance in the third-person (e.g., Smith 2022, 2025), the mode of inquiry becomes an intuition and represents a separate way of knowing that is radical for empirical science. Again, this is not speculative philosophy, it is a deductive extraction that typifies Koestler's (1967) thinking, for example. The emergence of the Standard Model offers a further example of a deductive extraction grounded in gauge symmetries, with experimental validation following only later. From this perspective, its articulation in Hegelian terms, as undertaken in Section 3, appears wholly natural.

We have no license to claim that the third-person account is any less restricted even as a traditional science has presupposed a physical reality that is safely separated from an observer. The third person account of physics and cosmology is equally understood as the result of a two-sided balancing. The central claim of this paper is therefore modest but decisive: the universe's structure is the result of a two-sided balancing, and the Standard Model is the final expression of that balance—not its origin. Extrinsic gravity is the missing middle-term that makes the entire edifice coherent.

The intrinsic two-sided structure of the Weyl tensor thus provides the concrete geometric expression of the homeostatic logic that underlies the universe's emergence.

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