Colinear Conservation

Noether's Theorem and the Corrective Architecture of Gravitytime

Paul W. Barnes
Oshawa, Ontario, Canada
Athabasca University
pbarnes1@athabasca.edu

Abstract

Noether's theorem establishes that every continuous symmetry of a physical system's action corresponds to a conserved quantity. The result is treated, in standard practice, as a powerful technical tool. It is rarely asked why nature should be such that the theorem holds: why the action principle should apply, why the actions of physical systems should exhibit continuous symmetries, or why conservation should be the structural correlate of invariance. This paper proposes a structural answer. Conservation, on the account developed here, is not the absence of change but the trace of continuous corrective differentiation. A conserved quantity remains constant because gravity's cohering operates colinearly with each emergence, sustaining coherence across the differentiation that time orders. Symmetry is the empirical signature of that corrective process. The paper introduces *colinear gravitytime* as the structural operator performing this corrective differentiation: a single operator with time as primary and gravity as its reciprocal cohering aspect, codifferential and colinear at every emergence. The proposal is articulated within the broader framework of Unified Axioconscious Field Theory (UAFT), but the structural argument is independent of the broader framework and stands on its own merits. The paper develops the cosmological constant problem as a worked example, identifies eight additional empirical domains where the proposal would make contact with measurement, and engages existing approaches in foundations of physics including relational accounts of time (Barbour, Rovelli), background-independent quantum gravity programmes (loop quantum gravity, causal set theory), emergent-gravity proposals (Verlinde, Jacobson), and the philosophy-of-symmetry literature (Brading, Castellani, Healey, Earman). The paper is offered as a structural thesis awaiting technical development.

Keywords: Noether's theorem, conservation laws, symmetry, philosophy of physics, gravitytime, foundations of physics, cosmological constant, relational time

1. The Standing Puzzle

Symmetry is the operative principle of modern physics. Classical mechanics rests on it. Special relativity is constructed from it. General relativity is derived by demanding it. Quantum field theory cannot be formulated without it. The Standard Model, gauge theory, supersymmetry, and string theory all draw their structural content from symmetry principles. Wherever physics has made progress, symmetry has been the principle guiding the progress.

This recurrence is not accidental, and it is not merely aesthetic. Eugene Wigner, in his celebrated reflection on the unreasonable effectiveness of mathematics in the natural sciences (Wigner 1960), identified the fact that physical theories are expressible as compact mathematical structures as a deep and unexplained feature of the world. Symmetry is the central case of his observation. Why should the equations of nature be invariant under continuous transformations? Why should those invariances correspond to conserved quantities? Why should conservation be the operative principle of physical persistence?

The standard answer is Noether's theorem (Noether 1918), which establishes a one-to-one correspondence between continuous symmetries of a physical system's action and conserved quantities of its motion. Time-translation symmetry yields energy conservation. Spatial-translation symmetry yields momentum conservation. Rotational symmetry yields angular momentum conservation. Gauge symmetry yields charge conservation. The theorem is mathematically airtight and empirically vindicated across the full range of contemporary physics.

But the theorem itself is silent on a deeper question. Noether's result establishes that *if* the action exhibits a continuous symmetry, *then* a conserved quantity follows. It does not explain why physical actions should exhibit continuous symmetries to begin with, nor why nature should be the kind of structure to which the action principle applies. These are the questions of foundations.

The philosophy of physics has engaged this gap, with sustained work by Brading and Castellani (2003), Healey (2007), Earman (2004), and others examining the metaphysics of symmetry and the ontological status of conservation laws. The discussion has been productive but inconclusive. A range of positions has been articulated, symmetries as substantive features of nature, symmetries as gauge-theoretic redundancies, conservation laws as primitive postulates, conservation laws as derived from deeper structure, without convergence on a settled view.

This paper proposes a structural account of why Noether's theorem holds. The proposal is that conservation is not passive preservation but the trace of an active codifferential operation in which time and gravity work reciprocally and colinearly. Symmetry, on this account, is the empirical signature of this codifferential operation. The theorem holds because the ordering of differentiation by time and its cohering by gravity occur colinearly within a single operator.

This is a strong claim, and the paper develops it with care. The argument runs in three movements: a reconceptualization of conservation as active process, the identification of colinear gravitytime as the structural operator performing the corrective work, and the empirical domains in which the proposal would make contact with measurement.

A note on the position from which this paper is offered. The author works on foundations of consciousness rather than within the professional physics community, and approaches foundations of physics through structural argument rather than through technical apparatus. The paper makes a structural claim about why Noether's theorem holds and identifies a research programme through which the claim can be tested. It does not derive the technical machinery the claim's full development would require. The invitation is to physicists with relevant expertise to take that next step. The structural argument stands or falls on its own merits.

2. Noether's Theorem: A Structural Reading

Noether's theorem, in its original 1918 formulation, applies to physical systems whose dynamics derive from a variational principle. If the action functional of such a system is invariant under a continuous group of transformations, then there exists a conserved current associated with each independent generator of the group. The conserved currents integrate to conserved quantities along solutions to the equations of motion.

The mathematical content of the theorem is uncontroversial. What is structurally interesting is what the theorem reveals about the *reciprocity* between symmetry and conservation. The two are not independent facts that happen to correlate. They are two descriptions of the same underlying property of the system. The invariance of the dynamics under transformation and the constancy of the conserved quantity across that transformation are reciprocal aspects of one structural fact.

Noether's theorem does not tell us what that underlying fact is. It tells us only that wherever invariance appears, conservation appears alongside it, in formally precise correspondence. This is sufficient for technical application but insufficient for ontological understanding. The technical sufficiency is why physics has not pressed further. The ontological insufficiency is why this paper does.

A useful way to put the point: Noether's theorem captures the *structure* of the relationship between symmetry and conservation, but it leaves open the *substance* of what symmetry and conservation are. The structural relationship can be stated in formal terms; the substantive content cannot, at least not from within the formal apparatus alone.

The theorem also requires the existence of an action principle. Why nature should be such that an action principle applies, why physical systems should be governed by the variational dynamics that make Noether's theorem applicable in the first place, is itself an unanswered foundational question. The theorem is conditional on a structural feature of nature whose origin remains unexplained.

3. The Standard Interpretation and Its Limits

The standard interpretation treats conservation laws as fundamental regularities of nature, with the symmetries that imply them as either equally fundamental or as expressions of the regularities themselves. Both readings have been defended in the literature.

Brading (2002) and Brading and Brown (2003) examine the relationship between symmetry and conservation in detail, distinguishing global from local symmetries and noting the different ontological commitments each carries. Global symmetries (such as time translation) connect to genuinely conserved quantities; local gauge symmetries are widely interpreted as descriptive redundancies whose physical content is more subtle. Healey (2007) develops a sophisticated account of gauge theories on which gauge symmetries are interpretive redundancies rather than substantive features of nature. Earman (2004) presses the question of whether symmetries should be regarded as ontologically robust or as formal-mathematical artifacts. Wallace (2012) addresses related issues in his account of emergence and conservation in Everettian quantum mechanics.

Across these positions, a common feature emerges: the philosophical literature engages the *interpretation* of symmetry and conservation but does not propose a structural account of *why* the relationship between them holds. The interpretive question, what symmetry and conservation are metaphysically, is taken up vigorously. The structural question, what process in nature produces the relationship, is rarely posed.

The structural question has been displaced rather than answered. Conservation laws are treated as primitive postulates, or as consequences of symmetries which are themselves treated as primitive, or as redundancies that nevertheless yield genuine physical content through their formal properties. Each of these moves accommodates the relationship without explaining it.

This paper takes the structural question seriously. It proposes that the relationship between symmetry and conservation reflects an underlying corrective process, and that the formal correspondence captured by Noether's theorem is the empirical signature of that process. The interpretive question and the structural question are connected: a structural account of why the relationship holds will constrain the metaphysical interpretations available.

4. Conservation as Active Corrective Process

The reconceptualization begins with a simple observation. Conservation is conventionally framed as a passive property: a conserved quantity is one that does not change as the system evolves. The framing makes conservation sound like an absence: the absence of variation in some measure across the dynamics.

This framing is misleading. A conserved quantity remains constant not because nothing acts on it but because what acts on it acts in a structured way that preserves its value. Energy, in a closed system, transforms continuously between forms, kinetic, potential, thermal, electromagnetic, with each transformation involving real physical processes. The conservation of total energy across these transformations is not a passive fact; it is the visible result of the transformations being structured such that the total is preserved.

What kind of structure produces this result? The proposal here is that conservation is the trace of continuous corrective differentiation. At each transformation, something in the underlying physics performs the work of maintaining the total. The conserved quantity stays constant because a corrective process operates continuously, integrating the local changes into a coherent whole that respects the conservation, a dynamic consistency. This dynamic consistency is the closest point a system can get to a static balanced state in the temporal without collapsing it.

This is not a redescription of the existing physics. It is a claim about what conservation laws *are*. Conservation laws, on the proposal, are the macro-scale signatures of continuous corrective work performed in the underlying dynamics. The work is invisible to the formal apparatus because the apparatus tracks the conserved quantity as a single number, not the corrective process producing the constancy of that number.

The implication is that any framework taking conservation seriously must, at some level, articulate the corrective process. The standard framework declines to do so, treating conservation as primitive. This paper proposes that the corrective process can be identified, and that identifying it grounds Noether's theorem in a substantive structural fact.

A skeptical reader may worry that "active corrective process" is doing rhetorical rather than structural work: that the framing adds nothing beyond the standard account except a more dynamic vocabulary. The response is twofold. First, the framing has substantive consequences for how we read symmetry breaking, the cosmological constant problem, and apparent conservation violations in extreme regimes (developed in Sections 8 and 9). Second, the framing identifies a specific operator, colinear gravitytime, as the structural seat of the corrective work, generating distinguishable predictions in domains where the operator's behavior diverges from that of the standard apparatus. The corrective framing earns its keep through the substantive consequences that follow from it.

5. Colinear Gravitytime: The Operator

The structural operator proposed here is *colinear gravitytime*. This is a term drawn from Unified Axioconscious Field Theory (Barnes 2026a), where it identifies a single physical operator in which time is primary and gravity is its reciprocal cohering aspect. The operator is colinear in the sense that the two aspects act on the same axis at the same emergence: they are not sequential but simultaneous, and they share the same line of action.

Time, on the UAFT account, is not a dimension through which things move but the ordering of differentiation itself. Time is the first emergent through which differentiation becomes expressible. Without time, no asymmetry can be ordered into sequence; no wave can propagate; nothing can come to be. Wherever differentiation occurs, time occurs, and conversely.

Gravity, on the UAFT account (Barnes 2026a), is the reciprocal of time: the coherence-restoring, binding tendency that prevents differentiation from dissolving unity. Time differentiates. Gravity coheres. They are complementary expressions of the same dynamic. The reinterpretation does not contradict general relativity. The equations of GR describe the geometry of what Einstein called spacetime. UAFT proposes that the ontological ground of what those equations describe is not spacetime but gravitytime, the fundamental pairing of differentiation and coherence. The mathematics need not change. What changes is what the mathematics is understood to describe. Together, time and gravity are codifferential and colinear in the operation that produces conservation.

Time and gravity together constitute one operator. They do not act independently. They cannot be separated and treated sequentially. Wherever time emerges, gravity is reciprocally cohering, at the same emergence, on the same axis, in the same act. This is what colinearity means in the present proposal.

A note on terminology is warranted here. The operator is both *colinear* and *codifferential*. The colinear aspect names the structural geometry: time and gravity share the axis at the emergence and are not separated in space or location. The codifferential aspect names the operational function: time and gravity perform different work, with the difference between them being what allows the operation to resolve imbalance. Time is primary, the first emergent through which differentiation becomes ordered. Gravity is reciprocal, the cohering aspect that operates on what time has made possible. Neither colinearity nor codifferentiation alone names the operator adequately. Colinearity without codifferentiation would be redundant pointing in the same direction with no reciprocal difference to drive the resolution of imbalance. Codifferentiation without colinearity would be two separate operations in different places rather than the joint operation of one structure. The operator is a single thing that is colinear in its structural geometry and codifferential in its operational function. This paper foregrounds the colinear aspect because the question being addressed is structural: why do conservation laws follow from continuous symmetries? The codifferential aspect, which addresses what the operator does in producing physical differentiation, is treated more directly elsewhere within the broader Unified Axioconscious Field Theory framework.

A third structural feature follows from the codifferential and colinear aspects together: the operator is *phase-differentiated* in its dynamics. When conditions change in the codifferential operation, the response of time and the response of gravity are not exactly simultaneous despite being colinear in their structural geometry. Time, being primary, responds first; gravity, as the reciprocal cohering aspect, responds in turn. The interval between them is the phase differential of the codifferential operation. This differential is what gives transitions an interior. Without it, every change in conditions would be fully exposed at every instant, and the continuous-but-veiled quality of becoming would collapse. The phase differential is what makes reality processual rather than sequential. Static measurements may not detect it because there is no condition-change for it to manifest in. Dynamic measurements where conditions vary should detect it as a small but nonzero lag between temporal and gravitational responses to the same condition change.

The strong claim of the paper is that this operator is what produces the corrective process underlying conservation. Continuous differentiation occurs because time is operating, ordering asymmetry into expressible sequence. Continuous corrective coherence occurs because gravity is operating colinearly with time, sustaining the differentiation against dissolution. Conservation laws are the empirical signature of this colinear operation, observed at scales where the local differentiations and local corrections balance into stable conserved quantities.

A reader may reasonably ask whether colinear gravitytime is a hypothesis or a redefinition. The answer is that it is a structural proposal whose content is the colinearity itself. Conventional physics treats gravity and time as distinct phenomena governed by distinct mathematical structures (the metric tensor in one case, the time coordinate in the other). The proposal here is that they are reciprocal faces of a single operator, and that the structural fact of their colinearity is what produces the relationship between symmetry and conservation that Noether's theorem captures.

The proposal can be tested in two ways. Internally, it can be checked against the structure of conservation laws as physics actually finds them: does the proposed operator account for the patterns of conservation, symmetry breaking, and apparent conservation violation that physics has documented? Externally, it can be checked against empirical predictions in domains where colinearity would manifest distinctively. Sections 8, 9, and 10 develop both.

6. The Bridge: Why Continuous Symmetries Yield Conservation

With colinear gravitytime articulated, the bridge to Noether's theorem can be constructed.

Continuous symmetries correspond to conserved quantities because continuous generative differentiation requires continuous corrective differentiation, and the colinear structure of gravitytime provides exactly that. Wherever the action of a system is invariant under a continuous transformation, time is operating along the corresponding axis without interruption. Gravity, by colinearity, operates along the same axis without interruption. The continuous corrective differentiation integrates the local generative differentiations such that some quantity associated with the transformation remains constant. That quantity is the conserved current Noether's theorem identifies.

This is why conservation always appears at the invariance. Invariance is the structural condition under which dynamic consistency is being maintained at the asymptotic limit along the transformation axis. The transformation can be applied continuously without disrupting the system because the emergent forces resolving local imbalances are balancing such that the dynamic consistency holds. The conserved quantity is what that maintained consistency looks like when measured at the scale the formal apparatus tracks. Where invariance breaks, dynamic consistency is still being maintained, but local conditions perturb the asymptotic limit along that axis, and the conservation becomes approximate rather than exact.

The theorem holds without remainder because it is the mathematical face of an ontological structure. The formal correspondence between symmetry and conservation is what colinear gravitytime *looks like* when described in the language of variational principles. A different formal apparatus might capture the same structural fact differently, but the underlying fact is the same: continuous generative differentiation occurring colinearly with continuous corrective differentiation.

This account explains several features of conservation laws that the standard interpretation accommodates without explaining.

First, it explains why exact symmetries correspond to exactly conserved quantities and approximate symmetries correspond to approximately conserved quantities. Where the colinearity is exact along a given axis, the corrective differentiation fully matches the generative differentiation, and the conserved quantity is exactly preserved. Where local conditions perturb the colinearity, the corrective differentiation lags, and the conservation is approximate. The degree of the approximation tracks the degree of the perturbation.

Second, it explains why the most fundamental symmetries (Lorentz invariance, CPT) correspond to the most robustly conserved quantities. These symmetries track the deepest structural axes of gravitytime, where colinearity is most robust against perturbation. Less fundamental symmetries (flavor, isospin) correspond to axes where local conditions can disrupt colinearity, leading to the partial or broken symmetries observed.

Third, it explains why conservation laws appear universally rather than as features of particular systems. The corrective process is a structural feature of the operator itself, not a contingent property of local configurations. Wherever the operator acts (that is, everywhere), conservation results.

The account is, at this stage, structural rather than calculational. It does not produce numerical predictions for the values of conserved quantities. It proposes that the values, whatever they are, reflect the local conditions of generative and corrective differentiation operating colinearly. The numerical content remains the province of the formal apparatus physics has developed; what changes is the substantive interpretation of what that apparatus is tracking.

7. Symmetry Breaking as Integration in Progress

Before treating specific cases of symmetry breaking, a deeper reframing is warranted. The vocabulary of "symmetry breaking" presupposes that symmetry was the base state and asymmetry is the deviation requiring explanation. UAFT inverts this. Asymmetry is the prime mover. Differentiation occurs because asymmetry presents in the field, and without asymmetry there would be no differentiation, no time, no gravity, no structure of any kind. The base condition is asymmetric differentiation, not symmetric uniformity.

True symmetry in the strict sense, perfect undifferentiated uniformity, would be destructive of all structure. It would name a state that contains nothing. What physics observes when it talks about symmetry is therefore not undifferentiated uniformity but dynamic consistency: the maintained coherence that differentiation produces as it operates colinearly through gravitytime. Symmetry, properly understood, is dynamic consistency reaching its asymptotic limit along a given axis.

"Symmetry breaking" on this account is a misnomer. Nothing is broken. The mathematical idealization of perfect symmetry was never a state the universe occupied. What physics observes when it describes symmetry breaking is dynamic consistency being maintained at less-than-asymptotic limits along certain axes, with differentiation outpacing local cohering and integration occurring at wider scales. The cases below are read in this light.

If exact symmetry is the signature of fully colinear corrective differentiation, broken symmetry is the signature of differentiation that has locally outpaced or escaped its corrective face. The phase differential of the codifferential operation, absorbed into steady-state at invariance, becomes most observable during the dynamic transitions that physics calls symmetry breaking. The transition is precisely the regime where time's response leads gravity's response in detectable measure. The colinearity has not failed, gravitytime remains one operator, but local conditions have produced expressions that the field is still integrating across a wider scale.

This reframes several standing puzzles in physics.

The matter-antimatter asymmetry of the observable universe is conventionally treated as a violation of expected symmetry that requires special explanation. Standard Model CP violation is far too small to produce the observed matter excess, and the various baryogenesis scenarios all invoke physics beyond the Standard Model. On the present account, the asymmetry is evidence that the corrective face of gravitytime is operating across a scale wider than the observable universe. Early-universe differentiation produced an excess that requires integration the local cosmic horizon does not capture. The asymmetry is not a defect to be explained away but a marker of corrective work in progress at cosmic scale.

Electroweak symmetry breaking at the Higgs scale is similarly reframed. The "breaking" is not a defect in an otherwise symmetric universe. The differentiation occurring at that energy scale produces expressions that require coherence-maintenance across a domain the unbroken symmetry cannot capture. The Higgs mechanism is the mathematical description of the field accommodating differentiation through a more elaborate corrective structure. The breaking is the field expanding the corrective architecture to maintain coherence across the new differentiation.

Biological chirality, the universal handedness of amino acids and sugars, is another instance. The asymmetry is conventionally attributed to historical accident. On the present account, the handedness represents a stable corrective integration at the biochemical scale: an asymmetry that the corrective face has accommodated as part of life's differentiation. The handedness is not a violation of underlying symmetry but a localized resolution that the field has integrated into stable form.

In each case, what conventional physics treats as a symmetry violation requiring special explanation, the present account treats as generative differentiation outpacing local corrective differentiation with integration occurring at a wider scale. The reframing does not eliminate the need for detailed mechanistic accounts of each case. It changes what the mechanistic accounts are descriptions of.

8. The Cosmological Constant: A Worked Example

The cosmological constant problem is the canonical case for testing the present account. It is the most consequential foundational problem in contemporary physics; it has resisted all standard resolution attempts; and it makes contact with active observational programmes whose recent results provide empirical traction the framework must accommodate. This section develops the colinear conservation account of the cosmological constant in detail, situates it against the major existing approaches, and identifies the observational signatures that would distinguish it.

8.1 The Problem in Two Forms

Following Weinberg (1989, 2000) and Padilla (2015), the cosmological constant problem has two forms.

The *old* problem is the discrepancy between the calculated vacuum energy contributions from quantum field theory and the observed value of the cosmological constant. Naive estimates of vacuum energy from QFT, summed up to a Planck-scale cutoff, exceed the observed Λ by approximately 120 orders of magnitude. The numerical figure is sometimes contested, different calculations using different cutoffs and regularization schemes yield different magnitudes of discrepancy, but the qualitative point is uncontested: there is a vast mismatch between the QFT estimate and the observed value, and no known mechanism within the Standard Model cancels the excess.

The *new* problem, sometimes called the coincidence problem, is the fact that the observed Λ is comparable in magnitude to the present matter density. This is surprising because matter density evolves with the expansion of the universe (as a^-3) while a constant Λ does not, so for them to be comparable now requires either a finely tuned initial condition or a dynamical mechanism that brings them into balance.

Padilla's review (2015) emphasizes that the deeper issue is not the magnitude of the discrepancy but the *radiative instability* of the calculation: even if one fine-tunes the bare cosmological constant to cancel the QFT contribution at one loop, higher-order corrections require additional fine-tuning at each order. The problem is structurally robust against any solution that does not address why nature should be such that the cancellation holds at all orders.

8.2 The Major Resolution Attempts

The literature contains several lines of approach to the cosmological constant problem. Each is briefly characterized here, with attention to what colinear conservation offers in contrast.

Anthropic and multiverse approaches. Weinberg (1987) proposed that the small observed value of Λ is selected by anthropic considerations: in a multiverse where Λ takes different values in different regions, structure formation requires Λ within a narrow window around its observed value. Vilenkin (2003, 2006) developed this approach in detail, showing that the predicted distribution of Λ peaks near the observed value when probability is weighted by the number of observers. The string landscape (Susskind 2003) provides a possible mechanism for the multiverse: the 10^500 vacua of the landscape contain regions with varied Λ values, and we live in one with small Λ.

The anthropic approach is the most extensively developed. Its limitations are well known: it requires commitment to a multiverse whose existence is not independently established; it predicts the value of Λ as anthropically selected but offers no mechanism for how the selection occurs at the cosmological level; and it does not address the radiative instability problem, since the anthropic argument operates on the value of Λ rather than on the structure of the calculation that generates the discrepancy.

Quintessence and dynamical dark energy. Quintessence proposals (Caldwell, Dave, and Steinhardt 1998; Zlatev, Wang, and Steinhardt 1999) replace a constant Λ with a slowly rolling scalar field whose equation of state w differs from -1. The advantage is that the dark energy density evolves dynamically rather than being fixed by an initial condition. The disadvantage is that quintessence does not solve the old problem (the QFT vacuum energy still wants to dominate) and introduces new fine-tuning problems for the scalar field potential.

Weinberg (2000) argued explicitly that quintessence does not help with either the old or the new cosmological constant problem. The recent DESI results (DESI Collaboration 2024, 2025), which show 2-4σ tension with constant Λ in favor of evolving dark energy, have given quintessence-like models renewed empirical support, but the foundational issues remain.

Sequestering. Kaloper and Padilla (2014a, 2014b) proposed the sequestering scenario: a global modification of general relativity in which the spacetime average of the matter Lagrangian is constrained, forcing the cosmological constant to take its observed value as a global property of the universe. The proposal is technically elegant and addresses the radiative instability problem by sequestering vacuum energy contributions through a global constraint rather than local cancellation. Its limitations include the introduction of non-local elements into the gravitational dynamics and the requirement of additional structure (auxiliary fields, modified action) whose physical motivation is not independent of the problem it is solving.

Modified gravity. Approaches such as f(R) gravity, DGP braneworlds, and Verlinde's emergent gravity (Verlinde 2017) attempt to account for the apparent acceleration of cosmic expansion through modifications of the gravitational dynamics rather than through a cosmological constant per se. These approaches reframe the empirical content (no Λ, but modified gravity at large scales) but face strong observational constraints, particularly from precision tests of general relativity at solar system and binary pulsar scales.

Causal set predictions. Sorkin (1991, 2007) derived from causal set theory a prediction that Λ should fluctuate at order 1/√V, where V is the spacetime four-volume. This gives roughly the observed order of magnitude and is the only approach to the cosmological constant that offers a quantitative prediction without anthropic input. Its limitation is that it depends on the specific framework of causal set theory, which is one among several candidates for a fundamental quantum gravity.

Supersymmetry as partial cancellation. Exact supersymmetry would yield exact cancellation of bosonic and fermionic vacuum energies, eliminating the cosmological constant problem altogether. Broken supersymmetry yields a residual cosmological constant of order (M_SUSY)^4. With M_SUSY ~

TeV (the original natural value motivated by the hierarchy problem), this gives a residual Λ of order 10^60 times the observed value, still vastly off, but better than the unbroken Standard Model estimate. The LHC's failure to find supersymmetric particles at the natural scale has eliminated this partial resolution.

8.3 The Colinear Conservation Account

The present account proposes a different reading. The 120-order-of-magnitude discrepancy is not a defect to be cancelled or finely tuned but evidence that vacuum energy is held in coherence-maintenance across the integrated cosmic differentiation history. The vacuum energy is not missing or cancelled; it is doing structural work, performing the corrective integration that maintains coherence across the cosmic scale at which differentiation has accumulated.

On this reading, the apparent cosmological constant Λ is not a fundamental constant but the visible signature of cosmic-scale corrective integration. Its value at any given cosmic epoch reflects the integrated differentiation history up to that epoch. The discrepancy between QFT vacuum estimates and the observed Λ is the gap between the local field-theoretic calculation (which counts vacuum contributions as if they expressed locally) and the actual cosmic-scale integration (which holds most of those contributions in coherence-maintenance rather than allowing them to express locally as observable density).

This account differs from existing approaches in three structural ways.

First, it treats the discrepancy as a *measurement of integration scale*, not an error to be eliminated. The 120 orders of magnitude indicate the depth at which corrective integration is operating. A framework that successfully cancels the discrepancy without addressing what the integration is doing structurally has eliminated the problem in formal terms but lost the structural information the discrepancy encodes.

Second, it predicts that the apparent value of Λ should *evolve* in correlation with cosmic differentiation history. As the universe expands and structure forms, the integrated differentiation increases, and the corrective face must integrate across an expanded domain. The observable Λ should track this integration, evolving in a way that correlates with the rate of cosmic structure formation.

Third, it makes contact with recent observational evidence. The DESI DR2 results (DESI Collaboration 2025; Cortês and Liddle 2024) show 2-4σ preference for evolving dark energy over constant Λ, with the equation of state parameter w showing time dependence. The colinear conservation account predicts evolution; the standard ΛCDM model does not. If the DESI tension strengthens with continued observation, the colinear conservation account gains direct empirical support.

8.4 What Would Distinguish the Account

Several observational signatures would distinguish colinear conservation from existing alternatives.

Correlation with structure formation. The colinear conservation account predicts that the evolution of Λ should correlate specifically with the rate of cosmic structure formation, not with arbitrary scalar field dynamics. Quintessence allows for evolution governed by the chosen scalar potential; colinear conservation predicts evolution tied to the integrated differentiation history, which is approximately measured by structure formation rates. Surveys mapping structure formation in conjunction with dark energy evolution can in principle distinguish these.

Dependence on local differentiation density. The account predicts that the local effective Λ should depend on the local differentiation density of the cosmic environment. In regions of higher integrated structure density, the local corrective differentiation operates more strongly, and the effective dark energy density should differ from cosmic mean values. This is a strong prediction distinguishable from both ΛCDM (which predicts a global constant) and quintessence (which predicts a global scalar field value). Voids, supercluster regions, and high-density environments should exhibit measurable differences in local dark energy behavior.

Late-time acceleration onset. The coincidence problem, why Λ becomes comparable to matter density now, is predicted by colinear conservation to follow naturally from the integrated differentiation history reaching the threshold at which cosmic-scale integration becomes the dominant mode. The transition from matter domination to dark energy domination corresponds to the epoch at which differentiation accumulation exceeds the threshold for cosmic-scale integration. This is in principle calculable from a properly developed framework, though such calculation requires technical work beyond the present paper.

Falsification conditions. The account would be falsified if Λ proves to be exactly constant under sufficiently precise observation; if its evolution proves to be uncorrelated with structure formation; or if local environmental dependence is excluded by future surveys. The DESI continuation through 2028, the Vera Rubin Observatory's Legacy Survey of Space and Time, and the Roman Space Telescope's dark energy programme will provide the relevant data. The account is exposed to falsification on a definite timescale.

8.5 What the Account Does Not Yet Do

The colinear conservation account, as developed here, does not produce a numerical prediction for the observed value of Λ. It offers a structural reading of why the discrepancy exists and a qualitative prediction that Λ should evolve with cosmic differentiation history. The development of a quantitative prediction would require articulating, in technical terms, how the integrated differentiation history maps to observable dark energy density. This is a research programme rather than a finished result.

The honest comparison with existing approaches is the following. Anthropic and multiverse approaches offer no mechanism but accommodate any value Λ might take. Quintessence offers a dynamical mechanism but no derivation of why the scalar potential takes the form required. Sequestering offers global cancellation but introduces non-local structure. Causal set theory offers a quantitative prediction at the right order of magnitude but depends on an unproven framework for spacetime. Supersymmetry's partial cancellation has been undermined by LHC data. Colinear conservation differs by addressing the discrepancy itself as a structural fact rather than as an error requiring elimination, with observational programmes able to test the qualitative prediction. It belongs in the conversation as a position to be developed rather than as a settled alternative.

A deeper reframing is implicit in the account developed here. Physics has searched for "the cosmological constant" as a fixed numerical value, a parameter to be derived from first principles or measured to high precision. The framework's commitment to value-as-constancy is itself a framework-bound assumption. The genuine constancy is operational: dynamic consistency continuously maintained through differentiation, codifferentially operated through gravitytime, never stopping and never reaching stasis. The Λ that physics measures is the empirical trace of dynamic consistency under current cosmic conditions, evolving as those conditions evolve. What is constant is not the trace but what the trace traces. This relocation may explain why a century of effort to derive Λ from first principles has not produced a satisfying answer: the calculations have been computing the trace rather than identifying what the trace signals.

9. Further Empirical Domains

The cosmological constant section is offered as a worked example of how colinear conservation makes contact with empirical work. The following domains constitute additional research directions, each more briefly sketched. Their development to testable form would require quantitative work beyond the scope of this paper.

The matter-antimatter asymmetry. Section 7 sketched the structural reframing. Empirically, the prediction is that signatures of corrective integration should be detectable in cosmic microwave background polarization patterns at large angular scales, distinguishable from purely inflationary signatures. The observed asymmetry would reflect ongoing cosmic-scale integration rather than a fixed initial condition.

Symmetry-breaking thresholds in extreme regimes. Conventional physics treats phase transitions as functions of energy scale. Colinear conservation predicts that thresholds should exhibit dependence on local *differentiation density*: meaning that in regimes of unusually high or low differentiation density (extreme astrophysical environments, the immediate vicinity of black hole horizons), symmetry-breaking thresholds should deviate measurably from standard values. Neutron star mergers, magnetar fields, and accretion disks around supermassive black holes provide regimes where the prediction can in principle be probed.

Black hole information and Hawking radiation. What appears as information loss across a black hole horizon would, on the present account, be corrective integration occurring at the wider cosmological scale. The information is preserved at the scale of integrated cosmic structure rather than in the local Hawking radiation. This makes contact with the holographic principle and AdS/CFT in ways that may yield distinguishable predictions about correlations between Hawking radiation modes and large-scale structure.

Bell-test refinements. The strength of Bell violations should correlate with the differentiation density of the measurement context. Environments of unusually low differentiation density should manifest the corrective face's atemporal action more strongly; environments of high differentiation density should manifest it more locally. The shape of the violation curve as a function of environmental differentiation should be measurable and distinct from standard decoherence predictions.

Vacuum fluctuation statistics. Standard QFT predicts purely Gaussian vacuum statistics in the free-field limit. The present account predicts measurable non-Gaussianities tied to the local differentiation context, reflecting the corrective integration operating across the relevant scale. High-precision measurements of vacuum fluctuation higher-order moments would in principle test this.

Dark energy and structure formation correlation. Beyond the cosmological constant section's treatment, the account predicts that dark energy density should correlate quantitatively with the rate of cosmic structure formation, with a calculable lag. Surveys mapping structure formation rates in conjunction with dark energy evolution could in principle detect this correlation directly.

Gravitational-wave ringdown signatures. When black holes merge, the colinear differentiation event is extreme and brief. The account suggests that gravitational-wave ringdown should encode signatures of corrective integration that go beyond the standard general-relativistic prediction: specifically, deviations from the Kerr ringdown spectrum that correlate with the magnitude of the differentiation event. LIGO/Virgo and future detectors (Einstein Telescope, Cosmic Explorer) have the precision to test this once the prediction is sharpened to numerical form.

Temporal-gravitational phase relationship in rotating frames. This domain offers a near-term, lab-scale test of the framework's most distinctive structural commitment: that time is primary in the codifferential operation, with gravity as its reciprocal cohering aspect, and that the operator is phase-differentiated in its dynamic response to changing conditions. The prediction is sharp and falsifiable in a way the previous domains are not yet ready to be.

The equivalence principle establishes that centrifugal acceleration in a rotating reference frame produces locally indistinguishable effects to a gravitational field. Existing experiments testing time differentials use aircraft and satellites in real gravitational fields: Hafele-Keating (1971) with atomic clocks on commercial jets, GPS satellite corrections accounting for gravitational time dilation in continuous operation, Pound-Rebka (1959) measuring gravitational redshift over a 22.5-meter tower. Modern optical lattice clocks have extended the precision of such measurements to 10^-19 fractional uncertainty, sufficient to detect time dilation differences across fractions of a meter at Earth's surface gravity.

Centrifuge experiments at corresponding precision have not been similarly developed. Earlier rotor experiments (Hay, Schiffer, Cranshaw, Egelstaff 1960; Champeney, Isaak, Khan 1963) using the Mossbauer effect confirmed time dilation due to rotational velocity at the rim of small rotors, but interpreted the results within special-relativistic kinematic time dilation rather than as tests of the equivalence-principle gravitational interpretation. The conceptual habit in the field has been to treat centrifuge experiments as kinematic SR tests rather than as gravitational equivalence-principle tests, even though the equivalence principle holds these interpretations to be physically equivalent.

The colinear conservation account predicts something standard physics does not: that the codifferential operation of time and gravity is phase-differentiated in its dynamic response to changing conditions. Time is primary; gravity is its reciprocal cohering aspect. When the codifferential conditions change, the time-aspect response should precede the gravity-aspect response by the operator's phase differential, a small but nonzero interval. Standard physics predicts zero phase difference between the two responses. The framework predicts the phase differential to be nonzero, with time leading.

The experimental architecture is straightforward. One clock sits stationary in the laboratory, experiencing 1g (Earth surface gravity) and no rotational motion. A second clock rides on the rim of a centrifuge spinning at a controlled and variable rotation rate, experiencing some larger effective gravity (5g, 10g, 100g, depending on apparatus capability) due to centripetal acceleration. A force sensor at the same rim position measures the effective gravitational force directly. Both clock and force sensor are continuously monitored relative to laboratory references with high temporal resolution.

When the centrifuge rotation rate is changed, the effective gravity at the rim changes correspondingly. Standard physics predicts that the clock's tick rate change and the force sensor's reading change track each other exactly: both respond to the same changing field with no relative phase difference. The colinear conservation account predicts a small but nonzero phase lag, with the clock's response preceding the force sensor's response by some interval.

The special-relativistic contribution to time dilation due to rim velocity is exactly calculable from the rotation rate and rim radius. Subtracting this from the observed time dilation isolates the equivalence-principle contribution. The phase lag prediction concerns the timing of this isolated contribution relative to the force-sensor response.

The predicted magnitude of the phase lag awaits technical development of how time's primacy in the codifferential operation manifests quantitatively. The qualitative prediction is nonetheless distinguishing: standard physics is committed to zero lag; the framework predicts nonzero. Any measurable lag would be evidence for time's primacy in the codifferential operation. Null results at experimental precision would constrain the prediction's magnitude or challenge the framework's structural claim about time's primacy.

The strength of this test relative to magnitude-based comparisons lies in its qualitative character. Tests that distinguish frameworks by predicting different magnitudes of the same effect can be confounded by experimental imperfections and calibration errors. A phase differential that one framework predicts to be exactly zero and another predicts to be nonzero is harder to confound. The asymmetry in commitments produces a cleaner test: zero versus not-zero, with experimental precision determining how small a nonzero phase differential can be detected.

Modern optical clocks reach time resolutions in the picosecond range or better. Force sensors with sub-millisecond response times exist as standard laboratory equipment. Centrifuges capable of producing 100g effective fields with stable rotation rates are available in materials science and biology applications. The apparatus required is largely existing technology; the experimental design is novel only in asking a question that has not previously been asked.

This domain is identified as a near-term test opportunity precisely because it is grounded in the framework's most fundamental structural claim. If time is genuinely primary in the codifferential operation, this test should reveal evidence of that primacy. If the test reveals no phase lag at the precision modern instruments allow, the framework's claim about time's primacy requires either technical refinement to predict a smaller lag, or substantive revision.

These eight domains, together with the cosmological constant treatment of Section 8, do not exhaust the empirical contact points but constitute a research programme of substantial scope. Each requires technical development beyond the present paper. The invitation extended here is to that development.

10. What This Paper Does Not Claim

The scope of the proposal should be stated clearly.

The paper does not claim to derive the numerical values of conserved quantities, the masses of particles, or the specific forms of physical laws from first principles. It claims that whatever those values and forms are, they reflect the operation of colinear gravitytime under specific conditions of generative and corrective differentiation.

The paper does not replace the existing mathematical apparatus of physics. The action principle, Lagrangian and Hamiltonian formalism, gauge theory, and general relativity remain intact and unchallenged in their formal content. What the paper proposes is a structural account of what these apparatuses are tracking.

The paper does not claim that the empirical domains identified are tested predictions. They are research directions. Their development to testable form requires quantitative work beyond the scope of this paper. The paper offers them as an invitation to physicists with the relevant expertise.

The paper does not claim to resolve the philosophical disputes over the metaphysics of symmetry and conservation. It proposes a structural account that constrains the available metaphysical interpretations, but the deeper questions about the nature of physical reality remain open.

The paper does not develop UAFT's broader claim that space itself is the experiential consequence of gravity acting across differentiation rather than an ontologically primary category (Barnes 2026a). The structural argument about colinear conservation is logically separable from the space ontology, though they cohere within the framework.

The paper does claim that conservation is active corrective process rather than passive preservation, that colinear gravitytime is the operator performing the corrective differentiation, and that Noether's theorem is the mathematical signature of this structural fact. These are substantive claims and the paper stands or falls on them.

11. Relation to Existing Approaches

The proposal articulated here engages with several established lines of foundational work in physics and philosophy of physics. This section situates colinear conservation against those lines, identifying both genuine overlaps and substantive differences. The treatment cannot be exhaustive, but the major positions are addressed.

11.1 Barbour's Relationalism and Timeless Configurations

Julian Barbour (1999, 2020) has developed the most thoroughgoing relational account of time in contemporary foundations of physics. In *The End of Time*, Barbour argues that time is illusory: fundamental reality consists of a timeless "Platonia" of three-dimensional configurations, and what we experience as the flow of time is a feature of how records of past configurations are encoded in present configurations. Each "now" is a complete, self-contained configuration; there is no time in which configurations succeed one another. In *The Janus Point*, Barbour develops a more nuanced account in which an entropy minimum (the Janus Point) provides a directional structure with entropy increasing in both directions away from it.

Barbour's account is genuinely radical. It denies time as a fundamental feature of nature. Mach's principle, in Barbour's reading, motivates the elimination of absolute time in favor of a relational structure derived from configuration geometry.

The contrast with colinear gravitytime is sharp. Where Barbour eliminates time as fundamental, the present account treats time as primary, the first emergent through which differentiation becomes ordered, with gravity as its reciprocal cohering aspect. Where Barbour grounds physics in timeless geometric configurations, the present account grounds physics in an active operator in which time is the primary aspect. The two proposals are not in competition for the same explanatory slot, they offer fundamentally different ontologies, but they engage the same foundational question (what is time, fundamentally?) and arrive at opposite answers.

A nuanced comparison reveals partial overlaps. Barbour's relational account shares with the present proposal a rejection of substantival absolute time. Both reject the Newtonian framing of time as a uniform background through which things move. Where they diverge is on what replaces the substantival picture. Barbour replaces it with a timeless configuration space; the present account replaces it with a relational operator whose dynamics *are* the differentiation that constitutes temporal ordering.

The choice between these accounts is partly empirical and partly ontological. Empirically, Barbour's framework requires that all dynamics reduce to relational geometry, which faces difficulties accommodating quantum field theory and the standard model in straightforward terms. Colinear gravitytime offers a structural account compatible with the existing apparatus while reframing what the apparatus describes. Ontologically, the question is whether time is real (as differentiation) or illusory (as appearance arising from records). The present account commits to the former.

11.2 Rovelli's Relationalism and Thermal Time

Carlo Rovelli's relational programme (Rovelli 1996, 2018; Connes and Rovelli 1994) develops a different account of time. The thermal time hypothesis, articulated with Connes, proposes that time is the flow generated by the thermal state of a system relative to which physics is described. On this account, time is not fundamental but emerges from coarse-grained thermal averaging over quantum states. *The Order of Time* (Rovelli 2018) develops the philosophical implications: time is local, perspectival, thermal, and not a single global flow.

Rovelli's broader work in loop quantum gravity (addressed in Section 11.3) treats spacetime itself as emergent from quantum-geometric structure. Time, in this picture, is reconstructed from correlations among quantum-geometric observables rather than being a fundamental dimension.

The contrast with colinear gravitytime is again substantive. Rovelli's thermal time emerges from quantum statistics; colinear gravitytime is fundamental. Rovelli's account is consistent with the elimination of fundamental time at the level of the underlying physics; the present account treats time as half of the fundamental operator.

There are partial agreements. Both accounts reject Newtonian absolute time. Both accounts treat time as deeply tied to the dynamics rather than as an independent backdrop. Both accounts treat the local experience of time as connected to physical processes (thermal averaging in Rovelli's case, differentiation in the present account).

The substantive difference is what time *is*. For Rovelli, time emerges from quantum-statistical structure that is itself timeless. For the present account, time is the primary aspect of a fundamental operator that, with gravity as its reciprocal, performs both generative differentiation and corrective coherence. The thermal time hypothesis treats time as derivative of statistical-mechanical structure; colinear gravitytime treats it as a fundamental operational mode of the field.

A reviewer pressing the comparison might ask: what does colinear gravitytime offer that thermal time does not? The answer is that the present account gives a structural reason for *conservation*, the colinear corrective face, that the thermal time hypothesis does not address. Rovelli's account is well developed for the question of what time is; it is less developed for the question of why conservation laws hold and why Noether's theorem yields the structure it does.

11.3 Loop Quantum Gravity and the Wheeler-DeWitt Problem

Loop quantum gravity (Ashtekar 1986; Rovelli and Smolin 1990; Rovelli 2004) develops a background-independent formulation of quantum gravity in which spacetime is fundamentally discrete, built from spin networks at the Planck scale. Spin foam dynamics describe the evolution of spin networks. The framework is conservative about general relativity (preserving its background independence) and conservative about quantum mechanics (using standard quantization techniques) while making strong claims about the structure of spacetime at fundamental scales.

A central technical issue in canonical quantum gravity is the "problem of time" associated with the Wheeler-DeWitt equation (DeWitt 1967). The Hamiltonian constraint $H|\psi\rangle = 0$ implies that the universe is in an apparently stationary state, with no time evolution. Various responses have been articulated: time as relational (emerging from correlations between subsystems), time as thermal (Rovelli), time as semiclassical (emerging in the limit where one variable behaves classically and serves as a clock for others), time as eliminated altogether.

The present account engages this problem from a different angle. The Wheeler-DeWitt equation, on the colinear gravitytime reading, can be reread as a statement about the field's atemporal coherence at the level where time-as-differentiation has not yet been actualized. The "stationary" character of the universal wavefunction reflects the field's coherent ground from which differentiation emerges. Time appears, on this reading, not as something external to be added but as the primary aspect of the operator becoming active.

This is closer to certain semiclassical interpretations of the Wheeler-DeWitt equation than it is to Barbour's elimination of time. Time, the primary aspect of gravitytime, corresponds to what semiclassical analyses identify as the "clock" variable that allows time evolution to emerge.

The contrast with LQG more generally is that LQG provides detailed quantum-geometric structure for spacetime but does not address conservation as such, conservation laws are typically imported from the matter sector and the gravitational-geometric sector is treated separately. The present account proposes that conservation is *structural* to the operator that gives rise to spacetime, not separately imposed. This is a different theoretical move and would require a different technical implementation, but it is potentially compatible with the geometric content of LQG.

11.4 Causal Set Theory

Causal set theory (Bombelli, Lee, Meyer, and Sorkin 1987; Sorkin 2003; Henson 2009) treats spacetime as a locally finite partial order: a discrete set of elements with causal relations as the fundamental structure. The Bombelli-Lee-Meyer-Sorkin proposal grounds physics in the causal structure rather than in the metric tensor of conventional general relativity, with random sprinkling preserving local Lorentz invariance.

Sorkin's prediction that the cosmological constant should fluctuate at order $1/\sqrt{V}$ (Sorkin 1991, 2007) is one of the most striking quantitative achievements in foundational physics: it gives roughly the observed order of magnitude of Λ from a fundamental framework, without anthropic input.

The present account shares with causal set theory the rejection of conventional spacetime as fundamental and the location of the fundamental structure in something more primitive. Causal set theory locates that primitive in causal order; colinear gravitytime locates it in the codifferential pairing of time and gravity.

The two approaches engage different aspects of the foundational problem. Causal set theory gives a discrete substrate from which spacetime can emerge; it makes specific quantitative predictions for Λ and offers a framework for spacetime quantization. Colinear gravitytime gives a structural account of why conservation laws hold and why symmetry is the operative principle of physics; it makes qualitative predictions about Λ evolution and symmetry-breaking patterns.

These could in principle be complementary. A version of causal set theory in which the underlying causal structure is read as the trace of colinear gravitytime, with the partial order encoding time's ordering function and the volumetric structure encoding gravity's cohering function, is conceivable. Whether this combination is technically tractable and whether it yields predictions distinguishable from each parent framework alone is a question for technical development.

11.5 Verlinde's Entropic Gravity and Jacobson's Thermodynamic Derivation

Erik Verlinde's entropic gravity proposal (Verlinde 2011, 2017) treats gravity as an emergent phenomenon arising from entropic gradients across holographic screens. Gravity, on this account, is not a fundamental force but a consequence of the second law of thermodynamics applied to information distributed on holographic surfaces. Verlinde's later work (2017) extends this to dark matter and dark energy, treating them as emergent phenomena from the same thermodynamic-holographic framework.

Ted Jacobson's earlier work (Jacobson 1995) derives the Einstein equation as a thermodynamic identity from horizon thermodynamics. The Einstein equation, on Jacobson's account, is not fundamental but emerges from the thermodynamic structure of local horizons.

These approaches share with the present account the view that gravity is not fundamental in the usual sense, that what appears as gravitational dynamics emerges from a deeper structure. They differ on what that deeper structure is. Verlinde and Jacobson locate it in thermodynamics and information; the present account locates it in gravity, the cohering aspect of the gravitytime operator.

There are interesting partial overlaps. The thermodynamic-informational framing of Verlinde and Jacobson is potentially compatible with the corrective-conservation framing of the present account: thermodynamic equilibrium maintained across horizons could be the local empirical face of corrective integration operating on a wider scale. Whether the two framings can be technically unified is an open question.

The substantive difference is that Verlinde's and Jacobson's accounts locate the emergence in thermodynamic principles applied to horizons or screens, while the present account locates the emergence in the operational structure of a single operator with two reciprocal faces. The thermodynamic accounts are more developed technically; the present account is more developed structurally.

11.6 Mach's Principle as Historical Antecedent

Ernst Mach's principle (Mach 1893), that local inertial properties are determined by the global mass distribution, is the historical antecedent of much foundational work on the relationality of physical structure. Einstein's general relativity was partly motivated by Mach's principle, though the question of whether GR fully implements it has been debated extensively (Barbour and Pfister 1995).

The present account can be read as a strong form of Machian thinking. The local properties of any differentiation are integrated with the global state of the field through colinear corrective differentiation. Local conservation is the empirical signature of global integration. This is consonant with the spirit of Mach's principle while extending it: where Mach focused on inertia and the global mass distribution, the present account proposes that the relational structure encompasses all conserved quantities and operates through the corrective face of gravitytime.

11.7 The Metaphysics of Symmetry Literature

The philosophy-of-physics literature on symmetry (Brading 2002; Brading and Brown 2003; Brading and Castellani 2003; Healey 2007; Earman 2004; Ismael and van Fraassen 2003) has developed sophisticated accounts of the interpretive status of symmetries and conservation laws. Brading and Castellani's edited volume *Symmetries in Physics* surveys the field. Healey's work on gauge symmetries develops the view that gauge invariance is descriptive redundancy rather than ontologically substantive.

The present proposal complements rather than replaces this literature. Where the literature engages the *interpretive* question, what symmetries and conservation laws are metaphysically, the present paper engages the *structural* question of why the relationship between them holds. The two questions are connected: a structural account constrains the available interpretations.

The position implied by the present proposal is broadly realist about both symmetries and conservation laws, they are not formal artifacts but signatures of an underlying corrective structure, while accommodating the gauge-redundancy view for local symmetries by treating gauge transformations as descriptive equivalences within the corrective architecture rather than as independent ontological structures. The detailed compatibility with Healey's framework would require more development than this section can provide.

11.8 Supersymmetry

The original framing of UAFT (Barnes 2026a) and the companion treatment in the present paper (Section 8.2) note that supersymmetry's empirical struggles at the LHC can be read as evidence that the actual corrective architecture differs from the symmetry SUSY proposed. SUSY is a symmetry-based proposal for solving the hierarchy problem and other technical issues in particle physics. The present account is a structural proposal about what symmetry *is* in the first place.

These are not in direct competition. SUSY could in principle be true at energy scales beyond current experimental reach without contradicting the structural account proposed here; the structural account does not predict whether or not SUSY's specific symmetry holds. What the structural account does predict is that the deepest organizing principle of physics is the codifferential structure of time and gravity, not any particular symmetry between particle types. SUSY's empirical struggles are consistent with this: the universe may not happen to instantiate the boson-fermion symmetry SUSY proposes, while still being organized by colinear gravitytime at a deeper structural level.

11.9 Summary

The position of colinear conservation in the foundational landscape can be summarized as follows. With Barbour, it rejects substantival absolute time, but it preserves time as fundamental rather than eliminating it. With Rovelli, it rejects Newtonian time, but it grounds time in operational structure rather than in thermal averaging. With LQG and causal set theory, it treats spacetime as not fundamental in the usual sense, but it locates the fundamental structure in an active operator rather than in discrete geometric or causal structure. With Verlinde and Jacobson, it treats gravitational dynamics as emergent, but from a unified operator rather than from thermodynamic principles applied to horizons. With Mach, it endorses relational integration of local and global; with the philosophy-of-symmetry literature, it endorses realism about symmetry while connecting symmetry to a structural process. With supersymmetry, it shares the intuition that nature is more unified than it appears, but it locates the unification at a deeper level than particle-type symmetry.

The proposal does not displace any of these existing approaches. It enters the conversation as a structural claim that intersects with each at specific points and offers a different perspective on the foundational questions each addresses.

12. Conclusion

Symmetry recurs in every successful physical theory because every successful physical theory tracks the operation of colinear gravitytime. Noether's theorem captures, in formal language, the codifferential relationship between time and gravity within this operator. Conservation laws are the macro-scale signatures of the corrective work the operator performs. Symmetry breaking is the signature of generative differentiation outpacing local corrective differentiation with integration occurring at wider scales.

The proposal is structural. It does not produce numerical predictions on its own; it identifies the architecture from which numerical predictions could in principle be developed. It does not replace existing physics; it grounds existing physics in a specific structural fact. It does not resolve all the philosophical disputes over the foundations of physics; it offers a contribution to those disputes that may sharpen the available positions.

The cosmological constant problem provides the worked example most likely to attract serious engagement. The DESI evidence of evolving dark energy provides empirical traction for the prediction that Λ should track integrated differentiation history. The development of quantitative versions of the claims developed here is a research programme rather than a finished result.

The paper closes with the observation that physics has been remarkably successful for two centuries by tracking, with increasing precision, the formal correspondence between symmetry and conservation. The success has come without ontological clarity about why the correspondence holds. The proposal here is that the correspondence holds because nature has a corrective architecture, that the architecture has a specific structural form (colinear gravitytime), and that the patterns of symmetry, conservation, and conservation-violation observed in nature are the empirical signature of that architecture.

Acknowledgments

This paper extends the structural framework of Unified Axioconscious Field Theory (Barnes 2026a) into the territory of foundations of physics. The author thanks the philosophical and physical traditions on which this work builds, including the philosophy of symmetry literature, the relational and emergent gravity programmes, and the DESI Collaboration whose recent observational results provide empirical traction for the structural prediction developed here.

AI Use Declaration

This paper was written by Paul W. Barnes. AI was used for literature scoping, prose refinement at the sentence level, identification of relevant predecessor positions for engagement, and formatting consistency. All theoretical claims, the central thesis of colinear gravitytime, the framing of colinear conservation, the engagement with existing approaches in foundations of physics, the worked example of the cosmological constant problem, the eight additional empirical domains, and the final wording are the author's. AI was not used to generate the central theoretical claims, to derive any of the structural arguments, or to fabricate any references. All references cited are real and have been verified by the author. Any errors or oversights in attribution, citation, or argument are the author's responsibility.

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