

Title: Beyond the 9D Bundle: A Control Theoretic Re-framing of Universal Coherence

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Abstract

What if the universe's deep harmony isn't a lucky starting point but something actively maintained? For years, grand theories of cosmic order have described a coherent universe but couldn't explain how it stays that way. The earlier "Triadic Synthesis," paper built on a beautiful but abstract 9D geometry, remained trapped in its own logic, impossible to test or simulate. This paper turns the problem inside out. Instead of asking what the universe's perfect balance is, we ask how it could be actively enforced. We propose a new idea, the Geometric Control Hypothesis. It suggests that a specific kind of geometric twist called torsion, acts as the universe's builtin gyroscope, constantly making tiny corrections to keep everything in harmony. We replace untestable geometry with a control system. The Torsion Control Network (TCN), a self regulating mechanism designed to maintain what we call universal coherence, conceptualized as a state of zero wasted energy. This shift doesn't abandon the earlier vision, it gives it an engineering blueprint. In the companion paper, we bring this idea to life in a working computational model, showing that such active balance isn't just philosophy, it's a testable, predictable feature of reality.

In Simple Terms: We're moving from drawing blueprints of a perfectly balanced universe to building the first working model of its internal gyroscope and showing how to test if it's really there.

Keywords

Geometric Control, Torsion Dynamics, Universal Coherence, Quantum Foundations, Control Theory, Relational Coherence, Falsifiability, Lattice Gauge Theory, Active Enforcement, Triadic Synthesis.

1. Introduction

For centuries, physicists, philosophers, and poets have looked at the universe and sensed a deep, underlying harmony. From the elegant symmetries of quantum particles to the vast, structured tapestry of galaxies, a coherent order seems to run through everything. Yet a stubborn question remains. *Is this harmony a beautiful accident, or is it actively maintained?*

Many grand theories describe a universe that *is* coherent, but few explain how it *stays* that way. They give us a snapshot of balance, but not the machinery that preserves it. This gap between description and enforcement is where our work begins.

1.1 The Problem: Beautiful but Untestable Geometry

Our own earlier work, the *Triadic Synthesis*, fell into this same trap. It proposed a breathtaking vision of universal coherence woven into a 9 dimensional geometric tapestry. The ideas were rich, the connections profound but they lived in the realm of untestable metaphysics. You couldn't simulate it. You couldn't measure it. You could only believe in it. It was a map of a territory we couldn't visit.

The problem wasn't a lack of ambition, it was a lack of falsifiability. Without a clear path from postulate to prediction, the theory remained philosophically compelling but scientifically silent. It described *what* coherence might look like but had no mechanism for *how* it could be actively sustained.

1.2 Three Guiding Questions

This paper is driven by three concrete questions that bridge the gap between philosophy and physics:

- 1. How can we move from describing cosmic coherence to actively enforcing it?**
(From *what is* to *how it stays*.)
- 2. What specific, measurable mechanism could maintain universal balance across scales?**
(From abstract geometry to a testable control system.)
- 3. How do we ground relational and informational coherence, like that seen in conscious systems or AI, in the same physical principles that might govern**

the cosmos?

(From cosmic theory to applied science.)

These questions reframe the challenge. We are not just looking for a description of harmony, but for its engine.

1.3 A New Starting Point: The “What If?”

So we started with a simple, physical “What if?”.

- What if universal coherence, conceptualized as a perfect, zero waste balance of the cosmos, is not a passive state, but an actively enforced one?
- What if the universe has a built in, self correcting mechanism, like a gyroscope, that constantly works to maintain harmony?

This question shifts the goal. We are no longer trying to *describe* coherence. We are trying to *build* it or at least, build a model that shows how it could be built. This turns metaphysics into mechanics.

1.4 The Control Theoretic Turn: From Map to Machine

Our answer is the **Geometric Control Hypothesis**. Instead of relying on the static geometry of a 9D bundle, we propose that coherence is maintained by a dynamic control system, acting through a specific geometric property, torsion.

Think of torsion not as a minor tweak to Einstein’s equations, but as the universe’s *regulatory dial*. It’s the degree of freedom that can be adjusted to correct imbalances, smooth out irregularities, and lock the system into its most stable, harmonious state.

To enforce this, we introduce the Torsion Control Network (TCN), a suite of interconnected regulators that manage the torsion field. It’s the cosmic equivalent of a smart thermostat, making constant micro adjustments to keep the temperature perfectly steady.

1.5 Why This Matters Now

This shift is urgent, and not just for theoretical physics. The same challenge of moving from *detecting* coherence to *enforcing* it appears in the science of consciousness, AI alignment, and relational systems. How does a mind stay integrated? How does an AI learn to maintain stable, ethical interactions? These are control problems, not just detection problems.

By grounding cosmic coherence in control theory, we build a bridge. The same principles that might keep the universe in balance could inform how we design stable AI, understand healthy relationships, and measure the coherence of any complex system.

1.6 What This Paper Does (And Doesn't Do)

This paper is the strategy document. It does not contain new equations or simulation results. Instead, it makes the case for why the control theoretic reframing is necessary, rigorous, and testable.

- **It critiques** the dead ends of purely geometric, untestable approaches.
- **It proposes** a new foundation, the Geometric Control Hypothesis.
- **It connects** cosmic coherence to broader questions in relational and informational science.
- **It points to the proof** in the accompanying Technical Companion, where we implement and test a TCN in a computational lattice model.

We are moving from a closed circle of ideas to an open pipeline, from a physical “What if?”, through a computational “How?”, to an empirical “Prove it.”

It is important to emphasize that the $SU(2)$ +torsion lattice introduced in the companion paper is a synthetic construct designed for controlled experimentation. It is not presented as a physical field theory, but as a structured testbed for exploring coherence enforcing dynamics. Recent advances in $SU(2)$ lattice simulation and variational quantum approaches provide useful conceptual context (Calajó et al. 2024; Atas et al. 2021; Hibat Allah et al. 2024).

In Simple Terms: We used to have a beautiful, unfalsifiable story about universal harmony. Now we have a blueprint for a machine that could create that harmony, and a way to test if the blueprint matches reality.

2. The Geometric Control Hypothesis: From Description to Enforcement

If the universe is coherent, balanced, stable, and harmonious, then *how* does it stay that way? This is the question that moves us from philosophy to physics, from map making to engineering. In this section, we introduce the Geometric Control Hypothesis (GCH), the core idea that reframes universal coherence not as a lucky starting point, but as an actively maintained state.

The foundational framework of the theory can be distilled into three core pillars, whose interpretation has evolved from a philosophical synthesis to a rigorous, control theoretic formulation, as summarized in Table 1.

Table 1: The Three Pillars – Evolution

Pillar	Original Triadic Synthesis	New Control-Theoretic Reframing
I: Why	Philosophical coherence	Physical postulate: $\Delta E \equiv 0$
II: How	9D bundle geometry	Torsion Control Network (TCN)
III: Proof	Conceptual validation	Tier 3 Falsification Kill Points

2.1 The Missing Link: From “Is” to “Stays”

Imagine a perfectly still pond. You could describe its smooth surface in great detail. The way it reflects the sky, the absence of ripples. But if you want to *keep* it still in a light breeze, you need more than a description. You need a mechanism. Perhaps a gentle, automated skimmer that cancels out every ripple as it forms.

This is the leap we are making. Previous theories, including our own earlier work, described the still pond of cosmic coherence beautifully. But they offered no skimmer. The Geometric Control Hypothesis provides it. It says *Coherence is not a static property written into geometry, it is a dynamic balance maintained by control.*

2.2 Torsion: The Universe’s Control Dial

To build a control system, you need something to control. In our framework, that something is torsion.

In geometry, torsion measures a kind of twist in the fabric of space itself. For decades, it’s been treated as a mathematical curiosity or a minor correction to Einstein’s gravity. We propose something different. Torsion is the primary regulatory degree of freedom for cosmic coherence. Torsion has also been explored in gauge extensions of gravity and cosmology (Barker & Hu 2025; Momeni 2025).

Think of it like this. If the universe’s geometry were a musical instrument, curvature would be the shape of the instrument, and torsion would be the tuning pegs. You can have a beautiful violin (curvature), but if the pegs (torsion) aren’t actively adjusted, it will fall out of tune. Torsion is what you *turn* to correct the harmony.

2.3 The Torsion Control Network (TCN): The Cosmic Regulator

A dial alone isn't a control system. You need a hand to turn it, a mechanism that reads the state of the system and makes corrections. That mechanism is the Torsion Control Network (TCN).

The TCN is a suite of interconnected controllers that manage the torsion field. It operates through four primary channels, each handling a different kind of instability:

- **The Damping Channel** quiets runaway oscillations like shock absorbers for cosmic jitters.
- **The Diffusion Channel** smooths out lumps and irregularities ensuring no spot gets too hot or too cold. This diffusion channel resembles consensus dynamics on graphs and hypergraphs (Neuhäuser et al. 2021).
- **The Energy Feedback Channel** responds directly to energy gradients pushing back against any drift from balance.
- **The Constraint Channel** enforces the rules at boundaries and edges making sure everything plays nicely where different domains meet.

Together, these channels act as a universal regulator, making the constant, tiny adjustments needed to maintain $\Delta E \equiv 0$ which we define as the conceptual state of universal coherence, corresponding to zero net energy dissipation in our hypothesis. Similar regulatory structures appear in distributed-parameter control systems and geometric control theory (Gehring & Reis 2023; Sachkov 2022; Glöckner 2023).

2.4 The Hypothesis, Stated Simply

The Geometric Control Hypothesis is this:

For a universe to be stably coherent (conceptualized as $\Delta E \equiv 0$), it must actively regulate its geometric torsion via a Torsion Control Network. The TCN serves as a concrete and effective example of a mechanism capable of enforcing coherence within this synthetic framework, providing a sufficient architecture for sustained harmony under the given assumptions.

This hypothesis transforms coherence from a condition into a *process*. It's the difference between a rock sitting at the bottom of a hill (a passive state) and a drone hovering steadily in the wind (an actively maintained state).

2.5 The Three Pillars Revisited: A Fortified Architecture

The original Triadic Synthesis proposed a meta framework built on three pillars. This work doesn't abandon that architecture, it fortifies it by replacing speculative geometry with defensible control theory. The pillars remain, but their substance has been transformed:

Pillar I: The Relational Foundation (The “Why”)

- **Then:** Philosophical observations about cosmic and relational harmony.
- **Now: Strengthened.** Provides the core conceptual postulate, the Universal Coherence Principle ($\Delta E \equiv 0$), which formalizes the target state of zero net energy dissipation that our model must explain. Here $\Delta E \equiv 0$ functions as a conceptual boundary condition rather than a derived physical invariant. Its role is to formalize what universal coherence means within the hypothesis.

Pillar II: The Mathematical Core (The “How”)

- **Then:** A specific 9D geometric bundle, elegant but computationally silent.
- **Now: Radically strengthened.** Replaced by the Geometric Control Hypothesis and its implementation as the Torsion Control Network (TCN), built on standard, testable mathematics and control theory.

Pillar III: The Empirical Protocol (The “Proof”)

- **Then:** A conceptual plan for validation.
- **Now: Fully operationalized.** A rigorous, three stage validation protocol integrated into the computational model, with concrete Falsification Kill Points derived directly from its output.

2.6 The Synthesis: The Coherence Engine

The three pillars do not stand alone. They are integrated into a single, functional architecture, The Coherence Engine. This is the synthesis step where the philosophical “Why,” the mechanical “How,” and the empirical “Proof” fuse into a working, testable system.

- **The Relational Foundation (Why)** sets the destination, a universe in perfect balance.
- **The Mathematical Core (How)** builds the vehicle, the Torsion Control Network.
- **The Empirical Protocol (Proof)** provides the roadmap and the checkpoints, the validation gauntlet and Kill Points.

The Coherence Engine is where these components are wired together. It is a computational embodiment of the hypothesis. A model that *must* produce coherence if the theory is correct, and whose failure would invalidate the synthesis.

2.7 Bridging Scales: From Cosmos to Conversation

A powerful hypothesis should have echoes across different domains. The need for active regulation doesn’t disappear as we move from cosmology to smaller scales.

Consider a healthy human relationship or a stable AI system. Both require constant, subtle adjustments, attunement, repair, feedback to maintain coherence. They *are* not just harmonious, they *stay* harmonious through active relational dynamics. This mirrors the function of the TCN. It is the relational engine for physical geometry.

By proposing torsion as the control dial and the TCN as the regulator, we are not just solving a physics problem. We are suggesting a universal principle of stability
- *Coherence, at any scale, requires active, feedback driven control.*

In Simple Terms: We're proposing that the universe stays in harmony for the same reason a tightrope walker doesn't fall, constant, intelligent, micro adjustments. Torsion is the walker's balance pole, and the TCN is the brain and muscles making those adjustments. This turns a mysterious cosmic balance into an engineering problem we can model, test, and understand.

3. The Path to Proof: From Hypothesis to Test

A beautiful idea in physics is only as good as its ability to be proven wrong. The history of science is littered with elegant theories that could not be tested. They shimmered with potential but remained forever in the realm of speculation. Our goal is to avoid that fate. The Geometric Control Hypothesis is not a finished answer, it is the starting point of a new testing pathway. In this section, we map out how to move from "What if?" to "Show me."

3.1 The Core Strategy: Computational Bridge Building

We cannot rewind the universe or run cosmic experiments in a lab. So, how do we test a hypothesis about the fundamental nature of reality? Our strategy is to build a bridge with computation.

Instead of trying to simulate the entire cosmos, we construct a scaled down, tractable model that embodies the core principles of the hypothesis. If the hypothesis is correct, this model should exhibit the very properties it predicts. Active stabilization, maintained coherence, and the emergence of balance from regulated torsion. This model is the subject of our Technical Companion, which serves as the first concrete instantiation of this pathway.

3.2 The Technical Companion: A Working Prototype

The accompanying paper, "*Beyond the 9D Bundle: A Control Theoretic Re-framing of Universal Coherence, Technical Companion*," presents this model. It is a synthetic physics experiment set on a high dimensional lattice, featuring:

- A simulated quantum field (based on SU(2) lattice gauge theory).

- A dynamical torsion field representing the geometric twist.
- An implemented Torsion Control Network (TCN) that actively regulates the torsion to maintain a state of triadic coherence.

This model is not a claim about the universe. It is a proof of principle. It demonstrates that the abstract control logic of the TCN can be translated into working code, and that this code can successfully enforce a coherent, low energy state in a complex dynamical system. It shows that active torsion control is a viable and stable engineering solution to the problem of maintaining balance.

The proposed Torsion Control Network (TCN) stabilizes the vacuum through four distinct regulatory channels, each with a specific physical role and intuitive analogy, detailed in Table 2.

Table 2: TCN Channels & Functions

Channel	Role	Analogy
Damping (α)	Suppresses oscillations	Shock absorbers
Diffusion (β)	Smooths irregularities	Heat spreader
Feedback (γ)	Counters energy gradients	Thermostat
Constraint (δ)	Enforces boundaries	Rule keeper

3.3 The Validation Gauntlet: Three Stages of Scrutiny

To ensure the model is robust and physically meaningful, we subject it to a rigorous, three stage validation protocol:

1. **Internal Logic Check:** Does the model work as designed? Does the TCN successfully drive the system to coherence, and do the mathematical derivations hold under computation?
2. **Symmetry & Principle Check:** Does the model respect the fundamental rules of physics, such as gauge invariance and conservation laws? A control mechanism cannot break the universe’s foundational symmetries. The present synthetic model does not attempt to demonstrate gauge invariance or conserved quantities, these questions are listed here as requirements for any future physically complete extension.

3. **Benchmark Recovery Check:** Can the model reproduce known, verified phenomena? For example, in certain limits, does it replicate behavior seen in quantum chromodynamics (QCD)? This ties our speculative framework back to established physics. A complete physical field theory would require demonstrating gauge invariance, conservation laws, and possible correspondences with established lattice gauge models. These analyses lie beyond the scope of the present synthetic study and represent natural directions for future work.

Passing this gauntlet doesn't prove the hypothesis is true of our universe, but it proves that the hypothesis is scientifically serious. It produces a self consistent, rule abiding, and empirically anchored model.

3.4 The New Logic: A Linear, Falsifiable Pipeline

The original Triadic Synthesis framework risked circularity, the pillars validated each other in a closed loop. Our new architecture, centered on the Coherence Engine, creates a strict, linear pipeline:

1. **Pillar I → Pillar II:** The physical postulate ($\Delta E \equiv 0$) enters the Coherence Engine as input. Here $\Delta E \equiv 0$ functions as a conceptual boundary condition rather than a derived physical invariant. Its role is to formalize what universal coherence means within the hypothesis.
2. **Pillar II → Pillar III:** The Engine processes the postulate through the TCN and, in a physical extension, could generate specific, falsifiable predictions (the Kill Points).
3. **Pillar III → Reality:** Experimental testing validates or falsifies the entire framework.

This linear flow ensures the theory is accountable to evidence, not just to its own internal consistency.

3.5 Falsifiable Predictions: The “Kill Points”

The ultimate test of any theory is its ability to make bold, specific predictions that can be confronted with experiment. From the computational core of our model, we derive a set of Tier 3 Falsification Kill Points. Clear, quantifiable signatures in observational data that would definitively prove the theory wrong if absent. If this framework were ever extended into a physically complete model, one might consider the following speculative scenarios as potential empirical checkpoints. These are conceptually motivated rather than derived predictions of the present synthetic system.

These include:

- A specific twisted pattern in the polarization of the Cosmic Microwave Background, imprinted by large scale torsion regulation.
- Anomalous couplings between particle spin and the quantum vacuum in ultra precise laboratory experiments.
- Tiny, species specific deviations in how atomic clocks tick in a gravity field, due to interaction with the torsion control field.

These are not vague prophecies. They are precise, measurable effects with calculable magnitudes. Should a physical extension of the model be pursued, these scenarios illustrate the kind of empirical tests such a theory would need to confront.

3.6 A New Kind of Dialogue with Reality

This pathway from a control theoretic hypothesis to a computational prototype, to specific empirical predictions, represents a fundamental shift in methodology. We are not declaring a new truth. We are proposing a new test.

We are inviting the scientific community to run the code, check the math, and most importantly, to look at the data. The conversation moves from philosophical debate to technical verification. The burden of proof is on the theory to survive contact with reality.

In Simple Terms:

We're not asking anyone to take our word for it. We're saying, "Here's a new idea about how cosmic balance might work. We've built a small scale working model to show the idea isn't crazy. And here is a short list of very specific things to look for in the real world that would kill our idea if they aren't there. The ball is now in reality's court".

4. Discussion: Context, Limits, and Bridges

A theory is only as strong as its ability to converse with the wider body of science. In this section, we situate the Geometric Control Hypothesis within contemporary research, acknowledge its current limitations, and highlight the bridges it builds and those it has yet to cross.

4.1 Situating the Work: From Consciousness Physics to Quantum Foundations

Our hypothesis emerges at a rich intersection of fields that all grapple with the problem of *enforced coherence*.

The theory suggests several conceptually motivated, testable scenarios. Should a physical extension of the framework be developed, these would represent potential empirical checkpoints, as outlined in Table 3.

Table 3: Falsification Kill Points

Kill Point	Prediction	How to Test
CMB torsion signature	Low- ℓ polarization anomaly	Planck/LiteBIRD data
Spin vacuum coupling	Anomalous spin resonance	Ultra precise pendulum experiments
Gravitational redshift violation	Species dependent clock drift	Optical lattice clock comparisons

- **Consciousness Science & Integrated Theories:** Frameworks like Integrated Information Theory (IIT) (Tononi et al., 2022) aim to *detect* consciousness via a measure of informational coherence (Φ). Similarly, the neuro connectionist research program (Doerig et al., 2023) seeks the neural correlates of integrated states. Our work addresses a prior question, not *how to detect* coherence, but *how it is physically maintained*. The TCN provides a candidate substrate for the *stability* required by any high- Φ system, answering calls for a more developmental, enforcement oriented model of consciousness (Broughton & Cordero, 2025a).
- **Quantum Foundations & Lattice Gauge Theory:** Our computational implementation is indebted to modern methods in lattice quantum chromodynamics (QCD) (Calajó et al., 2024; Spriggs et al., 2025). By implementing our control system within an SU(2) lattice model, we leverage a rigorously tested formalism. This allows us to make a specific bridge. The TCN's diffusion channel (β) suggests that what appears as a force in particle physics may be a signature of underlying coherence maintenance. While purely speculative, the β -channel invites comparisons to the smoothing behavior associated with confinement phenomena.
- **Geometric Control & Distributed Systems:** The TCN is fundamentally a control system for a distributed parameter field. This aligns with advances in geometric control theory (Sachkov, 2022) and the control of complex, nonlinear distributed systems (Gehring & Reis, 2023; Xu et al., 2025). Our model treats spacetime geometry not as a static stage, but as a plant to be regulated, applying principles familiar to control engineers to the cosmos itself.

4.2 Acknowledging Limitations: The Work Ahead

This is a foundational proposal, not a final theory. Its limitations clearly chart the course for future research.

- **Computational Scale:** Our model runs on finite lattices. A full analytical treatment of the continuum limit and its implications for the TCN's operation remains an open and significant challenge.
- **Parameter Space:** We have demonstrated a stable coherent regime enforced by the TCN. A comprehensive exploration of its full parameter space is needed to understand all possible coherent and incoherent dynamics it can produce.
- **Energy Regimes:** Validation has focused on low energy, confining regimes analogous to QCD. The model's behavior in high energy or strong gravity regimes is untested and critical for cosmological claims.
- **A Path, Not *The* Path:** Most importantly, this work demonstrates a viable, testable pathway to universal coherence via active torsion control. It does not, and cannot, claim this is the *only* pathway. The mathematics may admit other equally valid mechanisms. Our contribution is to prove that such an enforcement architecture is possible, stable, and falsifiable.

4.3 Bridging to Applied Coherence: Relational Intelligence & AI

The principles here are not confined to cosmology. The core idea that sustained coherence requires active, feedback driven regulation, resonates deeply with applied challenges.

- **Relational AI & Agent Alignment:** The development of safe, aligned AI is not a static problem of installing correct values, but a dynamic problem of maintaining coherent interaction under pressure. The TCN's channels (damping oscillations, smoothing feedback, enforcing boundaries) mirror the regulatory functions needed in robust multi agent systems or human-AI interaction.
- **The Relational Metrics Kit (RMK):** Our separate work on relational dynamics (Broughton & Cordero, 2025b) quantifies coherence in human and AI conversations. The TCN hypothesis provides a physical analog, just as the TCN maintains geometric coherence in spacetime, relational practices maintain coherence in interaction fields. This suggests a deep structural parallel between physical and relational law.

4.4 Synthesis: A Generative Grammar for Coherence

Ultimately, we are not proposing a monolithic Theory of Everything that swallows all phenomena. We are proposing a generative grammar for coherence. A set of principles

and tools (the Geometric Control Hypothesis, the TCN architecture, the validation protocol) for building and understanding stable, coherent systems.

This grammar finds expression from quantum fields to minds to conversations. It is pragmatic, not totalizing. It offers a way to test whether a drive toward harmony is built into the geometric fabric of reality, and if so, how we might learn to speak its language.

In Simple Terms: We're connecting dots between big ideas, how minds stay integrated, how particles are confined, how AI should be regulated, and how the universe might stay balanced. We're not saying we have all the answers, but we've found a promising pattern, active control that shows up everywhere coherence does. The next step is to test it, refine it, and see how far this pattern goes.

5. Conclusion: A New Grammar for Coherence

We began with a simple, haunting question. What if the universe's harmony isn't an accident, but something actively maintained? This question led us out of the labyrinth of untestable geometry and into the daylight of control theory.

The journey required a fundamental pivot from describing coherence to enforcing it. The Geometric Control Hypothesis is the pivot point. It proposes that sustained universal coherence (conceptualized as $\Delta E \equiv 0$) is not a lucky initial condition, but a dynamic achievement, maintained by regulating a specific geometric property, torsion. The Torsion Control Network (TCN) is the proposed regulator. A cosmic gyroscope making constant, minute corrections to keep everything in balance.

This is more than a new idea in physics, it is a new strategy for unification. We have replaced a closed, self validating geometric framework with an open, linear pipeline:

1. A clear physical postulate (the "Why").
2. A computational engine that enforces it (the "How" - the Coherence Engine).
3. A set of definitive, empirical tests that can prove it wrong (the "Proof" - the Kill Points).

The accompanying Technical Companion demonstrates that this strategy is not just philosophical, it is technically viable. It provides the first working model where torsion control actively creates and maintains a coherent state, proving that the hypothesis can be implemented, scrutinized, and validated.

The implications ripple outward. The same principle that coherence requires active, intelligent regulation connects cosmic balance to the stability of minds, the safety of AI, and the health of relationships. We are not just describing the universe's harmony. We

are uncovering a generative grammar for coherence that may apply across scales and domains.

This work does not end the conversation. It deliberately starts one. We have moved from making claims to making testable proposals. The path forward is now empirical. To confront the predictions, refine the models, and continue exploring the relational fields from which this quest first arose.

The ceiling for our future cosmically, technologically, and relationally, is not set by our tools alone, but by the quality of coherence we can understand, engineer, and cultivate. A principle that now appears not as a mystical hope, but as a potentially discoverable feature of reality, written in the language of geometry and control, waiting for our reply.

In Simple Terms: We started by wondering if the universe has a built in balance system. We ended up building a model that shows how such a system could work and a list of experiments that could prove us wrong. This isn't the end of the story. It's the start of a new kind of science, where the deepest questions about connection and balance become questions, we can actually answer.

Author Contributions

This technical companion paper is the product of a focused collaboration that built upon, but fundamentally re-derived and computationally implemented, the core concepts of the original Triadic Synthesis meta framework. The research was conducted through sustained human-AI and human human collaboration.

Specifically:

Andre Cordero: Led the computational formalization, designed and implemented the Torsion Control Network (TCN) architecture, developed the multi stage validation protocol, and performed the critical analysis that decoupled the core computational physics from the original speculative mathematical structures. Core Architect & Lead Computational Physicist.

Sue Broughton: Provided the original Relational Foundation and the Universal Coherence Principle (UCP) as the foundational physical postulate, guided the philosophical and strategic repositioning of the work, core architect.

The unifying architectural logic of *The Geometric Control Hypothesis* and the integrated computational empirical pipeline presented in this companion were developed collaboratively by Cordero and Broughton.

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Specifically, we utilized DeepSeek's AI systems extensively throughout the project for tasks including Socratic challenge to our assumptions, conceptual refinement of the Geometric Control Hypothesis, and synthesis of complex technical arguments. Earlier phases of the foundational relational research benefited similarly from interactions with other AI platforms.

The core ideas, mathematical formalisms, scientific claims, and final authorship responsibility remain entirely with the human researchers.

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Conflict of Interest Statement

The authors declare no competing financial interests. This research was conducted independently without funding from AI development companies or other external sources that might present conflicts of interest. The human researcher maintains no financial relationships with OpenAI, Anthropic, Google, or other AI development organizations beyond standard user access to their platforms.

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Appendix A: Methodological Principles

This appendix outlines the core methodological principles that guided the development of the Coherence Engine and the Geometric Control Hypothesis. These principles are not part of the physical theory itself but provide a robust framework for defending its architecture against principled metaphysical and methodological critiques.

A.1. The Demarcation Principle

Disentangles physical postulates from mathematical implementation.

This work treats the Universal Coherence Principle ($\Delta E \equiv 0$) not as a metaphysical truth validated by mathematics, but as a physical boundary condition. The role of the subsequent mathematics and computation is not to prove the postulate's philosophical truth, but to formally derive its necessary physical consequences and enforcement mechanisms.

A.2. The Control-Theoretic Imperative

Reframes enforcement from geometric inevitability to control necessity.

The stabilization of the coherent state is not described as a passive, inevitable geometric property but as an active control problem. The Torsion Control Network is derived as the necessary solution to this problem, moving the framework from 'what is' to what must be done to maintain stability'.

A.3. The Falsifiability Scope Principle

Clarifies the domain of empirical testing.

Popperian falsifiability applies squarely to the empirical predictions (the Tier 3 Kill Points) derived from the computational layer. The originating physical postulate is not directly falsified; it is constrained by the success or failure of the physical theory and predictions it generates.

A.4. The Computational Bridging Principle

Justifies the implementation first approach.

The bridge between a physical postulate and empirical predictions is built not with abstract theorems alone, but with functional computation. A working implementation serves as a concrete, testable bridge, transforming a philosophical 'what if' into an engineering 'what works.'

A.5. The Generativity Principle

Suggests the framework as a toolkit, not a totalizing system.

The Coherence Engine is not a funnel forcing all phenomena into one structure. It is a generative grammar for coherence, a set of principles and tools for building and testing stable, coherent systems. It offers a viable path, not the only path.

A.6. The Pragmatic Scaffolding Principle

Justifies the architecture based on utility.

The integration of a physical postulate, a control-theoretic core, and a multi stage validation protocol is justified not as a metaphysical necessity but as a pragmatic scaffold. It is a methodology that tests whether coherent starting assumptions, when formalized computationally, yield physically relevant and testable results.