

Hypostatic Field Theory

A Constraint-First Framework for Cosmogenesis and Emergent Spacetime

Jonas Tindstad
Independent Researcher, Norway

Abstract

This paper introduces Hypostatic Field Theory (HypoS), a constraint-first cosmological framework in which spacetime, causality, and physical law emerge from a pre-geometric substrate termed the omni field. The omni field carries ontological informational energy (Eoi), representing the constraint structure governing possible configurations of reality. Local realizability of physical structure is described by operational potential energy (Eop), a state parameter derived from Eoi that determines whether spacetime, causal order, and physical dynamics can instantiate in a given region.

In this framework, reality is fundamentally event-relational rather than point-geometric. Motion arises from differences in operational potential, rendering static energy configurations statistically unstable. Time emerges as the rate of change of relational configurations, while spacetime geometry appears as a macroscopic statistical description of propagation behavior within the event network.

Finite coherence capacity produces an effective upper bound on propagation, yielding the empirical constant c without requiring it to be introduced as a fundamental axiom. Cosmogenesis arises statistically when local concentrations of operational potential exceed an instantiation threshold, producing bounded spacetime regions (“embryonic universes”) within surrounding energy-deficiency environments.

The theory proposes explicit falsifiers, including regime-dependent propagation behavior and Eop-correlated anisotropies. HypoS is presented as a conceptual cosmological framework rather than a replacement for established physical theories.

1. Introduction

1.1 Motivation

Modern cosmology successfully describes gravitational dynamics and quantum phenomena within spacetime, yet fundamental questions remain unresolved:

- the origin of spacetime (Seiberg 2006)
- the nature of singularities (Penrose 1965; Hawking & Penrose 1970)
- the emergence of physical law (Wheeler 1990; Laughlin 2005)
- the origin of the speed-of-light limit (Einstein 1905)
- the cosmological initial condition problem (Guth 1981)

Many approaches in quantum gravity suggest that spacetime may not be fundamental. Instead, geometric structure may emerge from deeper relational or informational degrees of freedom.

Hypostatic Field Theory explores this possibility through a constraint-first approach.

Several contemporary research programs explore the possibility that spacetime geometry is emergent from deeper relational or informational structures, including thermodynamic gravity, causal set theory, and entanglement-based spacetime models. The Hypostatic framework developed here shares the general ambition of emergent geometry but introduces a different primitive variable: operational potential (E_{op}), which governs the admissibility of physical structure rather than deriving geometry from entropy or entanglement.

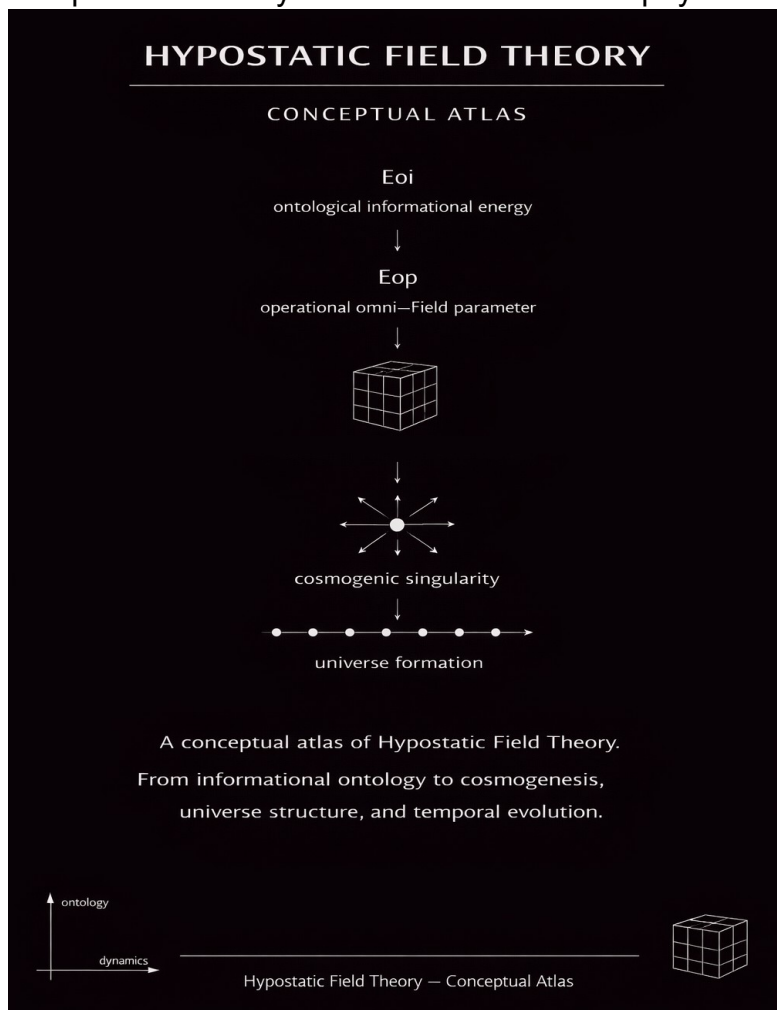
Section 10 outlines possible observational discriminators.

1.2 Conceptual Strategy

Rather than modifying existing physical laws, HypoS proposes that:

1. spacetime is not fundamental
2. physical law emerges locally
3. propagation constraints arise from finite coherence

The theory therefore operates one layer beneath conventional physics.



2. Ontological Foundations

2.1 The Omni Field

We postulate the existence of a pre-geometric omni field, defined as a homogeneous substrate of admissible configurations persisting in the pre-cosmic background:

- contains no intrinsic geometry
- contains no spacetime
- is not a quantum field
- does not possess classical locality

It represents the structural background within which physical instantiation may occur.

2.2 Ontological Informational Energy (Eoi)

The omni field carries ontological informational energy (Eoi).

Eoi represents the constraint structure governing possible configurations.

Properties of Eoi:

- not directly measurable
- not a force carrier
- not a dynamical energy term

Eoi encodes possibility and admissibility, not motion.

The term “energy” here is used in an informational–structural sense rather than as a measurable dynamical quantity.

3. Operational Potential Energy

3.1 Definition of Eop

Local physical realizability is quantified by operational potential energy (Eop).

Eop is defined as a local state parameter derived from the informational structure of the omni field.

Conceptually:

Eop characterizes the local admissibility of physical realization — it answers the question: what can become physically real here?

3.2 Role of Eop

Eop determines the admissibility of:

- spacetime
- causal ordering
- propagation of energy
- propagation of information
- emergence of physical law

Eop is therefore a regime-defining parameter rather than a conventional physical field.

Eq. 1)

$$Eop = H + Eoi$$

H = quantum point total potential energy

Eoi = ontological informational energy

H represents locally instantiated physical energy contributions, while Eoi represents ontological informational constraints of the omni field.

H and Eoi are expressed in compatible informational-energy units.

H and Eoi are treated within the same informational–structural unit system representing admissible configuration capacity rather than conserved physical energy.

VELOCITY DESCRIPTIONS

Effective propagation channels

V_{ee} — embryonic energy propagation

V_{ei} — embryonic information propagation

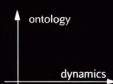
V_{oe} — pristine omni-field energy propagation

V_{oi} — pristine omni-field information propagation

HypoS distinguishes energy and information propagation
in embryonic and pristine regimes.

These velocities are effective propagation descriptions, not
classical particle speeds

Their values depend on local field state and configuration.



4. Event Ontology

4.1 Events as Primitive Elements

HypoS adopts an event-relational ontology.

Reality consists of:

- events
- relations between events

rather than objects embedded in spatial points.

These relations define the admissible causal network.

4.2 Emergence of Spatial Structure

Spatial geometry is not fundamental.

Instead, geometry arises as a statistical description of propagation behavior across the event network.

5. Mandatory Dynamics

5.1 Statistical Dispersion and Entropy

HypoS introduces the Mandatory Dynamics Principle.

Statistical instability provides the mechanism through which this structural tendency manifests.

Static energy configurations are statistically unstable within the operational potential framework.

Eq.2)

Differences in operational potential necessarily produce interaction:

$\Delta E_{op} \rightarrow$ propagation

Thus motion is structurally inevitable.

Eq.3)

$F_{Eop} \propto \nabla E_{op}$

Equilibrium corresponds to balanced dynamic exchange rather than stasis.

5.2 Entropic Consequences

Nonzero operational potential differences necessarily produce motion.

Mandatory propagation disperses operational trajectories across admissible configuration space. As the number of accessible configurations increases, entropy rises statistically.

Eq.4)

$$\Delta E_{op} \neq 0$$

→ dispersion of trajectories

→ expansion of configuration measure Ω

→ entropy increase.

6. Emergence of Time

Time is not fundamental in HypoS.

Instead:

Time emerges from the rate at which relational configurations change.

Without interaction, time has no operational meaning.

Time emerges as proportional to the rate of event transitions.

Eq.5)

$$t \propto \Delta S / \Gamma$$

ΔS = state change

Γ = interaction rate

7. Propagation and Coherence

Propagation of energy or information requires internal coherence.

Finite coherence capacity produces an effective upper bound on propagation velocity.

This yields the empirical constant c as a coherence limit rather than a fundamental axiom.

Eq.6)

$$V = \ell / \tau$$

ℓ = characteristic propagation distance

τ = characteristic realization time

Eq.7)

Internal coherence cost increases with velocity:

$$E_{int}(V) = \eta(V) \cdot (\frac{1}{2} m V^2)$$

$$\eta'(V) \geq 0$$

monotonically increasing.

$\eta(V)$ represents the coherence cost factor. The precise functional form of $\eta(V)$ is left open and is expected to depend on the coherence capacity of the local substrate.

Eq.8)

This normalizes the coherence capacity:

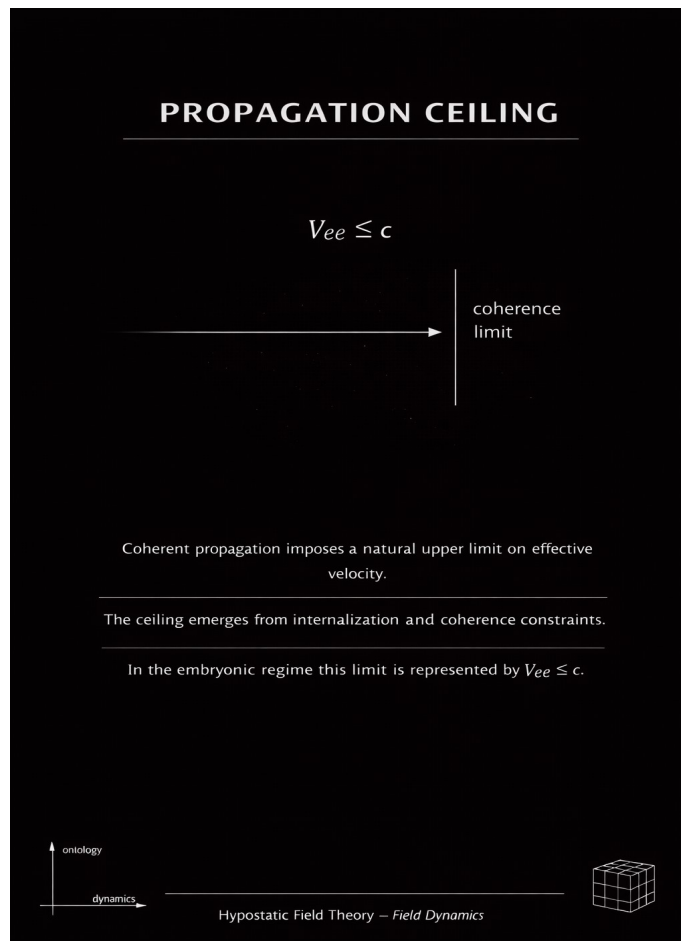
$$E_{\text{int}} \leq E_{\text{max}}$$

$$E_{\text{max}} = \alpha m c^2$$

Eq.9)

The empirical constant c appears as a coherence ceiling rather than a postulated universal speed limit:

$$V \leq c$$



8. Cosmogenesis

8.1 Statistical Formation of Universes

Given sufficient omni-field volume and ultra-deep time, local concentrations of operational potential can reach singularity-grade concentration (singularity-grade in the HypoS sense, not GR singularities).

When E_{op} exceeds a critical threshold:

- spacetime becomes admissible

- causality emerges
- physical law instantiates locally

Eq.10)

Instantiation threshold condition:

$$E_{op} \geq E_c$$

E_c = spacetime instantiation threshold

Eq.11)

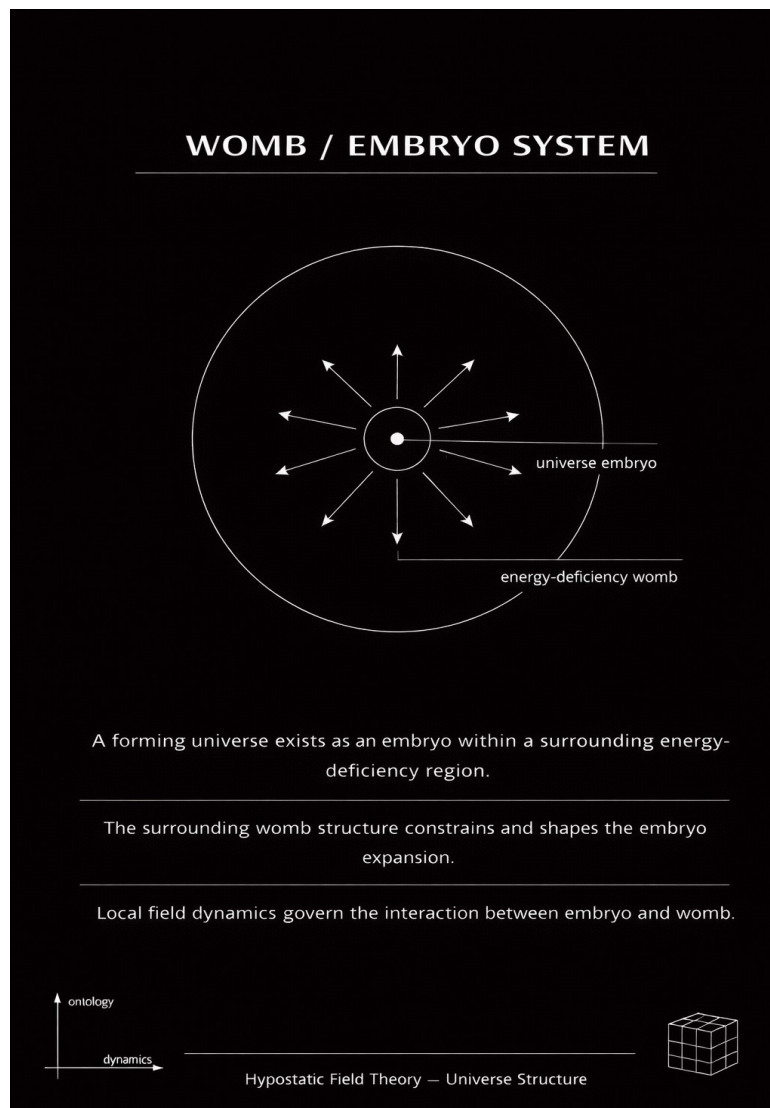
Ultra-deep-time inevitability:

$$P(\text{singularity}) \rightarrow 1 \text{ as } (\text{space} \times \text{time}) \rightarrow \infty$$

8.2 Embryonic Universes

Such events produce bounded embryonic universes embedded within surrounding energy-deficiency environments (“wombs”).

Cosmic inflation is interpreted as equalization dynamics between the embryo and the surrounding omni field.



9. Regime Dependence

Physical behavior depends on the surrounding operational regime. These regimes correspond to different ambient Eop environments.

Low surrounding Eop → equilibration → heat death.

Higher surrounding Eop → suppressed equilibration → persistent structure.

Heat death is therefore not necessarily universal. In sufficiently high ambient Eop environments, operational potential gradients may be continuously renewed, preventing the full thermodynamic equilibration required for heat death.

Vee = embryonic energy propagation

Vei = embryonic information propagation

Voe = pristine energy propagation

Voi = pristine information propagation

Eq.12)

$V_{ei} \leq V_{oi}$

Instantiation velocity cannot exceed the rate at which operational potential can propagate through the substrate.

10. Observational Consequences

HypoS proposes several possible empirical discriminators:

- regime-dependent propagation behavior
- anisotropies correlated with operational potential gradients
- scaling behavior of emergence thresholds
- modified interpretations of cosmological inflation

For example, propagation anisotropies could appear in extreme gravitational or early-universe environments.

Possible environments include early-universe conditions, extreme gravitational gradients, or highly coherent condensed systems.

These predictions are exploratory and require further development.

11. Falsifiability

The theory can be falsified if:

- coherent superluminal signal propagation occurs in near-zero-temperature embryonic regimes
- no regime-dependent propagation behavior exists
- cosmological observations show no signatures consistent with operational potential gradients

HypoS is therefore intentionally exposed to empirical falsification.

12. Candidate Evolution Equation for Operational Potential

The following equation illustrates a minimal dynamical form consistent with the conceptual principles introduced above.

Eq. 13)

$$\partial E_{op}/\partial t = \nabla \cdot (D(E_{op}) \nabla E_{op}) + S - \Gamma$$

$$S = S_{\text{cosmo}}(E_{op}, C)$$

$$\Gamma = \Gamma_{\text{inst}}(E_{op}, I)$$

$D(E_{op})$ — equalization coefficient

S — concentration source term

Γ — instantiation depletion rate

The local operational potential changes through three processes: statistical equalization across E_{op} gradients, rare concentration events that increase local admissibility, and depletion into instantiated structure once physical law becomes locally active.

This equation is proposed as the minimal operational evolution law consistent with

- (i) equalization dynamics,
 - (ii) statistical cosmogenesis,
 - and
 - (iii) irreversible local instantiation.
-

13. Conclusion

Hypostatic Field Theory proposes a constraint-first cosmology in which spacetime, causality, and physical law emerge from a pre-geometric omni field governed by operational potential.

Rather than replacing existing theories, HypoS provides a conceptual framework that may underlie their effective descriptions.

Further work will focus on formalizing the dynamical mathematics and identifying observational signatures of operational regimes.

References (Foundational Context)

Emergent Gravity

Verlinde, E. (2011).

On the origin of gravity and the laws of Newton.

Journal of High Energy Physics, 2011(4), 29.

[https://doi.org/10.1007/JHEP04\(2011\)029](https://doi.org/10.1007/JHEP04(2011)029)

Verlinde, E. (2017).
Emergent gravity and the dark universe.
SciPost Physics, 2(3), 016.
<https://doi.org/10.21468/SciPostPhys.2.3.016>

Thermodynamic Gravity

Jacobson, T. (1995).
Thermodynamics of spacetime: The Einstein equation of state.
Physical Review Letters, 75, 1260–1263.
<https://doi.org/10.1103/PhysRevLett.75.1260>

Padmanabhan, T. (2010).
Thermodynamical aspects of gravity: New insights.
Reports on Progress in Physics, 73(4), 046901.
<https://doi.org/10.1088/0034-4885/73/4/046901>

Emergent Spacetime / Quantum Information Approaches

Van Raamsdonk, M. (2010).
Building up spacetime with quantum entanglement.
General Relativity and Gravitation, 42, 2323–2329.
<https://doi.org/10.1007/s10714-010-1034-0>

Swingle, B. (2012).
Entanglement renormalization and holography.
Physical Review D, 86, 065007.
<https://doi.org/10.1103/PhysRevD.86.065007>

Causal Set Theory

Bombelli, L., Lee, J., Meyer, D., & Sorkin, R. (1987).
Space-time as a causal set.
Physical Review Letters, 59, 521–524.
<https://doi.org/10.1103/PhysRevLett.59.521>

Sorkin, R. (2005).
Causal sets: Discrete gravity.
In A. Gomberoff & D. Marolf (Eds.), *Lectures on Quantum Gravity*. Springer.

Relational Quantum Mechanics

Rovelli, C. (1996).
Relational quantum mechanics.
International Journal of Theoretical Physics, 35, 1637–1678.
<https://doi.org/10.1007/BF02302261>

Rovelli, C. (2004).
Quantum Gravity. Cambridge University Press.

Foundations of Emergent Spacetime

Seiberg, N. (2006).

Emergent spacetime.

arXiv:hep-th/0601234

Hossenfelder, S. (2018).

Lost in Math: How Beauty Leads Physics Astray. Basic Books.

Guth, A. H. (1981).

Inflationary universe: A possible solution to the horizon and flatness problems.

Physical Review D, 23(2), 347–356.

<https://doi.org/10.1103/PhysRevD.23.347>

Penrose, R. (1965).

Gravitational collapse and space-time singularities.

Physical Review Letters, 14, 57–59.

<https://doi.org/10.1103/PhysRevLett.14.57>

Hawking, S., & Penrose, R. (1970).

The singularities of gravitational collapse and cosmology.

Proceedings of the Royal Society A, 314(1519), 529–548.

<https://doi.org/10.1098/rspa.1970.0021>

Wheeler, J. A. (1990).

Information, physics, quantum: The search for links.

In W. Zurek (Ed.), *Complexity, Entropy, and the Physics of Information.*

Addison-Wesley.

Laughlin, R. B. (2005).

A Different Universe: Reinventing Physics from the Bottom Down.

Basic Books.

Einstein, A. (1905).

Zur Elektrodynamik bewegter Körper.

Annalen der Physik, 322(10), 891–921.