

Letter I

ToE Living Review Letters I: The Ontological Primacy of Entropy

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“The world is not a thing, but a process.”

— *Hermann Weyl, Space–Time–Matter (1922)*

“We cannot solve our problems with the same thinking we used when we created them.”

— *Albert Einstein, Address to the United Nations (1946)*

“What we observe is not nature itself, but nature exposed to our method of questioning.”

— *Werner Heisenberg, Physics and Philosophy (1958)*

“Information is physical.”

— *Rolf Landauer, IBM Journal of Research and Development (1961)*

“The future is not given. It is created through irreversible processes.”

— *Ilya Prigogine, From Being to Becoming (1980)*

“We are no longer satisfied with insights into particles or fields alone; we seek the foundation beneath them.”

— *John Archibald Wheeler, Frontiers of Time (1980)*

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Abstract

This Letter presents the foundational thesis of the Theory of Entropicity: that entropy is not a derived statistical quantity, not a measure of disorder, and not an epistemic accounting device, but the primary ontological field from which all physical structure emerges. At the center of this framework lies the entropic field, a universal, continuous, local, and dynamical scalar field defined over a differentiable structure called the entropic manifold. This field serves as the causal substrate of reality. Spacetime geometry, gravitational phenomena, quantum behavior, matter, and information are reconceived as emergent properties arising from entropic gradients, curvature, and dynamics rather than as fundamental primitives of nature.

The Letter introduces the Obidi Conjecture, the formal assertion that entropy constitutes a fundamental, real, dynamical field underlying all physical phenomena, and that the conventional hierarchy of physics, in which geometry and fields are primary and entropy is secondary, must be inverted. The Obidi Action is presented as the variational principle governing entropic dynamics, encoding both local differential structure and global spectral consistency through a dual formulation. The philosophical and physical framework arising from these foundations is termed ontodynamics: the study of existence as entropic motion.

This work is positioned relative to established programs in entropic gravity, including contributions by Verlinde, Jacobson, Padmanabhan, and Bianconi; information geometry in the tradition of Amari, Čencov, the Fisher-Rao metric, and the Fubini-Study metric; and emergent spacetime research across holography and black hole thermodynamics. The Theory of Entropicity does not extend these programs but subsumes and transcends them by eliminating spacetime, quantum states, and classical fields as axiomatic primitives, replacing them with a single entropic substrate. This Letter presents the conceptual and philosophical architecture without mathematical formalism, which will be developed in subsequent Letters in this series.

1. Introduction

Entropy occupies one of the most paradoxical positions in the architecture of modern physics. It appears in nearly every domain of fundamental theory, from thermodynamics and statistical mechanics to quantum information, black hole physics, and cosmology, yet it is almost universally treated as a secondary quantity: a statistical summary, a bookkeeping device for counting microstates, a measure of ignorance, or a convenient proxy for the degree of disorder within a system. Across more than a century of theoretical development, entropy has remained subordinate to the structures it describes. Fields, forces, spacetime, and quantum states are regarded as fundamental; entropy merely characterizes their collective behavior. It is the shadow, never the substance.

The Theory of Entropicity proposes a radical departure from this inherited hierarchy. It asserts that entropy is not derived from more fundamental entities but is itself the most fundamental entity, the primary ontological field from which spacetime, geometry, gravity, matter, quantum phenomena, and information emerge as secondary, derived structures. This inversion is not a metaphorical reframing or a philosophical conceit. It is a concrete proposal for a new foundation of physics, one in which the entropic field replaces the spacetime manifold, the metric tensor, and the quantum state as the primitive ingredient of physical theory.

This Letter, the first in a series of formal communications presenting the Theory of Entropicity (ToE), establishes the conceptual and philosophical foundations upon which the mathematical formalism will be constructed. Its purpose is to articulate the ontological architecture with precision and rigor, defining the central objects, principles, and commitments of the theory in natural language. No equations appear in this Letter. The variational calculus, the field equations, and the spectral formulation will follow in subsequent Letters. Here, the aim is clarity of vision: to state what the theory claims, why it claims it, and how its claims relate to the existing landscape of fundamental physics.

The scope of this exposition is deliberately foundational. The arguments proceed conceptually rather than computationally, drawing on the structural behavior of entropy across multiple domains to motivate its elevation to ontological primacy. What follows is an intellectual argument for a new beginning in physics, one that takes entropy not as the end of the story, but as its origin.

2. Fundamental Principles of the Theory of Entropicity (ToE)-I: The Obidi Conjecture, OEP, OCP, and OPoC

The Theory of Entropicity is built upon a set of foundational principles that articulate how an entropy-based ontology relates to the familiar geometric and dynamical structures of modern physics. These principles—the **Obidi Conjecture (OC)**, the **Obidi Equivalence Principle (OEP)**, the **Obidi Principle of Complementarity (OPoC)**, and the **Obidi Correspondence Principle (OCP)**—form the conceptual scaffolding that connects the entropic field to the emergent geometry of spacetime, the behavior of matter, and the structure of physical law. They serve as the interpretive bridge between the entropic substrate and the classical and quantum frameworks that arise from it in appropriate limits.

Together, these principles assert that the entropic and geometric descriptions of reality are not rivals but reflections of a deeper unity. They explain how the familiar structures of general relativity and quantum theory emerge from the entropic manifold, why these structures remain valid in their respective domains, and how they are ultimately subsumed by a more fundamental entropic dynamics. In this sense, the Obidi Principles are not auxiliary assumptions but the philosophical and structural commitments that define the Theory of Entropicity (ToE) as a coherent and complete framework.

2.1 The Obidi Conjecture (OC): Entropy as the Fundamental Field

The Obidi Conjecture is the central ontological claim of the Theory of Entropicity: **entropy is the fundamental dynamical field of the universe**, and all physical structures—geometry, matter, energy, information, and causality—are emergent manifestations of its

behavior. This conjecture inverts the conventional hierarchy of physics. Instead of treating entropy as a derived statistical quantity defined on top of more fundamental geometric or quantum structures, the Obidi Conjecture asserts that entropy is the primitive entity from which those structures arise.

In this view, the Einstein field equations are not fundamental laws but **large-scale approximations** of the entropic field's dynamics. Spacetime curvature, gravitational attraction, and the behavior of matter are all consequences of the entropic field's gradients, curvature, and higher-order structure. The Obidi Conjecture thus positions the Theory of Entropicity (ToE) as a generative framework: geometry does not constrain entropy; entropy generates geometry.

What changes when entropy is declared the fundamental field

The Obidi Conjecture asserts:

Entropy is the fundamental ontological field.

If this is true, then:

- the geometry of entropy = the geometry of reality
- the curvature of entropy = the curvature of reality
- the dynamics of entropy = the dynamics of reality

2.2 The Obidi Equivalence Principle (OEP): Entropic and Geometric Descriptions as Dual Expressions of One Reality

The Obidi Equivalence Principle states that the entropic and geometric descriptions of physical phenomena are **physically equivalent** when expressed in the appropriate variables. This principle asserts that the entropic action and the gravitational action encode the same physical content, even though they arise from different ontological commitments.

The entropic formulation describes the evolution of the entropic field on the entropic manifold; the geometric formulation describes the evolution of the emergent metric on the emergent spacetime manifold. These two descriptions are related by a transformation that maps entropic structure to geometric structure.

The OEP does not claim that geometry is fundamental. Rather, it asserts that geometry is a **faithful emergent representation** of the entropic field in the regime where spacetime has already formed. In this sense, the OEP plays a role analogous to the equivalence principle in general relativity: it identifies a deep unity beneath apparently distinct descriptions of physical reality. Just as inertial and gravitational mass are equivalent in Einstein's theory, entropic and geometric descriptions are equivalent in the Theory of Entropicity—though only one of them is ontologically fundamental.

2.3 The Obidi Principle of Complementarity (OPoC): Two Valid Descriptions, Each Dominant in Its Own Regime

The Obidi Principle of Complementarity asserts that the entropic and geometric descriptions are **complementary** rather than competing. Each description is valid and useful, but each is most natural in a different regime. The entropic description is fundamental and applies universally, but it is most transparent in regimes where the entropic field varies strongly or where geometry has not yet emerged. The geometric description is emergent and approximate, but it is extraordinarily effective in regimes where the entropic field varies smoothly and the emergent metric is well-defined.

This complementarity mirrors the dual descriptions of quantum mechanics, where wave and particle pictures are both valid but each is most useful in different contexts. In the Theory of Entropicity, the entropic and geometric descriptions are not contradictory but mutually illuminating. The OPoC thus provides the conceptual justification for using geometric tools in a fundamentally entropic universe: geometry is not wrong; it is incomplete.

2.4 The Obidi Correspondence Principle (OCP): Recovery of General Relativity in the Classical Limit

The Obidi Correspondence Principle ensures that the Theory of Entropicity reduces to general relativity in the appropriate classical or coarse-grained limit. This principle is essential for the empirical viability of the theory. It asserts that when the entropic field varies slowly, when gradients are small, and when the manifold is sufficiently coarse-grained, the emergent metric satisfies the Einstein field equations to an excellent approximation.

The OCP guarantees continuity with established physics. It ensures that the Theory of Entropicity does not discard the successes of general relativity but **explains them** as emergent consequences of a deeper entropic dynamics. Just as quantum mechanics reduces to classical mechanics in the limit of large quantum numbers, the Theory of Entropicity reduces to general relativity in the limit of low entropic curvature. The OCP thus positions general relativity not as a rival to the entropic framework but as its classical shadow.

2.5 The Unified Role of the Obidi Principles

Taken together, the Obidi Conjecture, the Obidi Equivalence Principle, the Obidi Principle of Complementarity, and the Obidi Correspondence Principle form a coherent hierarchy:

- **The Obidi Conjecture** establishes entropy as the fundamental field.
- **The Obidi Equivalence Principle** identifies the mapping between entropic and geometric descriptions.
- **The Obidi Principle of Complementarity** explains why both descriptions remain valid in different regimes.
- **The Obidi Correspondence Principle** ensures that the entropic theory reproduces general relativity where it must.

These principles transform the Theory of Entropicity from a philosophical idea into a structured physical framework. They articulate how the entropic field gives rise to geometry, how geometric physics emerges from entropic dynamics, and how the familiar laws of gravity arise as limiting cases of a deeper ontological substrate. They also provide the conceptual tools needed to compare the Theory of Entropicity with established theories without discarding their empirical successes.

In this way, the Obidi Principles serve as the intellectual architecture of the Theory of Entropicity. They define its commitments, clarify its claims, and ensure its continuity with the broader landscape of modern theoretical physics. They reveal a universe in which entropy is not a measure of ignorance but the very fabric of reality, and in which geometry, gravity, and matter are the emergent expressions of a single entropic field.

3. Fundamental Principles of the Theory of Entropicity (ToE)-II: Entropic Cost, Entropic Constraint, Entropic Resistance, Entropic Accounting, and Entropic Equivalence

The Theory of Entropicity (ToE) is built upon a family of structural principles that articulate how the entropic field governs motion, interaction, causality, and the emergence of physical law. These principles—**Entropic Cost (ECo)**, **Entropic Constraint (ECon)**, **Entropic Resistance (ER)**, **Entropic Accounting (EA)**, **Entropic Equivalence (EE)**, and their formal expressions in the **Entropic Constraint Principle (ECP)**, **Entropic Resistance Principle (ERP)**, and **Entropic Accounting Principle (EAP)**—constitute the operational grammar of the entropic universe. They provide the rules by which the entropic field evolves, reorganizes, and constrains all physical processes.

This section consolidates these principles into a coherent framework for future reference. They appear throughout the development of ToE in various contexts—gravity, quantum behavior, information geometry, thermodynamics, and the philosophy of ontodynamics—

but here they are presented systematically as the universal laws governing the entropic manifold.

3.1 Entropic Cost (ECo): The Currency of Physical Change

Entropic Cost is the principle that **every physical process requires an expenditure of entropic curvature**. Nothing in the universe changes state for free. Any reconfiguration of the entropic field—whether the displacement of a particle, the propagation of a signal, the stabilization of a measurement outcome, or the emergence of a classical structure—requires a minimum entropic investment.

ECo establishes entropy as the **universal currency** of physical reality. It implies:

- Distinguishability requires entropic curvature.
- Motion requires entropic expenditure.
- Information storage requires entropic structure.
- Classical outcomes require irreversible entropic flow.

This principle underlies the **Obidi Curvature Invariant (OCI)**, the smallest possible unit of entropic curvature required for physical distinction.

3.2 Entropic Constraint (ECon): The Limits Imposed by the Entropic Field

Entropic Constraint states that **all physical processes are limited by the finite rate at which the entropic field can reorganize itself**. This is not a statistical tendency but a structural law: the entropic field imposes hard constraints on what can occur, how fast it can occur, and how much entropic curvature must be invested.

ECon governs:

- the maximum speed of propagation
- the irreversibility of time
- the stabilization of classicality
- the admissibility of physical laws

This principle is formalized in the **Entropic Constraint Principle (ECP)**, which asserts that **no process can violate the structural limits of the entropic field.**

3.3 Entropic Resistance (ER): The Origin of Inertia and Mass

Entropic Resistance is the principle that **any attempt to accelerate or alter a system requires the reconfiguration of the surrounding entropic field**, which resists such changes. This resistance is not frictional but structural: the entropic field pushes back against rapid reconfiguration.

ER provides the entropic explanation for:

- inertia
- relativistic mass increase
- the energy cost of acceleration
- the impossibility of instantaneous change

This principle is formalized in the **Entropic Resistance Principle (ERP)**, which states that **inertia is the entropic drag exerted by the field against rapid curvature reconfiguration.**

3.4 Entropic Accounting (EA): The Ledger of Entropic Expenditure

Entropic Accounting asserts that the universe maintains a strict ledger of entropic expenditures. Every process draws from a finite entropic budget, and expenditures in one domain reduce availability in another.

EA explains:

- time dilation (motion consumes entropic budget, leaving less for internal processes)
- length contraction (structural equilibrium shifts under entropic load)
- energy–entropy tradeoffs
- the conservation of entropic curvature

This principle is formalized in the **Entropic Accounting Principle (EAP)**, which states that **all entropic expenditures must be balanced by corresponding reductions or redistributions elsewhere in the field.**

3.5 Entropic Equivalence (EE): A Generalization of Einstein’s Equivalence Principle

Entropic Equivalence states that **any two physical processes that produce identical reconfigurations of the entropic field are fundamentally equivalent**, regardless of their classical, quantum, or relativistic descriptions.

EE generalizes Einstein’s equivalence principle:

- not only gravitational and inertial mass are equivalent
- but any two processes with equal entropic cost are equivalent

This principle unifies:

- gravitational redshift and quantum transitions
- accelerated motion and gravitational motion
- classical trajectories and quantum paths
- relativistic effects and thermodynamic effects

EE is the structural axiom that **the universe recognizes only entropic transformations, not the descriptive frameworks used to model them.**

3.6 The Entropic Constraint Principle (ECP): The Structural Law of the Entropic Field

The **Entropic Constraint Principle** is the overarching law that integrates ECo, ECon, ER, EA, and EE. It states:

All physical processes are governed by the structural limits of the entropic field, which dictate the cost, resistance, accounting, and equivalence of all entropic transformations.

ECP is the entropic analogue of the Einstein field equations: it defines the admissible domain of physical reality.

3.7 The No-Rush Theorem (NRT): The Finite Rate of Entropic Propagation

The **No-Rush Theorem** is a direct consequence of ECP. It states:

- no process can occur faster than the entropic field can reorganize
- no signal can propagate faster than the entropic curvature limit

- no measurement can stabilize instantaneously
- no classical outcome can emerge without irreversible entropic flow

This theorem provides the thermodynamic foundation for the universal speed limit c : **light is the maximum rate of entropic reconfiguration.**

3.8 The Obidi Curvature Invariant (OCI): The Minimum Unit of Distinguishability

The **Obidi Curvature Invariant** defines the smallest possible entropic curvature required for two states to be physically distinguishable. It is the entropic analogue of Planck's constant.

OCI implies:

- reality is quantized in entropic curvature
- no distinction can occur below the OCI threshold
- classicality emerges when curvature exceeds this threshold
- measurement irreversibility is curvature-driven

OCI is the atomic unit of entropic geometry.

3.9 Entropic Principles in Application

These principles unify the behavior of physical systems across domains:

Gravity

Gravity is the entropic tendency of systems to move along paths that maximize entropic efficiency. ER and ECon explain gravitational attraction as entropic flow, not force.

Quantum Mechanics

The Vuli–Ndlela Integral (entropic reformulation of Feynman’s path integral) weights quantum paths by entropic cost. EE explains why classical and quantum descriptions converge in the appropriate limit.

Relativity

Time dilation, length contraction, and mass increase arise from EA and ER. The speed of light emerges from NRT.

Consciousness

Self-Referential Entropy (SRE) describes conscious systems as high-entropy subsystems negotiating entropic gradients.

3.10 Applications of the Theory of Entropicity (ToE) in Engineering: The Entropic Resistance Principle (ERP) in Engines

The Entropic Resistance Principle (ERP) provides a new physical interpretation of how engines operate within the entropic substrate. In conventional thermodynamics, an engine converts chemical potential into mechanical work by cycling through pressure–volume transformations. In the Theory of Entropicity, this description is incomplete. An engine is not merely a mechanical device but a **localized entropy pump** embedded within the entropic manifold. Its operation is governed not only by chemical energetics but by the structural constraints of the entropic field.

ERP states that **any attempt to accelerate or sustain motion requires the reconfiguration of the surrounding entropic field**, which resists rapid change. Engines must therefore continuously “pay” entropic cost to overcome this resistance. This entropic expenditure is not an inefficiency of engineering design but a structural requirement of the entropic universe.

Engine as an Entropy Pump

In ToE, a combustion engine functions as a **localized entropic generator**. The oxidation of fuel produces a sharp increase in local entropy, creating a transient entropic gradient in the surrounding field. This gradient is what enables the vehicle to move: the engine injects entropy into the manifold, and the manifold responds by reorganizing itself along entropic flow lines.

However, ERP dictates that sustaining motion requires more than generating thrust. The engine must continuously counteract the **entropic resistance field**, which increases with velocity. As the vehicle moves faster, the entropic field must be reconfigured more rapidly, and the entropic cost of maintaining motion rises accordingly. This is why engines consume disproportionately more fuel at higher speeds: a growing fraction of the combustion entropy is diverted to stabilizing the entropic field rather than producing net propulsion.

Cycle-by-Cycle Entropic Resistance

A four-stroke engine illustrates ERP in action:

- **Intake and compression** concentrate entropy density within the cylinder, preparing the system for a controlled entropic release.
- **Combustion** produces a rapid increase in entropy, generating a forward entropic gradient. But ERP requires that part of this entropy be spent counteracting the resistance of the field, especially at higher velocities.
- **Exhaust** expels low-potential entropy rearward, resetting the local entropic configuration but losing part of the entropic budget to field drag.

As velocity increases, the entropic resistance grows nonlinearly. More of the engine's entropic output is consumed by field stabilization, leaving less available for mechanical acceleration. This entropic redistribution explains why fuel efficiency drops sharply at

highway speeds: the engine is not fighting classical drag but negotiating finite-rate entropic propagation.

Fuel Efficiency as an ERP Trade-Off

ERP predicts the characteristic decline in fuel efficiency with increasing velocity. At low speeds, entropic resistance is negligible; most of the combustion entropy contributes to propulsion. At high speeds, the entropic field demands a larger share of the entropy budget to maintain structural coherence. The engine must therefore burn more fuel to produce the same incremental increase in velocity.

This entropic interpretation unifies thermodynamic inefficiencies (Carnot limits), relativistic effects (time dilation of internal processes), and mechanical losses into a single framework. In ToE, **no engine can achieve 100% efficiency** because the entropic field forbids free motion. All engines must allocate part of their entropic output to overcoming ERP.

Engineering Through the Lens of the Theory of Entropicity (ToE)

The entropic interpretation of engines has several implications:

- **Inertia** arises from entropic resistance, not mass as an independent property.
- **Fuel efficiency** is governed by entropic accounting, not merely mechanical design.
- **Maximum speed** is limited by the No-Rush Theorem: the entropic field cannot reorganize faster than its intrinsic propagation rate.
- **Engine optimization** becomes a problem of minimizing entropic expenditure, not simply maximizing mechanical output.

An engine doesn't "fight" a classical drag force but negotiates finite entropy flows—combustion initiates, field mediates, resistance reallocates. Hence, we see clearly here that

no engine runs at 100% efficiency in the Theory of Entropicity (ToE) because ToE's ERP forbids free motion in the entropic substrate.

In this view, engines are not classical machines but **entropic negotiation devices**. They mediate between chemical entropy production and the structural constraints of the entropic manifold. Their performance is determined not [strictly only] by engineering design but by the universal laws of entropic cost, resistance, and accounting.

3.11 Additional Entropic Principles in the Literature of ToE

A survey of the broader entropic-gravity and information-geometry literature [of the Theory of Entropicity (ToE)] reveals several principles consistent with ToE and can be explicitly integrated as corollaries of one or more of the earlier ToE principles given above:

- **Maximum Entropy Production Principle (MEPP)**—systems evolve toward states that maximize entropy production.
- **Holographic Entropic Bound** — information content is proportional to boundary entropy.
- **Thermodynamic Causality Principle** — causal order arises from entropy production.
- **Information–Curvature Correspondence** — curvature encodes informational divergence.
- **Finite-Information Principle** — physical systems cannot encode infinite information.

These principles naturally integrate into the ToE framework as corollaries of ECo, ECon, and EE.

3.12 Summary: The Entropic Laws of the Universe

The principles consolidated in this section form the operational backbone of the Theory of Entropicity:

- **ECo** — every change has entropic cost
- **ECon** — the entropic field imposes structural limits
- **ER** — inertia and mass arise from entropic resistance
- **EA** — the universe maintains an entropic ledger
- **EE** — equivalence is defined by entropic reconfiguration
- **ECP** — all processes obey entropic constraints
- **ERP** — acceleration requires entropic expenditure
- **EAP** — entropic budgets must balance
- **NRT** — no process can outrun entropic propagation
- **OCI** — distinguishability requires minimum curvature

Together, they provide a unified, comprehensive, and internally consistent set of laws governing the entropic universe.

4. The Ontological Reversal: From Derived Quantity to Fundamental Field

The standard conceptual hierarchy of modern physics proceeds along a well-established chain. At the base, one posits a spacetime manifold, typically a smooth four-dimensional continuum, equipped with a metric that encodes distances, causal structure, and geometric curvature. Upon this manifold, quantum fields are defined as operator-valued

distributions, giving rise to particles, forces, and interactions through the apparatus of quantum field theory. Entropy, in this framework, enters only after the fundamental structures have been specified. It describes the statistical properties of ensembles, the information content of quantum states, or the thermodynamic behavior of macroscopic systems. Entropy is always about something else. It is never the thing itself.

The Theory of Entropicity inverts this hierarchy completely through what is here termed the Obidi Conjecture: the formal proposition that entropy is a fundamental, real, dynamical field, and that all structures conventionally regarded as primitive, including spacetime geometry, gravitational fields, quantum states, and matter, are emergent consequences of entropic dynamics. This is not a claim that entropy is "important" or "useful" as a concept. It is a claim that entropy is constitutive, that it is the stuff of which reality is made.

To say that entropy is ontologically primary is to assert that it is not a measure of ignorance about underlying microstates, because there are no underlying microstates more fundamental than the entropic field itself. It is not a counting statistic derived from a partition function, because the partition function and the statistical ensemble from which it arises are themselves emergent from entropic structure. It is not a boundary quantity defined on horizons or screens, because horizons and screens are geometric objects that owe their existence to the entropic field. In the framework of the Theory of Entropicity, entropy does not describe reality. Entropy is reality.

This reversal carries profound consequences for the relationship between entropy and geometry. In General Relativity, the Einstein field equations establish a correspondence between the distribution of energy and momentum and the curvature of spacetime. Geometry is given first, and matter curves it. In the Theory of Entropicity, this relationship is inverted. The entropic field generates geometric structure through its gradients and higher-order behavior. Curvature is not an independent geometric phenomenon but a response to the configuration of the entropic field. What appears as spacetime in conventional physics is, in this framework, a macroscopic manifestation of the underlying

entropic manifold. The metric is not a primitive but a derived object, constructed from the entropic field and its derivatives.

The contrast with quantum field theory is equally stark. In the standard model and its extensions, quantum fields are the fundamental ontological entities, existing at every point in spacetime and giving rise to particles through quantization. The Theory of Entropicity does not deny the empirical success of quantum field theory but reinterprets its content. Quantum fields, in this view, are effective descriptions of entropic dynamics at scales where the entropic field admits certain characteristic excitation patterns. The quantum state is not axiomatic; it is a particular representation of the entropic field's local configuration. Similarly, within information theory, entropy is conventionally treated as an epistemic quantity, a measure of uncertainty or surprise associated with probability distributions. The Theory of Entropicity transforms this epistemic interpretation into an ontic one: information is not about the entropic field but is a geometric property of the entropic field. This brings us to the Information-Geometry Bridge (IGB) of the Theory of Entropicity (ToE):

The Information-Geometry Bridge (IGB) of the Theory of Entropicity (ToE)

The Information-Geometry Bridge of ToE asserts that the geometric structures of information theory (Fisher–Rao metric, Fubini–Study metric, and Amari–Čencov α -connections) become physically meaningful once entropy is promoted to a fundamental dynamical field. These structures do not directly produce spacetime curvature; rather, they define the pre-geometric differential structure from which [physical] spacetime curvature emerges when the entropic field is endowed with an action and field equations.

4. 1 The Entropic Field

At the heart of the Theory of Entropicity (ToE) lies a single fundamental object: the entropic field. This field is conceived as a universal, continuous, local, and dynamical scalar

field defined at every point on the entropic manifold. It is the sole primitive of the theory, the irreducible element from which all other physical structures are derived.

The entropic field differs fundamentally from the thermodynamic entropy encountered in classical physics and statistical mechanics. Thermodynamic entropy is defined only for macroscopic systems in states of equilibrium or near-equilibrium. It is an extensive quantity, additive over subsystems, and carries no local dynamical content. By contrast, the entropic field of the Theory of Entropicity is a local quantity, possessing a definite value at every point on the manifold. It is continuous, admitting smooth variation across the manifold. It is dynamical, evolving according to principles that will be formalized in subsequent Letters through the Obidi Action and the resulting field equations. And it is universal, applying not only to thermal systems but to all physical phenomena, from gravitational dynamics to quantum behavior to the structure of spacetime itself.

The entropic field admits multiple complementary interpretations, each illuminating a different aspect of its physical and mathematical content. First, it may be understood as an ontological density, representing the local intensity or concentration of being at a given point on the manifold. Where the entropic field is high, the manifold is rich in structure, potentiality, and dynamical activity. Where it is low, the manifold approaches a state of ontological sparseness. Second, the entropic field encodes configurational multiplicity, the local capacity of the manifold to support distinct configurations or arrangements. This interpretation connects directly to the classical Boltzmann and Gibbs notions of entropy while extending them beyond the statistical setting. Third, the entropic field functions as a geometric potential, whose gradients and higher-order derivatives generate the curvature, distances, and causal order that constitute the emergent geometry of the manifold. Fourth, the entropic field serves as the information substrate of reality, the medium in which information is encoded, stored, transmitted, and transformed.

These interpretations are not metaphors or loose analogies. They are structural properties encoded in the mathematical architecture of the theory, properties that will be made

precise in the formal developments of subsequent Letters. The unity of these interpretations is one of the distinguishing features of the Theory of Entropicity: what appears in other frameworks as four separate concepts, ontological substance, statistical multiplicity, geometric potential, and information content, are revealed in this theory to be four aspects of a single underlying field.

The behavior of the entropic field is governed by its gradients and by its higher-order structure. The gradient of the entropic field at any point determines the direction and magnitude of entropic flow, the natural tendency of the field to evolve toward configurations of greater entropy. This gradient-driven flow is the fundamental dynamical process in the Theory of Entropicity, replacing the forces and interactions of conventional physics. The second-order behavior of the entropic field, captured by its curvature in a sense to be formalized, governs the emergence of geometric structure. Where the entropic field curves, spacetime curves. Where the entropic field admits stable gradient patterns, matter appears.

The entropic field also provides a natural and precise account of the distinction between past, present, and future. In conventional physics, temporal asymmetry is imposed upon time-symmetric laws through special initial conditions. In the Theory of Entropicity, temporal asymmetry is not imposed but inherent: the entropic field evolves only in the direction of increasing entropy, and this directional evolution defines the **entropic arrow of time**. The past corresponds to regions of the entropic manifold already traversed by irreversible flow; the future corresponds to regions not yet entropically accessible; and the present is the moving boundary where the entropic field actively reconfigures itself. Time is not an external parameter but the internal bookkeeping of entropic evolution. The universe does not move through time; rather, time is the record of the universe's entropic motion.

This perspective dethrones the observer from the privileged position assigned in many interpretations of quantum theory and relativity. In the Theory of Entropicity, the observer

does not define temporal order, causal structure, or informational content. These arise from the entropic field itself, independent of any epistemic agent. The observer is simply another entropic configuration embedded within the manifold, subject to the same irreversible dynamics as every other structure. Observation does not collapse a wavefunction or define a frame of reference; it is an entropic interaction between two regions of the manifold, governed by the same principles that govern all entropic evolution.

The entropic field also reframes the classical variational principles of physics. Maupertuis' principle of least action, which asserts that physical systems follow the path that extremizes the action, is revealed as a geometric approximation to a deeper entropic law. In the Theory of Entropicity, the true dynamical principle is that the entropic field evolves along trajectories that **maximize entropic efficiency**—paths that most effectively increase the total entropic content of the manifold. The classical action is thus an emergent surrogate for the entropic Lagrangian density, valid only in the geometric limit where spacetime has already emerged. The entropic path is not the path of least action but the path of greatest entropic ascent, and classical mechanics appears as the macroscopic description of this more fundamental ontodynamic principle.

5. The Entropic Manifold

The entropic field requires a domain over which it is defined: a smooth, connected, differentiable structure that serves as the arena for all entropic dynamics. This structure is the entropic manifold, and it occupies a role in the Theory of Entropicity analogous to the spacetime manifold in General Relativity, though with fundamental differences in its character and physical interpretation.

In the Theory of Entropicity, the foundational structure of reality is not a vacuum, a background spacetime, or a pre-existing geometric arena, but the **Entropic Manifold**: a smooth, pre-geometric differentiable structure in which every point represents a local informational state of the entropic field. This manifold carries no intrinsic metric,

curvature, or causal order. Instead, these familiar geometric features arise only after the entropic field begins to vary across it. Geometry is not assumed; it is generated.

Within this framework, the Fisher–Rao and Fubini–Study metrics—traditionally treated as belonging to distinct mathematical domains—are reinterpreted as **different limits of a single underlying geometric structure** induced by the entropic field. They are not separate metrics but emergent “slices” of the same entropic geometry, appearing at different scales or regimes of entropic behavior. The Amari–Čencov α -connections provide the structural continuity that allows the entropic manifold to interpolate smoothly between these regimes, unifying classical information geometry and quantum geometry within one entropic substrate.

This unification has profound consequences for gravity. In General Relativity, gravity is the curvature of spacetime. In the Theory of Entropicity, gravity is the **gradient structure of the entropic field**. Regions of steep entropic variation correspond to strong gravitational behavior, not because spacetime is curved by matter, but because the entropic field drives the manifold toward configurations of maximal entropic efficiency. What we perceive as gravitational attraction is, in this view, the natural flow of the entropic manifold toward higher-entropy configurations.

Spacetime itself is not a primitive container in which events unfold. It is an **emergent property** of the entropic field’s density, gradients, and higher-order structure. Distances, durations, causal relations, and curvature arise from the entropic field’s configuration, not the other way around. General Relativity thus appears as the macroscopic limit of entropic information geometry—a large-scale approximation of a deeper, more fundamental entropic dynamics.

This synthesis is non-elementary, nontrivial, and audacious. It replaces the conventional hierarchy of physics with a single entropic substrate from which geometry, gravity, matter, and information all emerge as secondary manifestations of a more fundamental ontological field.

In General Relativity, the spacetime manifold is equipped from the outset with a Lorentzian metric, a symmetric tensor field that encodes distances, angles, causal structure, and gravitational content. The metric is a primitive of the theory, supplied as an initial ingredient alongside the matter content of the universe, and determined self-consistently through the Einstein field equations. The spacetime manifold of General Relativity is, in this sense, a geometric object from the start. Its structure is rich and fully determined by the theory's fundamental equations.

The entropic manifold, by contrast, begins in a pre-geometric state. It is a smooth, connected, orientable differentiable manifold, a topological and differential structure capable of supporting smooth functions, tangent vectors, and differential forms, but it carries no intrinsic metric, no distance function, no curvature tensor, and no causal order at the foundational level. The entropic manifold is a substrate of pure potentiality: it provides the arena for entropic variation and dynamical evolution, but it does not predetermine the geometry of that arena. Geometry is not given. It emerges.

The mechanism by which geometry emerges from the entropic manifold is one of the central achievements of the Theory of Entropicity (ToE). The entropic field, defined over the manifold, generates geometric structure through its gradients and higher-order behavior. From the first derivatives of the entropic field, a notion of direction and flow arises on the manifold. From the second derivatives, curvature-like structures emerge that encode the bending, warping, and deformation of the entropic landscape. The metric itself, the fundamental object of Riemannian and pseudo-Riemannian geometry, is constructed from the entropic field and its derivatives, making it a derived object rather than a primitive one.

This construction has deep connections to the mathematics of information geometry, where the Fisher information metric provides a natural Riemannian structure on the space of probability distributions. In the Theory of Entropicity, the entropic field plays a role

analogous to the log-likelihood function in information geometry, and the emergent metric on the entropic manifold inherits the geometric properties of the Fisher-Rao construction.

In the Theory of Entropicity (ToE), the Amari-Čencov α -connections do not directly transform informational divergence into physical spacetime curvature. Rather, they define the pre-geometric differential structure of the entropic manifold. Once the entropic field is promoted to a dynamical field with an action, this information-geometric structure becomes the substrate from which physical curvature emerges.

These connections will be developed in full mathematical detail in subsequent Letters, drawing on the Amari-Čencov alpha-connection formalism and its generalizations.

From the emergent metric, further geometric structures follow. Geodesics, the curves of extremal length that serve as the trajectories of freely falling objects in General Relativity, are reinterpreted as entropic flow lines, the paths along which the entropic field evolves most efficiently. Curvature, the local measure of geometric deformation, is identified with the second-order structure of the entropic field. Causal order, the distinction between past and future, is grounded in the irreversible character of entropic dynamics, a feature that is fundamental rather than emergent in this framework. The entropic manifold, initially devoid of geometry, acquires the full richness of a pseudo-Riemannian spacetime through the action of the entropic field upon it.

In this framework, the familiar light cone of Einsteinian relativity emerges as a special case of a deeper and more primitive structure: the **entropic cone**. The entropic cone is defined not by the propagation of light in a pre-existing spacetime, but by the permissible directions of entropic flow on the entropic manifold. Its boundary marks the limit of reversible variation, while its interior contains all trajectories along which the entropic field can evolve irreversibly toward higher entropy. What relativity interprets as the causal structure of spacetime is, in the Theory of Entropicity (ToE), the macroscopic shadow of this entropic ordering. The speed of light appears not as a fundamental constant but as the emergent slope of the entropic cone in the geometric limit. Thus, the light cone is the

geometric projection of a more fundamental entropic constraint, and causal structure is the large-scale expression of the entropic field's intrinsic irreversibility.

The road to these non-trivial conclusions is tortuous; but we are getting too far ahead of our journey because of the beauty of the landscape before us, so we must restrain this speed and reserve the fuller exposition for its proper place further afield.

6. The Obidi Action and Variational Architecture

Every fundamental theory of physics rests upon a variational principle: a mathematical statement that the physical laws governing the behavior of fields, particles, and geometry can be derived by requiring that a certain functional, the action, be stationary under small variations of the dynamical variables. In classical mechanics, this is Hamilton's principle. In General Relativity, it is the Einstein-Hilbert action. In quantum field theory, the action functional encodes the dynamics of all fundamental fields through the path integral formalism.

The Theory of Entropicity is no exception to this tradition. Its dynamics are governed by a variational principle centered on the Obidi Action, a functional of the entropic field and its derivatives, defined over the entropic manifold. The Obidi Action encodes the complete dynamical content of the theory: the evolution of the entropic field, the emergence of geometry, the behavior of matter and energy, and the global consistency constraints that ensure the coherence of the entropic manifold as a whole.

Conceptually, the Obidi Action is constructed from an entropic Lagrangian density, a local function of the entropic field value, its gradients, and its higher-order derivatives at each point of the manifold. This Lagrangian density captures the local cost of entropic variation: how the entropic field's behavior at each point contributes to the total dynamical content of the manifold. The principle of stationary action then dictates that the physical configurations of the entropic field are those for which the total Obidi Action, integrated over the entire manifold, is stationary with respect to infinitesimal variations of the field.

The resulting field equations, to be derived explicitly in Letter II, govern the local dynamics of the entropic field and provide the entropic analogues of the Einstein field equations, the Euler-Lagrange equations, and the equations of motion for matter and radiation.

A distinctive feature of the Obidi Action is its dual formulation. The Local Obidi Action governs the differential, point-by-point dynamics of the entropic field. It determines how the field evolves locally in response to its own gradients, curvature, and boundary conditions. The Spectral Obidi Action, by contrast, governs the global, spectral, and non-local consistency constraints of the theory. It ensures that the local dynamics of the entropic field are compatible with the large-scale topological and spectral properties of the manifold, including its connectedness, its spectral gaps, and its asymptotic behavior. This duality between local and spectral formulations is a novel structural feature of the Theory of Entropicity, without direct precedent in conventional variational principles. It ensures that the theory is self-consistent at every scale, from the infinitesimal neighborhood of a single point to the global topology of the entire entropic manifold.

The connection to established variational traditions is deliberate and precise. The Obidi Action generalizes the classical action principles of physics by replacing the spacetime manifold with the entropic manifold and the metric and matter fields with the entropic field. The resulting variational calculus inherits the mathematical rigor of the Euler-Lagrange formalism while introducing fundamentally new entropic content. The Obidi Action is not a modification of the Einstein-Hilbert action or the standard model action; it is a new functional defined on a new domain, encoding a new ontology.

7. Emergent Geometry, Gravity, and Dynamics

The most consequential implication of the Theory of Entropicity is the emergence of geometry, gravity, and physical dynamics from the behavior of the entropic field. In this framework, none of these structures are fundamental. Each arises as a macroscopic or mesoscopic manifestation of the underlying entropic substrate.

Geometry, in the sense of Riemannian or pseudo-Riemannian structure on a manifold, emerges from the entropic field through the mechanism described in the preceding sections. Distances arise from entropic gradients. Curvature arises from the second-order behavior of the entropic field. Geodesics, the straightest possible paths through a curved space, are identified with the flow lines of the entropic field, the trajectories along which the field evolves toward equilibrium with maximal efficiency. Causal order, the distinction between timelike, spacelike, and lightlike separations, is generated by the irreversible character of entropic dynamics. In conventional General Relativity, these geometric structures are primitives of the theory, postulated from the outset and determined by the Einstein field equations. In the Theory of Entropicity, they are consequences, derived from a more fundamental layer of physical reality.

Gravity, in this framework, is not a fundamental force. It is not even a fundamental geometric phenomenon, as it is in General Relativity. Gravity is an emergent statistical tendency arising from the entropic field's dynamics. Just as the second law of thermodynamics drives macroscopic systems toward states of higher entropy, the dynamics of the entropic field drive the entropic manifold toward configurations that maximize the total entropic content. This tendency, when expressed in the emergent geometric language of spacetime and curvature, manifests as gravitational attraction. The apparent universality and geometric character of gravity are explained not by postulating that gravity is geometric but by recognizing that both gravity and geometry are emergent from the same entropic substrate.

Matter receives a striking reinterpretation within the Theory of Entropicity. Rather than being composed of fundamental particles or quantum field excitations defined on a pre-existing spacetime, matter is reconceived as frozen entropy: stable, localized regions of entropic condensation in which the entropic field forms persistent, self-sustaining configurations. These configurations correspond to local minima or saddle points of the entropic Lagrangian density, structures that resist dissolution because they represent dynamically stable patterns of entropic variation. The mass, charge, spin, and other

quantum numbers of particles are, in this view, labels for the topological and geometric properties of these entropic condensates. The distinction between matter and radiation corresponds to the distinction between localized, stable entropic configurations and propagating, wavelike disturbances of the entropic field.

Motion, the displacement of objects through space over time, acquires a new ontological status. In the Theory of Entropicity, motion occurs when the entropic field reconfigures its gradients in response to local and global entropic pressures. An object moves because the entropic landscape around it is not in equilibrium, and the field evolves toward a new configuration that alters the position and trajectory of the entropic condensate. This replaces the Newtonian concept of force as the cause of acceleration and the relativistic concept of geodesic motion as the natural trajectory through curved spacetime.

The arrow of time, one of the deepest puzzles in modern physics, receives a natural resolution within this framework. In conventional physics, the fundamental laws are time-symmetric: they permit evolution in both temporal directions with equal validity. The observed asymmetry between past and future, the arrow of time, must then be explained by special initial conditions, typically a low-entropy initial state of the universe. In the Theory of Entropicity, time asymmetry is not accidental or contingent. It is built into the irreversible dynamics of the entropic field at the most fundamental level. The entropic field evolves in one direction, toward configurations of greater entropy, and this directional evolution is the origin of temporal asymmetry. The arrow of time is not emergent from statistical considerations imposed on time-symmetric laws; it is fundamental, encoded in the very structure of entropic dynamics.

Forces, interactions, and conservation laws, the foundational elements of conventional physics, are similarly reinterpreted. Forces arise from entropic gradients. Interactions correspond to the coupling of different modes or configurations of the entropic field. Conservation laws reflect the symmetries of the Obidi Action through an entropic analogue of Noether's theorem. The full apparatus of classical and quantum physics is recovered, not

as a set of independent postulates, but as a coherent system of consequences flowing from a single entropic principle.

7.1. Thanu Padmanabhan's CosmIn and the Pre-Geometric Paradigm: Context and Extension within the Theory of Entropicity (ToE)

A significant precursor to the Theory of Entropicity (ToE) is the work of the great Indian physicist, Thanu Padmanabhan, who argued that the classical geometric universe described by Einstein's equations must emerge from a deeper, pre-geometric phase. In this paradigm, spacetime is not fundamental but the macroscopic expression of a more primitive informational substrate. Padmanabhan introduced the concept of **Cosmic Information (CosmIn)**, a conserved quantity that measures the total information transferred from the quantum-gravitational, pre-geometric phase to the classical geometric phase of the universe.

CosmIn provides a bridge between two regimes:

- (1) a primordial phase where geometry, distance, and time have no meaning, and
- (2) the emergent Einsteinian phase where these concepts acquire operational significance.

Remarkably, Padmanabhan showed that CosmIn takes the value 4π , corresponding to the number of information "bits" on the surface of a unit sphere, and that this conserved quantity determines the observed value of the cosmological constant. This was the first model with no adjustable parameters to relate the cosmological constant to the quantum-to-classical transition of the universe.

The Theory of Entropicity (ToE) extends and deepens this pre-geometric paradigm. Where Padmanabhan identifies information as the bridge between pre-geometry and geometry, ToE identifies **entropy as the ontological substrate** from which information itself arises. In this framework, information geometry—embodied in the Fisher–Rao metric, the Fubini–

Study metric, and the Amari–Čencov α -connections—constitutes the **pre-geometric differential structure** of the entropic manifold. These structures do not, by themselves, generate physical curvature; rather, they define the intrinsic geometry of entropy. Once the entropic field is promoted to a dynamical field through the Obidi Action, this information-geometric structure becomes the substrate from which physical curvature emerges.

Thus, ToE may be viewed as a natural continuation of Padmanabhan’s insight. Padmanabhan demonstrated that geometry must emerge from a deeper informational phase; ToE identifies the entropic field as the source of that information, constructs a variational principle for its dynamics, and derives the emergent geometric phase as a consequence of entropic curvature. In this sense, Padmanabhan opened the conceptual door to pre-geometry, and the Theory of Entropicity provides the full ontological and dynamical framework that completes the transition from entropy to information, from information to geometry, and from geometry to the physical universe.

Padmanabhan: information \rightarrow geometry

Obidi: entropy \rightarrow information \rightarrow information geometry \rightarrow entropic action \rightarrow geometry

Padmanabhan stops at the informational bridge. Obidi builds the entire entropic manifold, action, and field equations on top of it.

7.2 Quantized Pre-Geometric Invariants:

Padmanabhan’s CosmIn (4π) and the Obidi Curvature Invariant (OCI) of Ln 2

One of the most striking conceptual resonances between the Theory of Entropicity (ToE) and contemporary approaches to emergent gravity arises from the work of Thanu Padmanabhan. In his “Cosmic Information” (CosmIn) program, Padmanabhan argued that

the universe underwent a transition from a primordial, pre-geometric phase to the classical geometric phase described by Einstein's equations. This transition, he proposed, is governed by a **conserved informational invariant** that measures the total information transferred from the quantum-gravitational regime to the classical spacetime regime. Remarkably, Padmanabhan showed that this invariant takes the value 4π , corresponding to the number of information "bits" on the surface of a unit sphere. This conserved quantity determines the observed value of the cosmological constant and provides a parameter-free explanation of the quantum-to-classical transition of the universe.

The Theory of Entropicity (ToE) identifies a structurally analogous invariant: the **Obidi Curvature Invariant (OCI)**. OCI represents the **minimum entropic curvature required for physical distinguishability**, the smallest possible "pixel" of entropic geometry. It is the quantized threshold that separates the undifferentiated pre-geometric entropic manifold from the emergent geometric structures that constitute spacetime. Just as Padmanabhan's CosmIn encodes the total information transferred during the universe's transition to classicality, OCI encodes the **local entropic curvature** required for any physical distinction to arise. CosmIn is global; OCI is local. CosmIn governs the universe-scale transition; OCI governs the pointwise emergence of curvature.

The conceptual connection is clear: **both CosmIn and OCI are quantized, conserved pre-geometric invariants that govern the emergence of spacetime from a deeper substrate**. Padmanabhan's invariant measures the total informational content required for the universe to become classical. Obidi's invariant measures the minimum entropic curvature required for any region of the manifold to become geometrically meaningful. Both assert that geometry is not fundamental but emerges from a pre-geometric phase governed by a discrete informational or entropic seed.

Where Padmanabhan identifies information as the bridge between pre-geometry and geometry, ToE identifies **entropy as the ontological substrate** from which information itself arises. In this framework, information geometry is the geometry of entropy, and the

Obidi Action promotes this geometry into a dynamical field theory. Once the entropic field becomes dynamical, its curvature becomes physical, and the Obidi Curvature Invariant becomes the seed of emergent spacetime curvature. Thus, Padmanabhan's CosmIn and Obidi's OCI stand in conceptual resonance: both reveal that the universe is built not from geometry downward but from **quantized pre-geometric invariants upward**.

- **Padmanabhan discovered the global informational invariant of the universe.**
- **Obidi discovered the local entropic curvature invariant underlying it.**

In other words:

- **Padmanabhan found the total number of bits needed for the universe to become classical.**
- **Obidi found the entropic cost of one bit.**

This is the **global-local duality** of pre-geometric invariants.

For Padmanabhan, 4π counts global bits on a unit sphere. And for Obidi, $\ln 2$ is the entropic cost of one bit

Now, this is the **Shannon-Boltzmann bridge**:

Shannon established the conversion factor ($\text{bits} \times \ln 2 = \text{nats}$), Boltzmann established that physical entropy is measured in nats.

- *bits* → informational units
- *$\ln 2$* → entropic units

Hence:

$$4\pi \text{ bits} \leftrightarrow 4\pi \ln 2 \text{ entropic curvature units}$$

So, the **conversion factor between Padmanabhan and Obidi is simply:**

$$(\text{information bits}) \times \ln 2 = (\text{entropic curvature})$$

Padmanabhan's invariant is expressed in **bits**. Obidi's invariant is expressed in **entropy**.

The conversion is canonical and universal.

Thus, Padmanabhan opened the door by showing that a conserved informational invariant governs the emergence of classical spacetime. The Theory of Entropicity walks through that door and constructs the full entropic field theory on the other side, identifying the entropic curvature invariant as the fundamental unit of pre-geometric structure. Together, CosmIn and OCI illuminate a profound truth: the universe is not fundamentally geometric but fundamentally **entropic-informational**, and geometry is the large-scale structure of quantized pre-geometric invariants.

7.3 The Physical Significance of the $4\pi \leftrightarrow \ln 2$ Conversion: A Deeper Analysis of Pre-Geometric Quantization

Padmanabhan's global invariant ($\text{CosmIn} = 4\pi$) and the Obidi Curvature Invariant ($\text{OCI} = \ln 2$) are structurally related through the Shannon–Boltzmann correspondence, but the deeper physical meaning of this relation lies in the quantization of pre-geometric structure. The appearance of 4π and $\ln 2$ is not numerology; it reflects two independent quantization mechanisms that converge when geometry emerges from a pre-geometric substrate.

The factor 4π arises from the topology of the two-sphere, the unique compact surface that encodes the causal structure of a point in any Lorentzian manifold. In Padmanabhan's framework, the unit sphere represents the minimal holographic screen capable of encoding the information required to define a classical spacetime region. The value 4π therefore reflects a **topological quantization**: the smallest closed surface that can support a well-defined causal domain carries exactly 4π informational units. This is a global constraint imposed by the topology of the emergent spacetime.

The factor $\ln 2$, by contrast, arises from the quantization of distinguishability. In the Theory of Entropicity (ToE), the entropic field is the ontological substrate, and distinguishability is not free: it requires a minimum entropic curvature. The smallest such curvature corresponds to the entropic cost of producing one bit of information, which is $\ln 2$ in

natural units. This is a **local quantization**: the smallest entropic deformation that can produce a meaningful physical distinction. OCI therefore reflects the discrete structure of the entropic manifold itself.

The conversion factor between these two invariants,

$$4\pi \rightarrow 4\pi \ln 2,$$

is the bridge between **topological quantization** (global) and **entropic quantization** (local). It implies that the emergence of spacetime requires not only a global informational threshold but also a local entropic curvature threshold. Geometry appears only when both conditions are satisfied: the universe must possess enough global informational capacity (4π), and each unit of information must carry a minimum entropic curvature cost ($\ln 2$).

This dual quantization has several consequences. First, it implies that the cosmological constant is fixed by the interplay between global topology and local entropic curvature, rather than by arbitrary parameters. Second, it suggests that curvature is fundamentally discrete, with $\ln 2$ representing the smallest curvature quantum. Third, it reveals that the emergence of spacetime is governed by a **two-tiered quantization structure**: topology determines how much information must be transferred, while entropy determines the cost of transferring it.

In this view, Padmanabhan's 4π and Obidi's $\ln 2$ are not independent curiosities but complementary aspects of a single pre-geometric quantization principle. The universe becomes geometric only when the global informational content of a causal domain (4π bits) is matched by the local entropic curvature cost required to instantiate those bits ($\ln 2$ per bit). Their product defines the total entropic curvature budget necessary for the emergence of classical spacetime. This reveals a profound unity between topology, information, and entropy at the foundations of physics.

7.4 The Obidi–Padmanabhan Conversion (OPC): A Quantized Relation Between Global Information and Local Entropic Curvature

A deeper structural insight emerges when Padmanabhan’s Cosmic Information invariant (CosmIn) is placed alongside the Obidi Curvature Invariant (OCI) of the Theory of Entropicity. Although derived from different conceptual frameworks, the two invariants are connected by a precise conversion law that links global informational content to local entropic curvature. This relation, which we term the **Obidi–Padmanabhan Conversion**, reveals the quantized mechanism by which pre-geometric structure becomes classical spacetime.

Padmanabhan’s CosmIn identifies the total informational content required for the universe to transition from a pre-geometric quantum phase to the classical geometric phase described by Einstein’s equations. The value of this invariant is 4π , corresponding to the number of informational degrees of freedom (“bits”) on the surface of a unit sphere. This global informational threshold determines the cosmological constant and sets the scale at which geometry becomes meaningful.

The Theory of Entropicity identifies a complementary invariant at the local scale: the **Obidi Curvature Invariant (OCI)**. OCI represents the minimum entropic curvature required for any physical distinction to exist. In ToE, distinguishability is not free; it requires a quantized entropic expenditure. The smallest such expenditure is $\ln 2$, the entropic cost associated with producing one bit of distinguishability. OCI therefore defines the smallest curvature quantum of the entropic manifold.

We thus see a **precise, quantized, pre-geometric conversion law** between:

- **Padmanabhan’s global informational invariant**

$$\text{CosmIn} = 4\pi \text{ bits}$$

and

- **Obidi's local entropic curvature invariant**

$$\text{OCI} = \ln 2 \text{ entropic units}$$

linked through the **Shannon–Boltzmann correspondence**.

The conversion between these two invariants follows from the Shannon–Boltzmann correspondence:

$$1 \text{ bit} = \ln 2 \text{ entropic units.}$$

Applying this to Padmanabhan's global invariant yields:

$$4\pi \text{ bits} \leftrightarrow 4\pi \ln 2 \text{ entropic curvature units.}$$

This is the **Obidi–Padmanabhan Conversion (OPC)**: a quantized mapping between the global informational requirement for the emergence of spacetime and the local entropic curvature cost of producing that information.

The physical significance of this conversion is profound. It implies that the emergence of classical spacetime is governed by a **two-tiered quantization structure**:

1. **Global topological quantization** — the unit sphere contributes 4π informational degrees of freedom.
2. **Local entropic quantization** — each degree of freedom requires $\ln 2$ units of entropic curvature to become physically distinguishable.

Geometry emerges only when both quantization conditions are satisfied. The cosmological constant is fixed by the interplay between these global and local invariants. The curvature of spacetime is not continuous but built from discrete entropic curvature quanta. And the universe's transition from pre-geometry to geometry is governed by a conserved informational–entropic budget.

The **Obidi–Padmanabhan Conversion (OPC)** therefore unifies two independent insights into a single structural principle: **the universe is not fundamentally geometric but fundamentally entropic-informational, and geometry is the macroscopic expression of quantized pre-geometric invariants.**

8. Ontodynamics: Existence as Entropic Motion and Entropic Negotiation

The Theory of Entropicity demands a new philosophical language to accompany its new physical content. The term ontodynamics is introduced to name the philosophical and physical framework that studies how existence, phenomena, interactions, measurements, and observations evolve through entropic dynamics. Ontodynamics is the study of being in entropic motion and entropic negotiation, where the motion in question is not only displacement through spacetime [as we know it] but also the evolution of the entropic field across its manifold.

In the ontodynamic framework, the universe is described as an entropic manifold whose structure and evolution arise entirely from gradient-driven dynamics. Every phenomenon, from the formation of galaxies to the decay of a radioactive nucleus, from the entanglement of quantum particles to the expansion of the cosmic horizon, is an expression of the entropic field's tendency to evolve toward configurations of higher entropy. The universe does not merely contain entropy; the universe is entropy, structured, dynamical, and self-organizing.

This perspective reframes the entire enterprise of physics. Rather than studying forces, interactions, and symmetries as the fundamental building blocks of nature, ontodynamics studies entropic dynamics as the single underlying process from which all physical phenomena emerge. The distinction between different branches of physics, mechanics, electrodynamics, thermodynamics, quantum theory, becomes a distinction between

different regimes or limiting cases of the entropic field's behavior, not a distinction between fundamentally different kinds of phenomena.

Information, one of the most important concepts in contemporary physics, acquires a precise ontological status within ontodynamics. Information is not an abstract or epistemic quantity but a derived geometric property of the entropic field. The information content of a region of the entropic manifold is determined by the geometric structure of the entropic field within that region, specifically by its curvature, its gradients, and its topological properties. This connection between information and geometry has been anticipated by developments in black hole physics, holography, and the study of quantum entanglement, but the Theory of Entropicity provides the explicit mechanism by which information is encoded in the geometry of a fundamental field.

Quantum entanglement, often regarded as one of the most mysterious features of quantum mechanics, is reinterpreted within ontodynamics as a manifestation of entropic connectivity. Two regions of the entropic manifold that are entangled share a non-local entropic correlation, a structural feature of the field that persists regardless of the geometric distance between the regions in the emergent spacetime. This interpretation resonates with recent proposals in the emergent spacetime literature, notably the conjecture that entanglement and spatial connectivity are related through holographic duality, but it grounds this relationship in the concrete structure of the entropic field rather than in conjectural holographic correspondences.

The entropic manifold, in the ontodynamic framework, is not a passive stage upon which events unfold. It is an active participant in the dynamics of the universe. The field shapes the manifold, and the manifold constrains the field. This mutual determination between the entropic field and its manifold is the entropic analogue of the relationship between matter and geometry in General Relativity, but it operates at a deeper level: not between two independent entities (matter and spacetime) but between two aspects of a single entity (the entropic field and the manifold it generates).

9. The Broader Philosophical Implications of the Theory of Entropicity (ToE)

The Theory of Entropicity (ToE) does more than propose a new foundation for physics; it demands a re-examination of the deepest philosophical assumptions that have guided scientific thought for centuries. By elevating entropy to ontological primacy, the theory challenges inherited distinctions between substance and process, matter and information, observer and observed, and even between being and becoming. It invites a shift from a worldview built upon static entities and fixed structures to one grounded in dynamical flow, informational density, and irreversible evolution. In this sense, the Theory of Entropicity is not merely a physical theory but a philosophical reorientation: a new metaphysics of motion, structure, and existence.

At the heart of this reorientation lies the recognition that the universe is not a collection of things but a continuous entropic process [which vehemently aligns with and re-echoes earlier insights and convictions of *Ilya Prigogine, From Being to Becoming* (1980) and *Hermann Weyl, Space-Time-Matter* (1922)]. The entropic field, the sole primitive of the theory, is not a passive background or a descriptive tool but the active substance of reality itself. Everything that exists—geometry, matter, energy, information, causality—arises from the gradients, curvature, and higher-order behavior of this field. This perspective dissolves the classical distinction between ontology and dynamics: to exist is to participate in entropic evolution. Being is inseparable from becoming. The universe is not a static architecture populated by moving parts; it is a self-organizing entropic flow whose structures are temporary condensations of a deeper dynamical substrate.

This shift has profound implications for the philosophy of time. In conventional physics, time is either an external parameter (as in Newtonian mechanics) or a geometric dimension (as in General Relativity). In both cases, the arrow of time is an emergent or contingent feature, imposed upon fundamentally time-symmetric laws. The Theory of Entropicity (ToE) reverses this hierarchy. Time is not a container or a coordinate but the internal

bookkeeping of entropic evolution. The past is the region of the entropic manifold already traversed by irreversible flow; the future is the region not yet entropically accessible; and the present is the moving boundary where the entropic field actively reconfigures itself. Temporal asymmetry is not an accident of initial conditions but a fundamental property of the entropic substrate. The universe does not evolve in time; time evolves in the universe.

The dethronement of the observer follows naturally from this entropic conception of time and causality. In many interpretations of quantum mechanics and relativity, the observer plays a privileged role in defining measurement outcomes, reference frames, or informational content. The Theory of Entropicity rejects this epistemic centrality. The observer is not a special agent whose perceptions shape reality but an entropic configuration embedded within the manifold, subject to the same irreversible dynamics as every other structure. Observation is not a collapse, a choice, or a frame; it is an entropic interaction between two regions of the manifold. The universe does not require an observer to define its state; the entropic field defines its own state through its intrinsic dynamics.

The entropic field also reframes the classical variational principles that have guided physics since the eighteenth century. Maupertuis' principle of least action, which asserts that physical systems follow the path that extremizes the action, is revealed as a geometric approximation to a deeper entropic law. In the Theory of Entropicity, the true dynamical principle is that the entropic field evolves along trajectories that maximize entropic efficiency—paths that most effectively increase the total entropic content of the manifold. The classical action is thus an emergent surrogate for the entropic Lagrangian density, valid only in the geometric limit where spacetime has already emerged. The entropic path is not the path of least action but the path of greatest entropic ascent. This reinterpretation unifies mechanics, thermodynamics, and information theory under a single ontodynamic principle.

The entropic cone, introduced earlier as the deeper structure underlying Einstein's light cone, further illuminates the philosophical implications of the theory. In relativity, the light

cone defines the causal structure of spacetime by constraining the propagation of signals to the speed of light. In the Theory of Entropicity, this geometric structure is the macroscopic projection of a more fundamental entropic ordering. The entropic cone defines the permissible directions of entropic flow on the manifold, with its boundary marking the limit of reversible variation and its interior containing all trajectories of irreversible evolution. The speed of light emerges as the slope of this cone in the geometric limit, not as a fundamental constant but as a derived property of entropic dynamics. Causality is thus not a geometric primitive but an entropic constraint, and the structure of spacetime is the large-scale expression of the entropic field's intrinsic irreversibility.

Taken together, these insights reveal the Theory of Entropicity as a unifying philosophical framework that dissolves long-standing dualisms: between matter and information, geometry and dynamics, observer and observed, past and future, being and becoming. It offers a vision of the universe as a single entropic process whose structures, laws, and symmetries arise from the behavior of a fundamental ontological field. This vision is not merely a reinterpretation of existing physics but a proposal for a new foundation upon which the edifice of physical theory may be rebuilt. The Theory of Entropicity thus stands not only as a scientific hypothesis but as a philosophical invitation: to rethink the nature of reality from the ground up, beginning not with spacetime or matter or quantum states, but with entropy itself.

9.1 Ontodynamics, Entropology, and Entrodynamics in the Theory of Entropicity (ToE)

The Theory of Entropicity does not merely propose a new physical ontology; it establishes a new philosophical architecture grounded in the primacy of the entropic field. This architecture is organized around three mutually reinforcing pillars—**Ontodynamics**, **Entropology**, and **Entrodynamics**—each addressing a different dimension of reality: what exists, how systems know, and how the universe evolves. Together, they constitute a

unified metaphysics, epistemology, and dynamics built upon the irreducible structure of entropy.

9.1.1 Ontodynamics: What Exists (Entropic Gradients)

Ontodynamics is the metaphysical branch of the Theory of Entropicity. It asserts that **existence is the persistence of entropic gradients** within finite boundaries. In this view, the universe is not composed of particles, fields, or spacetime manifolds as primitive entities. Instead, it is composed of **entropic curvature**, the local and global structure of the entropic field.

Where classical physics begins with geometry and populates it with matter, Ontodynamics begins with **entropic variation**, from which geometry, matter, and even time emerge. Being is not a static property but a dynamic condition: a region of the entropic manifold maintains its identity only insofar as its entropic gradients remain stable. Becoming is the irreversible redistribution of entropy across the manifold.

Ontodynamics thus reframes ontology in entropic terms:

- **Being** → stable entropic gradients
- **Structure** → persistent entropic curvature
- **Identity** → entropic distinguishability
- **Existence** → entropic persistence over finite intervals

In this framework, the universe is not a collection of things but a continuous entropic process.

9.1.2 Entropology: How Systems Know (Entropic Negotiation)

Entropology replaces traditional [philosophical] epistemology. It studies **how systems register, negotiate, and stabilize information** through entropic interaction. Knowing is not a mental abstraction but a physical process: the stabilization of entropic gradients into persistent informational structures.

In Entropology:

- **Perception** is the entropic stabilization of incoming gradients.
- **Measurement** is the irreversible entropic coupling between subsystems.
- **Knowledge** is accumulated entropic structure.
- **Consciousness** is a high-entropy subsystem capable of synchronizing with the global entropic field.

This dethrones the observer from the privileged position often assigned in quantum mechanics. Observation does not collapse a wavefunction; it is an entropic interaction between two regions of the manifold. The universe does not require a conscious observer to define its state; the entropic field defines its own state through its intrinsic dynamics.

Entropology thus provides a physical account of knowing: **to know is to negotiate entropy**.

9.1.3 Entrodynamics: How Reality Evolves (Finite-Rate Entropic Propagation)

Entrodynamics is the dynamical branch of the Theory of Entropicity. It studies how the entropic field evolves and how its evolution gives rise to physical laws. The central insight is that **all evolution occurs at a finite entropic rate**. No process can occur instantaneously; no distinction can stabilize without entropic maturation.

This is formalized in the **No-Rush Theorem (NRT)**:

- no physical process can evolve faster than the entropic propagation limit
- no classical outcome can stabilize without irreversible entropic flow
- no measurement can occur without entropic dissipation

This theorem provides the thermodynamic foundation for the universal speed limit c . Light is reinterpreted as the **maximum rate at which the entropic field can reorganize information**. Time emerges as the internal bookkeeping of this irreversible reorganization. Thus, ToE teaches us that reality “cannot be rushed” because distinguishability requires **entropic maturation**. This is the basis of the ToE assertion: **“God or Nature Cannot Be Rushed” (G/NCBR)**.

Entrodynamics also governs:

- the emergence of spacetime from entropic curvature
- the stabilization of classicality
- the irreversibility of measurement
- the admissibility of physical laws

The **No-Go Theorem (NGT)** *states that any proposed physical law that cannot coexist with the entropic field collapses into contradiction. Reversibility becomes incompatible with distinguishability.* The entropic field is thus the ultimate arbiter of physical possibility and admissibility.

9.2 The Obidi Curvature Invariant and the Minimum Difference Principle

A central structural insight of the Theory of Entropicity is the **Minimum Difference Principle**, which asserts that **physical distinction is not free**. To distinguish one

configuration from another requires entropic curvature. This principle introduces a quantized threshold of distinguishability: the **Obidi Curvature Invariant (OCI)**.

9.2.1 The Obidi Curvature Invariant (OCI)

The OCI represents the **minimum entropic curvature required for two configurations to be physically distinguishable**. It is the smallest “pixel” of reality, the irreducible unit of entropic differentiation. In the Theory of Entropicity, this invariant plays the role that Planck’s constant plays in quantum mechanics: it sets the scale at which distinctions become meaningful.

The OCI ensures that:

- no physical distinction can occur below a minimum entropic threshold
- no measurement can resolve differences smaller than this threshold
- no classical structure can stabilize without exceeding this curvature

This invariant is deeply connected to the entropic manifold’s geometry. It defines the smallest non-zero curvature that the entropic field can sustain, and thus the smallest unit of emergent spacetime structure.

9.2.2 The Minimum Difference Principle

The Minimum Difference Principle states that **distinguishability costs curvature**. To separate two states, the entropic field must invest curvature equal to or greater than the OCI. This principle governs:

- the emergence of particles as stable entropic condensates
- the quantization of informational structure
- the stability of classical outcomes

- the irreversibility of measurement

It also explains why the universe cannot evolve arbitrarily fast: distinguishability requires curvature, and curvature requires time.

9.2.3 The No-Rush Theorem and the Entropic Speed Limit

The No-Rush Theorem (NRT) follows directly from the OCI. If distinguishability requires curvature, and curvature propagates at a finite rate, then **no process can outrun the propagation of entropic curvature**. This yields a thermodynamic explanation for the speed of light:

- *c* is the maximum rate at which the entropic field can reorganize curvature
- light is the fastest possible entropic reconfiguration
- causality is the macroscopic shadow of finite-rate entropic propagation

Thus, the entropic cone is the deeper structure beneath the Einsteinian light cone.

9.2.4 A Unified Philosophical System in the Theory of Entropicity(ToE)

Taken together, **Ontodynamics**, **Entropology**, **Entrodynamics**, and the **Obidi Curvature Invariant** form a unified philosophical and physical system:

- **Ontodynamics** → what exists (entropic gradients)
- **Entropology** → how systems know (entropic negotiation)
- **Entrodynamics** → how reality evolves (finite-rate entropic propagation)
- **OCI** → the minimum curvature required for distinguishability

This system reframes the universe as a **self-organizing entropic continuum** that maximizes flow, minimizes constraint, and evolves toward greater distinguishability. **Humans are temporary but meaningful participants in this entropic evolution, not external observers but embedded configurations of the same entropic field.**

The Theory of Entropicity (ToE) *thus offers not only a new physics but a new philosophy:*

a monistic, entropic worldview in which existence, knowledge, and evolution are unified by the dynamics of a single fundamental field [of entropic negotiation].

10. The Great Leap of Obidi: From Information Geometry to a Dynamical Entropic Theory of Fields

A central achievement of the Theory of Entropicity (ToE) is the recognition that information-geometric structures—long regarded as mathematically elegant but physically peripheral—are not merely suggestive analogies to spacetime geometry but the very substrate from which spacetime emerges. Yet the decisive step in this development is not the identification of the Fisher–Rao metric, the Fubini–Study metric, or the Amari–Čencov α -connections as physically meaningful. Many researchers have speculated that information geometry “resembles” physical geometry or that statistical manifolds “look like” curved spaces. Such observations, while insightful, remain descriptive. They do not constitute physics.

The great leap of Obidi lies in transforming these geometric correspondences into a **dynamical theory**. The Theory of Entropicity (ToE) does not merely assert that information-geometric structures are physical; it **promotes them into an action principle** and derives **field equations** from them. This is the moment where mathematics becomes physics. It is the structural move that elevates the entropic manifold from a conceptual analogy to a genuine physical ontology; for if **entropy is the fundamental field, and information geometry is the natural geometry of entropy, then the**

structures of information geometry become the *pre-geometric precursors* of physical curvature once the entropic field is promoted to a dynamical field with an **action**. This is precisely what the Theory of Entropicity (ToE) has done. In other words, ToE compels us to agree that if entropy is the fundamental field, then the geometry of entropy is the geometry of reality, and [physical] spacetime curvature is the macroscopic expression of entropic curvature.

The first step in this transformation is the promotion of entropy from a derived statistical quantity to a **fundamental field**. In the Theory of Entropicity, entropy is not a measure of ignorance, disorder, or multiplicity; it is the primitive dynamical variable defined at every point of the entropic manifold. This alone is a radical inversion of the conventional hierarchy of physics. But the second step is even more consequential: the entropic field is declared to be **identical** to the information-geometric structure of the manifold. The Fisher–Rao and Fubini–Study metrics are not approximations or analogues of physical geometry; they are the emergent geometric expressions of the entropic field itself. The Amari–Čencov α -connections are not mathematical curiosities; they are the structural degrees of freedom through which the entropic manifold transitions between quantum and classical regimes.

The third and decisive step is the construction of an **entropic action** from the curvature and higher-order structure of this field. This is the step no previous program in information geometry or emergent gravity has taken. By writing an action for the entropic field, Obidi transforms information geometry into a **variational theory**. Once an action exists, the entropic field becomes a dynamical object governed by stationary-action principles. And once the action is varied, the resulting field equations define the local and global behavior of the entropic manifold. This is the same structural move that transformed Riemannian geometry into general relativity, gauge symmetry into Yang–Mills theory, and spinor algebra into quantum field theory. Geometry becomes physics only when it becomes an action.

From this action, the Theory of Entropicity derives **field equations** for the entropic field. These equations encode the dynamics, constraints, conservation laws, and emergent structures of the theory. They determine how the entropic field evolves, how geometry arises from its gradients and curvature, how matter appears as stable entropic condensates, and how gravitational behavior emerges as the macroscopic expression of entropic flow. The entropic field equations thus play the role that the Einstein field equations play in general relativity, but they arise from a deeper substrate and govern a richer dynamical structure.

This is why the Theory of Entropicity is not merely another contribution to information geometry or emergent gravity. Most approaches stop at the observation that “information geometry resembles spacetime geometry.” Obidi goes further: **information geometry is the entropic field, and the entropic field obeys a universal action principle**. This is a structural re-architecture of physics. It replaces the conventional hierarchy—spacetime first, fields second, entropy last—with a new hierarchy in which entropy is primary, geometry is emergent, and physical law is the expression of entropic dynamics.

In this sense, the Theory of Entropicity (ToE) stands in direct lineage with the great conceptual revolutions of theoretical physics. Just as Einstein transformed geometry into a dynamical theory of gravitation, and just as Yang and Mills transformed symmetry into a dynamical theory of interactions, Obidi transforms information geometry into a dynamical theory of entropic evolution. The leap is not the claim that information geometry is physical; the leap is the construction of an action and the derivation of field equations that make it so. This is the transition from analogy to ontology, and from ontology to dynamics. It is the moment where the Theory of Entropicity (ToE) becomes a genuine physical theory.

11. Relation to Existing Programs

The Theory of Entropicity does not arise in a vacuum. It draws on, engages with, and ultimately transcends several established research programs in fundamental physics, each

of which has contributed essential insights into the relationship between entropy, gravity, geometry, and information.

The entropic gravity program, developed in influential works by Jacobson, Verlinde, and Padmanabhan, represents the most direct precursor to the Theory of Entropicity. Jacobson's 1995 derivation of the Einstein equation from thermodynamic considerations on local Rindler horizons demonstrated that gravitational dynamics could be understood as a consequence of entropy and temperature, rather than as a fundamental geometric postulate. Verlinde's 2011 proposal extended this insight by treating gravity as an entropic force, arising from changes in entropy associated with the displacement of matter near holographic screens. Padmanabhan's extensive body of work developed the thermodynamic perspective on gravity into a comprehensive program, revealing deep structural connections between gravitational field equations and the thermodynamics of horizons.

The Theory of Entropicity acknowledges the profound contributions of this program while identifying its fundamental limitation. In all of these approaches, entropy is used as a tool within a pre-existing spacetime framework. The spacetime manifold, the metric, and the causal structure are assumed to exist before the entropic arguments are applied. Entropy explains gravity, but it does not explain spacetime. The Theory of Entropicity removes this limitation by eliminating spacetime as a fundamental entity altogether. In this framework, both gravity and spacetime emerge from the entropic field, and the results of the entropic gravity program are recovered as limiting cases of a more fundamental theory.

The emergent spacetime program, including holographic duality, the anti-de Sitter/conformal field theory correspondence, and conjectures such as the identification of Einstein-Rosen bridges with quantum entanglement, represents another major point of contact. These programs have produced compelling evidence that spacetime connectivity, dimensionality, and geometry may not be fundamental but may emerge from the entanglement structure of quantum states. The Theory of Entropicity shares this

commitment to the emergence of spacetime but provides a concrete field-theoretic mechanism for the emergence process. Rather than relying on holographic correspondences or conjectural identifications, the Theory of Entropicity derives the emergence of geometry from the explicit dynamics of the entropic field through the variational principles encoded in the Obidi Action.

The mathematical framework of information geometry, pioneered by Amari and developed through the Fisher-Rao metric, the Fubini-Study metric, and the theory of alpha-connections, provides an essential mathematical toolkit for the Theory of Entropicity. Information geometry equips spaces of probability distributions with natural Riemannian structures, and these structures play a central role in the construction of the emergent metric on the entropic manifold. The Theory of Entropicity integrates the Amari-Čencov alpha-connection formalism as part of its rigorous mathematical foundation, using these structures to ensure that the emergent geometry of the entropic manifold is well-defined, unique, and physically meaningful. This integration will be developed in full detail in subsequent Letters.

The thermodynamics of black holes, beginning with Bekenstein's 1973 identification of black hole entropy with horizon area and Hawking's 1975 discovery of black hole radiation, has long suggested a deep connection between entropy, gravity, and geometry. The Bekenstein-Hawking entropy formula, which relates the entropy of a black hole to the area of its event horizon, has been interpreted as evidence that the degrees of freedom of quantum gravity are encoded on boundaries rather than in the bulk of spacetime. The Theory of Entropicity offers a different interpretation. In this framework, the entropy associated with a black hole horizon is not a boundary effect but a manifestation of the fundamental entropic field in the region of extreme entropic condensation that constitutes the black hole. The horizon is not a fundamental boundary but an emergent geometric surface arising from the entropic field's structure, and its entropy is a reflection of the field's value and configuration in that region.

The Theory of Entropicity (ToE) is not, therefore, an extension or modification of any existing framework. It is a new foundation, one that absorbs the insights of entropic gravity, emergent spacetime, information geometry, and black hole thermodynamics into a single coherent structure with a single primitive: the entropic field.

12. The Logical Chain Leading to the Creation of the Theory of Entropicity (ToE)

The Theory of Entropicity (ToE) did not arise from a single conceptual leap but from a systematic re-examination of the historical development of entropy, information, and geometry. The path begins with the classical thermodynamic formulations of **Clausius** and **Gibbs**, passes through the statistical and informational generalizations of **Boltzmann**, **Shannon**, and **von Neumann**, and culminates in the generalized entropies of **Rényi** and **Tsallis**. Each stage in this lineage reveals a deeper structural insight: entropy is not merely a thermodynamic quantity but a universal measure of multiplicity, information, and distinguishability. The Theory of Entropicity extends this insight to its natural conclusion: if entropy generates information, and information possesses geometry, and geometry admits a field structure, then entropy itself must be a geometric and dynamical field.

The classical conception of entropy begins with Clausius, who introduced entropy as a state function governing the irreversibility of thermodynamic processes. Gibbs extended this notion to statistical ensembles, revealing entropy as a measure of multiplicity and probability distribution. Boltzmann's famous relation between entropy and microstates provided the first bridge between thermodynamics and statistical mechanics. Yet even in these early formulations, entropy remained a derived quantity—an emergent descriptor of underlying mechanical states. It was Shannon who reframed entropy as a measure of information, independent of thermodynamic context. Shannon's entropy quantified uncertainty, distinguishability, and informational content, and in doing so, revealed that entropy is fundamentally a measure of structure, not merely of heat or disorder.

Von Neumann extended this informational perspective to quantum systems, defining entropy as a property of quantum states and density matrices. Rényi and Tsallis generalized entropy further, demonstrating that the classical Shannon form is only one member of a broader family of entropic measures. **These generalizations showed that entropy is not tied to any particular physical system or statistical interpretation; it is a universal mathematical object capable of describing classical, quantum, and non-extensive systems alike.** Across these developments, a pattern emerges: **entropy is not a secondary descriptor but a primary structural quantity that governs the behavior of systems across scales and domains.**

The next step in the logical chain arises from the recognition that information possesses geometry. **Fisher** introduced the Fisher information metric, revealing that probability distributions form a **Riemannian manifold** whose geometry encodes distinguishability. Rao formalized this insight, and **Amari** and **Čencov** developed it into a full differential-geometric framework, complete with α -connections and dualistic structures. In quantum theory, the **Fubini–Study metric** plays an analogous role, defining the geometry of pure quantum states. **These developments established that information is not merely a numerical quantity but a geometric one: it defines distances, angles, curvature, and geodesics on statistical and quantum manifolds.**

Einstein’s realization that geometry is not a static backdrop but a dynamical field completes the logical chain that underlies Obidi’s formulation. This insight provides the final conceptual bridge: **if information induces geometry, and geometry can carry a field structure, then entropy—the generator of information—must itself admit a geometric and dynamical field description.** In **Einstein’s monumental and beautiful Theory of General Relativity (GR)**, the metric is not a static background but a dynamical field governed by a variational principle. Geometry becomes physics when it is endowed with an action and field equations. If information has geometry, and if geometry can be dynamical, then information geometry must also admit a field-theoretic formulation. **And if entropy generates information, then entropy must have its own geometry and**

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must be the underlying field from which information geometry—and thus spacetime geometry—emerges.

This is the logical foundation of the Theory of Entropicity (ToE). **Obidi's reasoning proceeds step by step: entropy generates information; information induces geometry; geometry admits a field structure; therefore, entropy must be a geometric and dynamical field. The entropic manifold is the natural domain of this field, and the entropic action is the variational principle that governs its dynamics.**

The Fisher–Rao and Fubini–Study metrics are not analogies to spacetime geometry but emergent expressions of the entropic field in different regimes. The Amari–Čencov α -connections are not mathematical curiosities but structural degrees of freedom through which the entropic manifold transitions between classical and quantum behavior.

The great leap of the Theory of Entropicity (ToE) lies in transforming this logical chain into a physical theory. It is not enough to observe that entropy, information, and geometry are related; the decisive step is to promote the entropic field to a dynamical object governed by an action principle. By constructing the Obidi Action and deriving field equations from it, the Theory of Entropicity (ToE) elevates information geometry from a descriptive framework to a generative physical theory. This is the moment where entropy ceases to be a statistic and becomes a field, where information ceases to be epistemic and becomes ontological, and where geometry ceases to be assumed and becomes emergent.

In this sense, the Theory of Entropicity (ToE) is the culmination of a century-long evolution in the concept of entropy. It unifies the thermodynamic, statistical, informational, and geometric interpretations of entropy into a single ontological framework. It reveals that the structures of spacetime, matter, and physical law are not primitive but emergent from the dynamics of a universal entropic field. And it provides the variational and dynamical machinery needed to transform this insight into a coherent physical theory. **The logical chain that begins with Clausius and Gibbs thus ends with the entropic manifold and**

the Obidi Action—a new foundation for physics built upon the oldest concept in thermodynamics.

13. Ontological Courage and the Road Ahead

To propose that the inherited primitives of modern physics, spacetime as a fundamental arena, quantum states as irreducible elements, geometry as a given structure, should be abandoned and replaced by a single entropic field is an act of considerable theoretical audacity. The conceptual foundations of General Relativity, quantum mechanics, and quantum field theory have been confirmed by over a century of precision experiments. The mathematical structures they employ, Riemannian geometry, Hilbert spaces, gauge theories, are among the most successful products of human intellectual effort. To claim that these structures are emergent, that they are not the foundations of reality but the consequences of a deeper entropic substrate, is to challenge not merely specific equations or predictions but the entire ontological framework within which modern physics operates.

This otherwise provocative audacity is not, however, without justification. The structural evidence for the ontological primacy of entropy is extensive and spans multiple independent domains of physics. In thermodynamics, entropy governs the direction of all natural processes through the second law. In statistical mechanics, entropy determines the equilibrium states toward which all systems evolve. In black hole physics, entropy is proportional to the area of horizons, suggesting a fundamental connection between entropy and the geometry of spacetime. In quantum information theory, entanglement entropy measures the correlations between subsystems and has been shown to encode the geometry of the emergent spacetime in holographic contexts. In cosmology, the entropy of the observable universe increases monotonically, providing the arrow of time that orders all physical processes. Across every domain, entropy behaves as a fundamental quantity, constrained by universal laws, encoding geometric and dynamical information, and governing the evolution of physical systems. The Theory of Entropicity does not invent this

behavior. It simply makes it explicit, elevating entropy from a universal descriptor to a universal substrate.

The road ahead is substantial, and the journey has not even begun. Letter II in this series will introduce the full mathematical formalism of the Theory of Entropicity (ToE), including the explicit construction of the Obidi Action, the derivation of the Master Entropic Equation (MEE) and the Obidi Field Equations (OFE), and the demonstration that the Einstein field equations of General Relativity (GR) emerge as a limiting case of the entropic field equations. Letter III will develop the spectral formulation of the theory, establishing the Spectral Obidi Action (SOA) and its role in enforcing global consistency constraints on the entropic manifold. Subsequent Letters will address specific applications, including the entropic derivation of quantum mechanics, the resolution of singularities in black hole and cosmological contexts, and the generation of testable predictions that distinguish the Theory of Entropicity (ToE) from conventional approaches to fundamental physics.

The Theory of Entropicity (ToE) represents a bold, new ontological foundation for physics. It proposes that beneath the forces, fields, particles, and spacetimes of contemporary theory lies a single, universal, dynamical substrate: the entropic field. From its gradients, geometry emerges. From its curvature, gravity arises. From its stable configurations, matter condenses. From its irreversible evolution, the arrow of time is born. Entropy is not the end of the story. It is the beginning.

And we have not even begun!

References

- Amari, S. (2016). *Information Geometry and Its Applications*. Springer.
- Bekenstein, J. D. (1973). Black Holes and Entropy. *Physical Review D*, 7(8), 2333.
- Bianconi, G. (2024). Gravity from Entropy. *Physical Review D*.
- Hawking, S. W. (1975). Particle Creation by Black Holes. *Communications in Mathematical Physics*, 43(3), 199–220.
- Jacobson, T. (1995). Thermodynamics of Spacetime: The Einstein Equation of State. *Physical Review Letters*, 75(7), 1260.
- Obidi, J. O. (2025). The Theory of Entropicity (ToE): An Entropy-Driven Derivation of Mercury's Perihelion Precession Beyond Einstein's Curved Spacetime in General Relativity. *Cambridge Open Engage*.
- Obidi, J. O. (2026). Theory of Entropicity (ToE) — Monograph. GitHub/Cloudflare Archive.
<https://entropicity.github.io/Theory-of-Entropicity-ToE/>
- Padmanabhan, T. (2010). Thermodynamical Aspects of Gravity: New Insights. *Reports on Progress in Physics*, 73(4), 046901.
- Verlinde, E. (2011). On the Origin of Gravity and the Laws of Newton. *Journal of High Energy Physics*, 2011(4), 29.

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