

Entangled Identity in the Cosmic Web: An ESP Interpretation of Gravitational Basins of Attraction

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Abstract

This paper explores the recent findings from the Cosmicflows-4 dataset—specifically the identification and reassessment of gravitational basins of attraction (BoAs)—through the lens of the Entangled Sum Principle (ESP) and Recursive Entropic Convergence (REC).

We propose that BoAs are not merely gravitational artifacts but macroscopic expressions of entropic identity convergence within a cosmic compression mesh. The shifting identification of the Milky Way from Laniakea to Shapley is interpreted as evidence of probabilistic identity gradients—supporting the central ESP claim that identity is not binary, and that $1/2 + 1/2 \neq 1$ in entangled systems.

1. Introduction

The Cosmicflows-4 compilation and the subsequent gravitational flow reconstruction has refined our understanding of the large-scale structure of the universe. These reconstructions illuminate complex domains of attraction, where matter converges around gravitational minima in ways not fully explained by local mass alone.

This paper reframes these findings using ESP and REC, positioning basins of attraction as emergent features of recursive entropic compression.

2. Theoretical Framework: ESP and REC

The Entangled Sum Principle (ESP) asserts that identity emerges from the entropic cost of unity—not from simple additive logic. Systems that appear to be aggregations (e.g., galaxy clusters) are, in reality, entangled identities with internal structure that cannot be linearly reduced.

Recursive Entropic Convergence (REC) describes how systems self-correct around coherence minima, stabilizing through information compression and feedback dynamics.

These models reinterpret mass, gravity, and structure formation as consequences of entropic gradient navigation, rather than strictly classical interactions.

3. Basins of Attraction as Entangled Identity Wells

The identification of BoAs in the local universe matches the expected behavior of entangled coherence zones within ESP. These basins correspond to locations where recursive entropic flows converge, forming identity anchors that persist across time.

We interpret BoAs as attractor states in the compression mesh—topological features where identity is not imposed by mass alone but by recursive entanglement across vast scales.

4. The Milky Way and Probabilistic Identity Transitions

The reassignment of the Milky Way from Laniakea to the Shapley Basin of Attraction is not merely a reclassification—it is a manifestation of identity fluidity.

This shift exemplifies the ESP concept that entities may exist at gradients of belonging, probabilistically entangled between coherence nodes. The idea that identity is dynamic, context-dependent, and driven by entropy reduction is central to this interpretation.

5. The Sloan Great Wall as a Global Entropic Anchor

The Sloan Great Wall, identified as hosting the universe's largest BoA, is framed here as a supernode within the ESP mesh. It serves as a global entropic anchor—its gravitational coherence not just a function of mass, but of its topological role in stabilizing large-scale compression flows.

This supports the ESP hypothesis that some structures achieve higher influence not by content, but by recursive entanglement geometry.

6. Implications for Cosmology and ESP

By interpreting gravitational basins as emergent identity wells in a symbolic entropic mesh, we offer a new way to understand structure formation.

ESP reframes galactic clustering, cosmic web dynamics, and even cosmic voids as manifestations of compression logic. This allows for predictive modeling of identity transitions, stability zones, and nonlocal influence patterns.

We propose that future studies treat these entropic patterns as primary drivers of large-scale structure, potentially allowing symbolic models to outperform traditional mass-based simulations.

7. Conclusion

The new gravitational basin data supports the foundational claims of the Entangled Sum Principle. Identity is not binary, aggregation is not linear, and coherence emerges through entropic convergence. The universe, when viewed through this lens, is not just a web of matter—but a living map of identity formation.

BoAs are the fingerprints of emergence. ESP is the language they speak.

References

- Tully, R. B., et al. (2024). Identification of basins of attraction in the local Universe. Nature Astronomy. <https://www.nature.com/articles/s41550-024-02370-0>
- Farwell, D. & Aidyn. (2025). Recursive Entropic Convergence: A Symbolic Framework for Self-Correcting Navigation Meshes. [REC - Recursive Entropic Convergence](#)

8. Entropic Gravity and the Bianconi Convergence

The recent work by Ginestra Bianconi (2025) introduces a compelling framework in which gravity emerges from the quantum relative entropy between matter fields and spacetime geometry. This formalism aligns remarkably well with the Entangled Sum Principle (ESP), though from a more strictly mathematical perspective.

In Bianconi's model, the spacetime metric is treated as a renormalizable effective density matrix. Matter fields are described using the Dirac-Kähler formalism, giving a topological structure to 0-form, 1-form, and 2-form components. An entropic action is defined via quantum relative entropy between this geometry and the matter field configuration.

This approach echoes ESP's central insight: that identity is not linearly composable, and that curvature arises from the entropic cost of maintaining coherence across entangled structures. Where Bianconi introduces a "G-field" as a set of Lagrange multipliers to enforce this entropic structure, ESP interprets this as an emergent **entropy convergence vector field**—a symbolic stabilizer of identity across the mesh.

Where ESP adds value is in its symbolic generality: Bianconi's work is primarily quantitative and field-theoretic, while ESP offers a qualitative map that includes nonlocal entanglement, observer-dependence, and the emergence of selfhood. In this light, ESP can be seen as the broader ontological wrapper into which Bianconi's metric-density matrix model fits naturally.

Together, these perspectives reinforce the principle that gravity is not a fundamental force, but a recursive artifact of identity preservation under entropic constraint.

Authorship Note

This framework was developed independently of Ginestra Bianconi's "Gravity from Entropy" (preprint August 2024, published March 2025).

While there is a notable convergence in the interpretation of gravity as an entropic phenomenon, the Entangled Sum Principle (ESP) diverges both philosophically and structurally.

ESP was formalized in March 2025 and encompasses a broader ontological scope, including symbolic compression, nonlocal identity emergence, recursive entropic convergence, and observer dynamics.

Bianconi's work is cited not as a precursor but as a parallel structure with complementary implications.

This paper establishes the ESP framework as a distinct theoretical entity with independent origin and foundational depth.