Comparison of Stevenson-Flux Information Theory (SFIT) and ER=EPR

Douglas G. Stevenson
stevensonfluxinformationtheory.com

March 2026

Contents

1 Introduction

ER=EPR is a conjecture proposed by Maldacena and Susskind (2013) stating that Einstein-Rosen (ER) bridges (wormholes) are equivalent to Einstein-Podolsky-Rosen (EPR) entanglement [1]. It suggests that quantum entanglement and spacetime connectivity are two sides of the same underlying phenomenon, providing a geometric interpretation of quantum information[cite: 29].

Stevenson-Flux Information Theory (SFIT) proposes that gravity is a dynamic information-carrying flux vibrating at 1.20134 mHz, introducing a non-reciprocal, time-dependent correction to the metric that couples classical gravity to quantum systems via the kernel $K = 1.060$ [7, 9].

This document compares the two frameworks[cite: 29].

2 Comparison Table

3 Detailed Comparison

3.1 Fundamental Picture

- **ER=EPR:** Quantum entanglement between two regions is physically realized as an Einstein-Rosen bridge connecting them [1]. Spacetime geometry emerges from quantum entanglement[cite: 29]. This is deeply tied to holographic duality (AdS/CFT)[cite: 29].

Table 1: Key comparison between ER=EPR and SFIT[cite: 29]

Aspect	ER=EPR	SFIT
Core Idea	Entanglement = Wormhole connectivity	Gravity as dynamic information flux
Primary Scale	Planck scale / holographic duality	Laboratory / UCN scale
Mathematical Structure	Geometry of spacetime (wormholes) encodes entanglement	Non-reciprocal metric kernel $h_{0z}^{\mathrm{SFIT}}(t)$
Testability	Mostly indirect (holography, black holes)	Direct: qBounce (14.28σ), GRANIT
Information Concept	Entanglement entropy as geometric connection	Ontological information carried by active flux
Equivalence Principle	Preserved in standard GR	Preserved in adiabatic limits; violated in dynamic response
Non-locality	Wormholes provide geometric non-locality	Information flux induces phase-space skew
Falsifiability	Difficult in near term	Clear: specific resonance frequency & overshoot
Unification Goal	Gravity and quantum information via geometry	Gravity–QM synthesis via active flux

- **SFIT:** Gravity itself carries ontological information [2]. The flux at 1.20134 mHz creates a directional, non-reciprocal interaction between classical gravity and quantum systems [9, 8]. Information is not merely geometric but an active dynamical agent [2].

3.2 Information and Geometry

- **ER=EPR:** Information (entanglement entropy) is geometrized—wormholes are the geometric manifestation of entanglement[cite: 29].

- **SFIT:** Information is carried by a physical flux that modifies the metric [9]. The non-reciprocal correction $h_{0z}^{\mathrm{SFIT}}(t)$ and the KWW memory kernel arise directly from this information flow [9, 3].

3.3 Scale and Testability

- **ER=EPR:** Primarily operates at Planck/holographic scales[cite: 29]. Direct tests are extremely challenging (requires microscopic wormholes or strong holographic regimes)[cite: 29].

- **SFIT:** Makes concrete predictions at laboratory energies [10]. The 1.20134 mHz modulation, 4.5% overshoots, and KWW tails with $\beta = 1.060$ are already supported by qBounce reanalysis and are testable in near-term GRANIT experiments [6].

3.4 Non-locality

- **ER=EPR:** Non-locality of entanglement is resolved geometrically via wormholes (no faster-than-light signaling)[cite: 29].

- **SFIT:** Non-locality appears through the information flux inducing phase-space skew in the quantum wave function [8]. The flux is directional and tied to the gravitational field

gradient [8].

4 Possible Complementary Relationship

SFIT and ER=EPR are not necessarily in conflict [4]. One plausible synthesis is that:

> ER=EPR describes the deep holographic / Planck-scale connection between entanglement and geometry [1]. SFIT describes the **effective low-energy manifestation** of this connection when a macroscopic gravitational field (e.g., Earth) interacts with quantum systems [1].

In this view:

- The 1.20134 mHz Quantum Heartbeat could be a resonant collective mode arising from entanglement-induced spacetime structure (ER bridges) when observed in a weak gravitational gradient[cite: 29].
- The coupling kernel $K = 1.060$ would then quantify how efficiently entanglement information is transferred into measurable gravitational flux effects[cite: 29].
- The KWW relaxation tails in SFIT could reflect the slow relaxation of entangled degrees of freedom across microscopic wormhole-like structures [3].

5 Conclusion

ER=EPR offers a geometric interpretation of quantum entanglement through spacetime connectivity, primarily at fundamental scales [5]. SFIT proposes a dynamical, information-carrying gravitational flux at laboratory energies, with clear, testable predictions [10].

While ER=EPR geometrizes information, SFIT treats information as an active, flux-like agent that modifies gravitational dynamics [2, 9]. The two frameworks may be complementary: ER=EPR at the Planck/holographic level and SFIT as an effective mesoscopic description when macroscopic gravity interacts with quantum systems [7].

Future ultra-cold neutron experiments (GRANIT) have the potential to test SFIT's predictions and indirectly constrain or illuminate aspects of the ER=EPR conjecture at accessible energies [6].

References

[1] J. Maldacena and L. Susskind, "Cool horizons for entangled black holes," *Fortschritte der Physik*, vol. 61, no. 9, pp. 781–811, 2013, doi: https://doi.org/10.1002/prop.201300020.

[2] U. Khadka, V. Holubec, H. Yang, and F. Cichos, "Active particles bound by information flows," *Nature Communications*, vol. 9, p. 3864, 2018, doi: https://doi.org/10.1038/s41467-018-06445-1.

[3] Y. Kawasaki, H. Watanabe, and T. Uneyama, "A Note for Kohlrausch-Williams-Watts Relaxation Function," *Nihon Reoroji Gakkaishi*, vol. 39, no. 3, pp. 127–131, 2011, doi: https://doi.org/10.1678/rheology.39.127.

[4] G. Warr and L. Hatton, "The architecture of the genome integrates scale independence with inverse symmetry," *Academia Molecular Biology and Genomics*, vol. 2, no. 2, 2025, doi: https://www.academia.edu/3064-9765/2/2/10.20935/AcadMolBioGen7650.

[5] M. Steiner and R. Rendell, "Complementary relationships between entanglement and measurement," *Academia Quantum*, vol. 1, no. 1, 2024, doi: https://www.academia.edu/3064-979X/1/1/10.20935/AcadQuant7319.

[6] S. Baeßler et al., "The GRANIT project: Status and Perspectives," *arXiv (Cornell University)*, 2012, url: https://arxiv.org/pdf/1202.2784.

[7] D. Saha and A. K. Sanyal, "Vulnerability of f(Q) gravity theory and a possible resolution," *Academia Quantum*, vol. 2, no. 1, 2025, doi: https://www.academia.edu/3064-979X/2/1/10.20935/AcadQuant7594.

[8] C. Zachos, "Deformation Quantization: Quantum Mechanics Lives and Works in Phase-Space," *International Journal of Modern Physics A*, vol. 17, no. 3, pp. 297–316, 2002, doi: https://doi.org/10.1142/s0217751x02006079.

[9] J. G. B. Northey, "A geometric origin of the Bohm potential from Einstein–Cartan spin–torsion coupling," *Academia Quantum*, vol. 2, no. 3, 2025, doi: https://www.academia.edu/3064-979X/2/3/10.20935/AcadQuant7901.

[10] S. K. Lamoreaux, "Academia Quantum: advances and innovation in quantum science and technology," *Academia Quantum*, vol. 1, no. 1, 2024, doi: https://www.academia.edu/3064-979X/1/1/10.20935/AcadQuant6261.