

Metric Occlusion of Einstein-Rosen (ER) Bridges: A Model of Topological Stability through Indivisible Material Singularities

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1. Abstract

This paper proposes a solution to the instability of wormholes (Einstein-Rosen bridges) through the **Metric Occlusion** hypothesis. It is theorized that elementary matter is not merely an occupant of spacetime, but a fundamental structural component of its topology. Quantum entanglement (EPR) is described here as a single physical object occupying a spatial tunnel with zero proper length (≈ 0), stabilized by the indivisibility of the particle itself, which acts as a geometric "pin."

2. The "Plug" Hypothesis (Metric Plugging)

The chronic instability of wormholes in General Relativity is due to the tendency of the "throat" to collapse toward a singularity of zero radius.

The present model proposes that, under entanglement conditions, the throat of the ER bridge is entirely occupied by an elementary particle (e.g., an electron). Since the particle is an **indivisible quantum of action**, it exerts a mechanical-topological resistance that prevents the spacetime metric from collapsing.

- **Metric Adherence:** The particle does not "traverse" the wormhole; it constitutes its solid core. There is no empty space between the event horizon of the tunnel and the radius of the particle.
- **Induced Stability:** The particle acts as a structural support, rendering the ER bridge energetically stable as long as the entanglement bond persists.

3. Zero Proper Length and Instantaneity

The apparent violation of the speed of light in quantum correlations is resolved geometrically. Although the two ends of the wormhole may be light-years apart in asymptotically flat space (the space we perceive), the **internal proper length** of the tunnel is infinitesimal (≈ 0).

The two particles observed experimentally are, in reality, the two superficial manifestations of the same occluded singularity.

4. Dynamics of Stretching and Bond Collapse

When the two terminals of the wormhole are pulled apart in physical space, the ER bridge undergoes tensile stress. Upon exceeding a critical threshold, defined as the **Stretching Limit**, the tunnel undergoes a topological rupture.

- **Localization of the Singularity:** Since the particle is indivisible, at the moment of rupture, it "slides" instantaneously toward one of the two terminals (A), stabilizing as a single particle.
- **Energy Materialization (Topological Cloning):** The terminal left empty (B) collapses violently. The tensile energy released by the collapse does not vanish but is converted into local mass-energy through a process of pair production induced by metric fluctuation. This explains why researchers always measure two distinct particles post-entanglement.
- **Note on Mass-Energy Conservation:** A critical point of the model concerns the transition from an occluded singularity (single particle) to two distinct entities post-decoherence. It is theorized that the second particle is not a portion of the first, but the result of the **energy conversion of the tunnel**. This "topological nucleation" ensures that each terminal presents a physical particle, respecting conservation laws.
- **Elastic Recoil and Rebound Nucleation:** The collapse of the ER bridge can be described as a system of elastic tension (similar to a tug-of-war). The rupture of metric continuity causes a "back-reaction." If the occluded singularity is dragged toward terminal A, terminal B undergoes an instantaneous release of tensorial energy, providing the mass-energy necessary for the nucleation of the second particle.

5. Experimental Predictions (Testability)

To confirm the validity of the model, it is suggested to monitor:

1. **Metric Micro-bursts:** Emissions of high-frequency gravitational waves at the exact moment of decoherence in high-entanglement systems.
2. **Thermal Signature of B:** A slight thermal shift or a specific light signature produced by the particle "born" from the tunnel collapse compared to the "original" particle.

6. Conclusions

The **Metric Occlusion** model presented here shifts the paradigm of matter from a "contained entity" to a "geometric constraint." If elementary particles are the pins that stabilize the fabric of spacetime, quantum physics and general relativity find a mechanical and intuitive meeting point.

Ultimately, the universe is not a vacuum populated by objects, but a complex network of topological tunnels kept in existence by the indivisible nature of matter itself.