

Quantized Curvature and the Collapse of Force Separation

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Abstract:

This paper explains a unifying theory that bridges quantum field theory and general relativity by introducing the concept of quantized curvature. Instead of viewing spacetime as a smooth continuum, it is seen as being made up of individual, unbreakable geometric units. These units can bend or twist in quantized increments, which can generate all the fundamental forces. The theory proposes that all forces—gravity included—come from the same structure of these units.

1. Introduction

Modern physics is divided between two major frameworks:

- **General Relativity:** Shows that Gravity can curve spacetime.
- **Quantum Field Theory (QFT):** Explains the electromagnetic, weak, and strong forces as quantum fields on flat spacetime.

These theories are both highly accurate but are contradictory. No unified theory currently exists that combines gravity with the other fundamental forces.

2. The Central Hypothesis: Quantized Curvature

This theory suggests that spacetime itself is not a smooth continuum, but made up of indivisible units—"packets" of curvature.

Key ideas:

- Spacetime is made from discrete, geometric units or packets.
- Each unit can bend or twist in fixed, quantized increments.
- These units resemble digital pixels of curvature, similar to how photons are quanta of light.

This concept is similar to loop quantum gravity but expands toward a unified geometry-driven theory of all forces.

3. Collapse of Force Separation

In current models:

- Gravity is geometry (curved spacetime).
- The other forces are fields existing *in spacetime*.

This theory argues:

All four forces are actually different modes of the curvature behavior. The difference is only in the way it twists or curves.

Consequences:

- Electromagnetic, weak, and strong forces are not separate from gravity.
- They are *emergent behaviors* of the same underlying quantized spacetime structure.

This unifies all forces by collapsing their separation—turning them into one phenomenon seen from different perspectives.

4. Predictions and Testability

To make this theory scientifically powerful, it must eventually produce testable predictions such as:

- Deviations from general relativity at extremely small scales.
 - Patterns or "signatures" in gravitational waves caused by curvature quantization.
 - Unusual unification behaviors in high-energy particle collisions.
 - Evidence of discrete gravitational lensing at quantum resolution.
 - Possibility of pixel-like effects in the Cosmic Microwave Background (CMB).
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5. Supporting Logic and Connections to Known Physics

While the theory is novel, it is grounded in logical extensions of known principles:

- **Planck Scale Geometry:** The idea of spacetime being quantized aligns with the Planck length as a minimum unit of measurement in nature.
- **Loop Quantum Gravity:** The proposal shares similarities with loop quantum gravity, which also suggests a granular structure of space.
- **Quantum Field Theory:** In QFT, forces arise from field interactions. This theory proposes that fields themselves are expressions of deeper geometric behaviors.
- **Einstein's General Relativity:** This theory extends the concept of curvature but makes it discrete rather than continuous.

Visual models could represent these curvature units as geometric “atoms” of space, and force interactions as vibrational or torsional patterns among them.

6. Significance and Future Development

This theory:

- Bridges the quantum–gravity divide without extra dimensions or string theory.
- Offers a radical but geometrically intuitive way to unify physics.
- May lead to a full theory of everything (ToE), including spacetime, matter, and energy as one quantized structure.

Future work will involve constructing the exact geometry model, quantization rules, and field behaviors mathematically—possibly leading to new quantum gravity equations.

7. Conclusion

Quantized Curvature and the Collapse of Force Separation suggests that what we perceive as separate forces are unified through spacetime's deepest structure. This framework turns gravity, electromagnetism, the weak force, and the strong force into different manifestations of the same geometric units—redefining the very fabric of physical law.