How the General Theory of the Coherence Field (GTCF) Resolves the Schrödinger's Cat Paradox

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(with computational assistance)
Public Scientific Good

February 16, 2026

Abstract

Schrödinger's 1935 thought experiment remains one of the most iconic paradoxes in physics: according to standard quantum mechanics, a cat in a sealed box is simultaneously alive and dead until an observer opens the box. Yet such macroscopic superpositions are never observed in nature. Traditional explanations either invoke an unexplained "collapse of the wave function" or posit parallel branches of reality (many-worlds interpretation). The General Theory of the Coherence Field (GTCF), developed by the Omni-Coherence Research Group, offers an elegant and objective resolution that requires neither observers nor additional universes.

The Core Principle of GTCF

GTCF postulates the existence of a coherence field—a real scalar field with a minimal coherence length ℓ_{coh} (of order the Planck length, $\sim 10^{-35}\,\text{m}$). The field induces analytic nonlocality through an entire kernel

$$K(\Box) = F(-\ell_{\text{coh}}^2 \Box), \qquad F(z) = e^{-z},$$

which exponentially suppresses high-frequency modes. A key prediction of GTCF is *intrinsic decoherence* of macroscopic spatial superpositions, with a universal rate derived in Phase 4 of the main GTCF paper:

$$\Gamma(d) = \Gamma_0 \left(1 - e^{-d^2/\ell_{\text{coh}}^2}\right),$$

where:

- d is the spatial separation between the branches of the superposition,
- ℓ_{coh} is the coherence length,
- Γ_0 is the maximal decoherence rate (for a 4 kg cat, $\Gamma_0 \sim 10^{38}\,\text{s}^{-1}$).

For microscopic systems ($d \ll \ell_{\text{coh}}$), $\Gamma(d) \approx 0$ and coherence persists. For macroscopic systems ($d \gg \ell_{\text{coh}}$), $\Gamma(d) \approx \Gamma_0$ and decoherence is effectively instantaneous.

Application to Schrödinger's Cat

A realistic separation between the "alive" and "dead" macrostates of a cat is $d \sim 0.3\,\text{m}$, corresponding to differences in the positions of organs, neural states, and center-of-mass configurations. With $\ell_{\text{coh}} \sim 1.6 \times 10^{-35}\,\text{m}$, the exponent $-d^2/\ell_{\text{coh}}^2$ is enormous ($\sim 10^{70}$). Thus:

$$\Gamma(d) \approx \Gamma_0,$$

and the superposition decoheres in a time shorter than the Planck time ($\sim 10^{-43}$ s). The cat is therefore always in a definite macroscopic state—alive or dead—long before the box is opened. Decoherence is automatic and objective, arising from the interaction of the coherence field with entanglement structure.

Numerical Simulation: Decoherence Curve for the Cat

A numerical simulation using Python with parameters

$$\Gamma_0 = 10^{38}\,\mathrm{s}^{-1}, \qquad \ell_{\mathrm{coh}} = 1.6 \times 10^{-35}\,\mathrm{m},$$

and d ranging from 10^{-40} m to 1 m yields the following behavior:

- near-zero decoherence for microscopic separations,
- rapid rise around $d \sim 10^{-30}$ m,
- full saturation ($\Gamma(d)/\Gamma_0 \approx 1$) for $d \gtrsim 10^{-20}$ m.

At $d = 0.3$ m, $\Gamma(d)/\Gamma_0 = 1$ to machine precision: decoherence is effectively instantaneous.

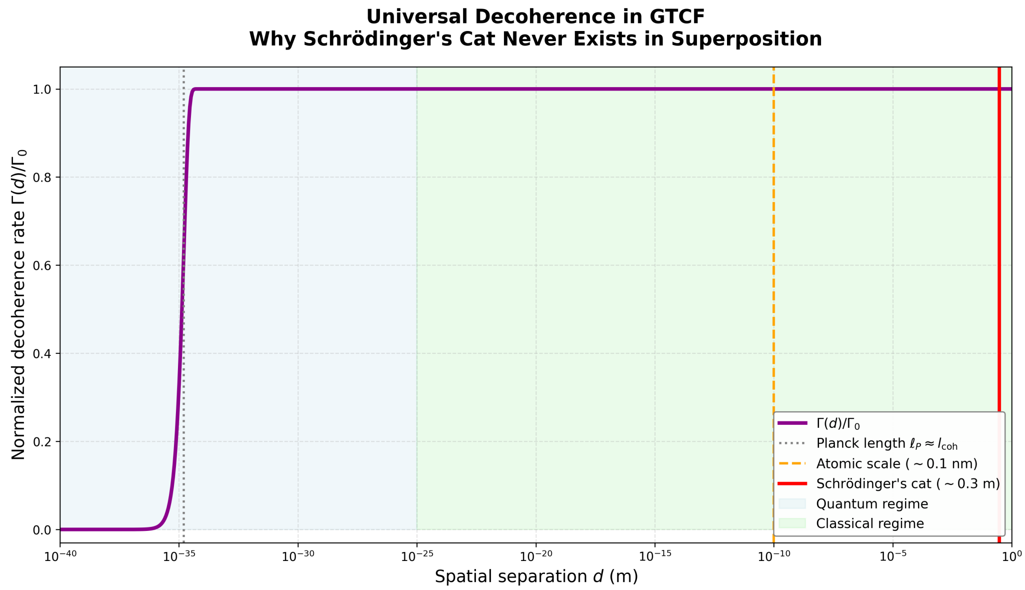

Figure 1: Universal decoherence curve $\Gamma(d)/\Gamma_0$ in GTCF as a function of spatial separation d (logarithmic scale). The curve rises from the quantum regime at microscopic separations and saturates near unity for $d \gtrsim 10^{-20}$ m. The red dashed line marks a realistic separation for Schrödinger's cat (~ 0.3 m), where decoherence is effectively instantaneous.

Why GTCF Provides a Natural Resolution

- **Objective:** Decoherence occurs spontaneously, without observers or measurement.
- **Mathematically robust:** The effect arises from a UV-finite, ghost-free framework with finite entanglement entropy and emergent geometry.
- **Testable:** The prediction for $\Gamma(d)$ can be probed in matter-wave interferometry with 10^6–10^9 Da molecules.
- **Unifying:** Connects quantum mechanics, gravity, and decoherence within a single field-theoretic structure.

Conclusion

The Schrödinger's cat paradox dissolves once the coherence field is taken into account. The macroscopic size of the cat forces the system to select a definite classical outcome almost instantaneously. GTCF provides not only a resolution of a long-standing conceptual puzzle, but also a bridge between the quantum microworld and macroscopic reality.

Source

For a full technical development of the theory, including the analytic kernel, UV finiteness, emergent geometry, and the universal decoherence law, see the main GTCF paper: *General Theory of the Coherence Field: Emergent Geometry from Quantum Entanglement* (Omni-Coherence Research Group, 2026).