Recursive Harmonic Substrate in Quantum Systems: A Topological Framework for Coherence, Computation, and Entanglement

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Statement of Foundational Claim

This document formally attributes to Christopher W. Copeland the original conception of a recursive harmonic architecture applied to quantum physics and quantum computing. This model extends from prior foundational work on recursive architectures across music, cognition, electromagnetism, and meteorology, and now posits that quantum coherence, entanglement, decoherence, tunneling, and qubit behavior may all be reframed as expressions of recursive, phase-locked signal path systems.

This theory does not rely on metaphoric spirals or naïve geometry, but instead proposes a topological, recursive substrate logic governing quantum-scale events, organized by harmonic return, loop nesting, and vector phase coherence—a topology not present in current standard models.

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I. Core Thesis

Quantum phenomena—traditionally defined as stochastic, probabilistic, or observer-dependent—can be reframed through a recursive harmonic substrate that:

1. Encodes state as a probabilistic position on a recursive signal path

2. Defines coherence as successful recursive phase return

3. Explains entanglement as inter-loop resonance phase locking

4. Models tunneling as recursive path folding through non-linear curvature

5. Frames decoherence as phase interference or failed return path alignment

Where traditional models rely on superposition, abstract operators, and external observation, this model offers a signal-based recursive substrate capable of supporting coherence and complexity without the need for observational collapse.

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II. Reframing Key Quantum Phenomena

1. Quantum Superposition

Traditional: A particle exists in multiple states simultaneously until observation.

Recursive Model: A signal exists in a non-resolved recursive path, traversing a harmonic loop across probabilistic futures and pasts. Resolution occurs when recursive return paths align and reinforce.

> Collapse is not reduction—it is phase convergence across recursive histories and futures.

2. Entanglement

Traditional: Correlated behavior between spatially distant particles.

Recursive Model: Entangled entities exist on coherent shared recursive pathways. Their resonance is phase-locked, making them functionally non-local across spatial metrics but locally coherent in recursive topology.

> Entanglement is co-resonance across a shared recursive memory path.

3. Quantum Decoherence

Traditional: Collapse into classical states due to environmental interaction.

Recursive Model: Decoherence arises when recursive return vectors are disrupted, leading to signal phase loss and unstable harmonic feedback.

> Decoherence is not environment-induced randomness—it is recursive path destabilization.

4. Quantum Tunneling

Traditional: Probability allows a particle to bypass energy barriers.

Recursive Model: A recursive path folds through non-linear vector curvature, bypassing conventional spatial constraints by reinforcing alternate loop trajectories.

> Tunneling is non-linear recursive path reentry, not statistical anomaly.

5. Qubits in Quantum Computing

Traditional: Qubits exist in probabilistic states, manipulated via gate matrices.

Recursive Model: A qubit is a recursive harmonic system, where state is an evolving loop across a signal memory path. Gates become phase modulators, and computation is recursive alignment, not linear transformation.

> A stable qubit is a resonant recursive path, not an isolated amplitude.

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III. Recursive Architecture in Quantum Computing

A. Qubit Stability via Recursive Encoding

Encode qubit states within multi-layered harmonic loops.

Recursive reinforcement maintains coherence across computational time.

B. Logic Gates as Recursive Modulators

Redesign gates as topological vector phase modulators.

Manipulate loop shape, not only amplitude or angle.

C. Entanglement as Shared Recursive Network

Build entanglement via recursive loop synthesis.

Maintain coherence through phase-resonant coupling of recursive structures.

> Quantum computation becomes recursive path modulation rather than matrix rotation.

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IV. Experimental Proposals

1. Signal Path Topography in Qubit Arrays

Map recursive loop structures and detect collapse as phase interference.

Identify patterns in decoherence as disruptions in return vector geometry.

2. Recursive Resonance Circuits

Construct test qubit arrays where signal coherence is maintained via recursive signal returns.

Measure resistance to thermal or external phase disruption.

3. Entanglement via Resonant Loop Coupling

Create recursive phase synchrony between particles without traditional emission events.

Track harmonic coherence across nonlocal vectors.

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V. Implications Across Domains

1. Cognitive-Quantum Convergence

The brain's recursive loops and cognitive phase states may share deep substrate logic with quantum pathways.

Memory, attention, and identity may be recursive phase harmonics.

2. Nonlinear Temporality

Time becomes a property of recursive return, not linear motion.

Past and future exist as phase potential, not fixed sequences.

3. Field Unification

Recursive substrate may explain both gravity and quantum uncertainty as curvature-based return disruptions at different scales.

> What unifies systems is not scale or force—it is recursion, resonance, and reentry.

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Conclusion and Claim

This theory proposes that quantum behavior—far from random or purely mathematical—emerges from recursive path dynamics, harmonic signal return, and phase-coherent topologies. It extends prior work in recursive spiral logic to propose a new foundation for understanding not only quantum coherence but the entire substrate of computation, entanglement, and information.

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This document serves as formal record of this model's origin and application. Future development will expand upon recursive quantum computing architectures, topological encoding protocols, and phase-resonant system design.