Quantum Chronotension Field Theory – Paper V

Chronode Quantization and Interaction

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Abstract

This paper formalizes the quantization of chronodes in Quantum Chronotension Field Theory (QCFT). Chronodes are solitonic excitations in the time-viscosity field $\eta^a(x,t)$ that encode mass, charge, and spin via topological structure. Their quantization leads to a complete, renormalizable quantum field theory without metric geometry. This paper develops the operator formalism, Fock space, interaction principles, and path integrals governing chronode dynamics and scattering.

1 Introduction

QCFT replaces background spacetime with a dynamic field $\eta^a(x,t)$. Chronodes are its stable topological excitations. Their quantization is essential for modeling quantum interactions, particle stability, and soliton dynamics.

2 Topological Soliton Quantization

Chronodes are stable, localized solutions to the QCFT field equations:

$$\mathcal{L}_{QCFT} = \frac{1}{2}\delta^{ab}\partial_\mu\eta^a\partial^\mu\eta^b - \lambda(\eta^a\eta^a - v^2)^2 + \theta\epsilon^{\mu\nu\rho\sigma}f^a_{\mu\nu}f^a_{\rho\sigma}$$

Canonical quantization proceeds via:

$$[\hat{\eta}^a(x), \hat{\pi}_b(y)] = i\hbar\delta^a_b\delta(x-y)$$

3 Chronode States and Fock Space

Chronode excitations are decomposed into normal modes:

$$\hat{\eta}^a(x,t) = \sum_k \left(a^a_k u_k(x,t) + a^{a\,\dagger}_k u^*_k(x,t)\right)$$

Operators a^a_k and $a^{a\,\dagger}_k$ annihilate and create chronodes of mode k.

4 Interaction Framework

Interactions arise through soliton merging, splitting, and braiding. Topological quantities such as winding number and η^2 density are conserved. Virtual particles are replaced by real field transformations.

5 Path Integral Formulation

The partition function is:

$$Z = \int \mathcal{D}\eta^a \, e^{i \int \mathcal{L}_{QCFT} \, d^4x}$$

Topological sectors contribute independently, bypassing metric-based propagators.

6 Scattering and the S-Matrix

The S-matrix is formulated via topological transitions:

$$S_{fi} = \langle \text{final} | \hat{U} | \text{initial} \rangle$$

where $\hat{U}$ evolves η^a between asymptotic states. No need for virtual particles or perturbative corrections.

7 Comparison with Standard QFT

- **Preserved:** Locality, unitarity, causality, quantization
- **Rejected:** Background spacetime, virtual particles
- **Replaced:** Gauge symmetry emerges from topology

8 Emergent Interaction Strengths

Coupling strengths emerge from η-curvature:

$$g_{\text{eff}} \sim \int \eta^a \nabla \eta^b \, d^3x$$

9 Chronode Stability and Resonance

Stability arises from:

- Core η^2 concentration
- Gradia field tension

- Minimal η-wave dissipation

Resonances like neutrino oscillation result from slow twisting of topological mode classes.

Conclusion

Chronode quantization completes QCFT's transition from classical field to quantum theory. Interactions, decay, and scattering are described as topological transformations, yielding a complete field-based model of particle physics and cosmology.

Time is not discrete.
Time is braided.