

Deterministic Quantum Mechanics via T0-Energy Field Formulation:

**From Probability-Based to Ratio-Based Microphysics
Building on the T0 Revolution: Simplified Dirac Equation, Universal La-
grangian, and Ratio Physics**

Abstract

This work presents a revolutionary deterministic alternative to probability-based quantum mechanics through the T0-energy field formulation. Building upon the simplified Dirac equation, universal Lagrangian, and ratio-based physics of the T0 framework, we demonstrate how quantum mechanical phenomena emerge from deterministic energy field dynamics governed by the modified Schrodinger equation. Using the empirically determined parameter $\xi = 4/3 \times 10^{-4}$, we provide quantitative predictions that preserve all experimentally verified results while eliminating fundamental interpretation problems.

Contents

0.1 Introduction: The T0 Revolution Applied to Quantum Mechanics

0.1.1 Building on T0 Foundations

This work represents the fourth stage of the theoretical T0 revolution:

Stage 1 - Simplified Dirac Equation: Complex 4×4 matrices to simple field dynamics

Stage 2 - Universal Lagrangian: More than 20 fields to one equation

Stage 3 - Ratio Physics: Multiple parameters to energy scale ratios

Stage 4 - Deterministic QM: Probability amplitudes to deterministic energy fields

0.1.2 The Quantum Mechanics Problem

Standard quantum mechanics suffers from fundamental conceptual problems:

QM Problem	Standard Approaches	T0 Solution
Measurement problem	Copenhagen interpretation	Continuous field evolution
Schrodinger's cat	Superposition paradox	Definite field states
Many-worlds vs. Copenhagen	Multiple interpretations	Single reality
Wave-particle duality	Complementarity principle	Energy field patterns
Quantum jumps	Random transitions	Field-mediated transitions
Bell nonlocality	Spooky action at distance	Field correlations

0.1.3 T0-Energy Field Solution

The T0 framework offers a complete solution through deterministic energy fields:

Standard QM Problems

Probability Foundation Problems:

- Wave function: mysterious superposition
- Probabilities: only statistical predictions
- Collapse: non-unitary measurement process
- Interpretation: Copenhagen vs. Many-worlds vs. others
- Single measurements: unpredictable (fundamentally random)

0.1.4 T0-Energy Field Solution

The T0 framework offers a complete solution through deterministic energy fields:

T0 Deterministic Foundation

Deterministic Energy Field Physics:

- Universal field: single energy field for all phenomena
- Modified Schrodinger equation with time-energy duality
- Empirical parameter: $\xi = 4/3 \times 10^{-4}$ from muon anomaly
- Measurable deviations from standard QM
- Continuous evolution: no collapse, only field dynamics
- Single reality: no interpretation problems

0.2 T0-Energy Field Foundations

0.2.1 Modified Schrodinger Equation

From the T0 revolution, quantum mechanics is governed by:

$$i \cdot T(x, t) \frac{\partial \psi}{\partial t} = H_0 \psi + V_{T0} \psi \quad (1)$$

where:

$$H_0 = -\frac{\hbar^2}{2m} \nabla^2 \quad (2)$$

$$V_{T0} = \hbar^2 \cdot \delta E(x, t) \quad (3)$$

0.2.2 Energy-Time Duality

The fundamental T0 relationship:

$$T(x, t) \cdot E(x, t) = 1 \quad (4)$$

Dimensional verification: $[T][E] = 1$ in natural units.

0.2.3 Empirical Parameter

Following precision measurements of the muon anomalous magnetic moment:

$$\xi = \frac{4}{3} \times 10^{-4} \approx 1.333 \times 10^{-4} \quad (5)$$

0.3 From Probability Amplitudes to Energy Field Ratios

0.3.1 Standard QM State Description

Traditional approach:

$$|\psi\rangle = \sum_i c_i |i\rangle \quad \text{with } P_i = |c_i|^2 \quad (6)$$

Problems: Mysterious superposition, only probability-based predictions.

0.3.2 T0-Energy Field State Description

T0 field-theoretic approach:

$$\psi(x, t) = \sqrt{\frac{\delta E(x, t)}{E_0 V_0}} \cdot e^{i\phi(x, t)} \quad (7)$$

with probability density:

$$|\psi(x, t)|^2 = \frac{\delta E(x, t)}{E_0 V_0} \quad (8)$$

Advantages:

- Direct connection to measurable energy field density
- Deterministic field evolution through modified Schrodinger equation
- Preservation of probabilistic interpretation with T0 corrections
- Field-theoretic foundation for quantum mechanics

0.4 Deterministic Spin Systems

0.4.1 Spin-1/2 in T0 Formulation

Standard QM Approach

State: Superposition of spin-up and spin-down

Expectation value: Probability-based

T0-Energy Field Approach

State: Energy field configuration with separate fields for both spin states

T0-corrected expectation value:

$$\boxed{\langle \sigma_z \rangle_{\text{T0}} = \langle \sigma_z \rangle_{\text{QM}} + \xi \cdot \frac{\delta E(x, t)}{E_0}} \quad (9)$$

0.4.2 Quantitative Example

With the empirical parameter $\xi = 4/3 \times 10^{-4}$:

T0 correction to expectation value:

$$\langle \sigma_z \rangle_{\text{T0}} = \langle \sigma_z \rangle_{\text{QM}} + \frac{4}{3} \times 10^{-4} \times \delta \sigma_z \quad (10)$$

0.5 Deterministic Quantum Entanglement

0.5.1 Standard QM Entanglement

Bell state: Antisymmetric superposition

Problem: Non-local spooky action at a distance

0.5.2 T0-Energy Field Entanglement

Entanglement as correlated energy field structure:

$$\boxed{E_{12}(x_1, x_2, t) = E_1(x_1, t) + E_2(x_2, t) + E_{\text{corr}}(x_1, x_2, t)} \quad (11)$$

Correlation energy field:

$$\boxed{E_{\text{corr}}(x_1, x_2, t) = \frac{\xi}{|x_1 - x_2|} \cos(\phi_1(t) - \phi_2(t) - \pi)} \quad (12)$$

0.5.3 Modified Bell Inequality

The T0 model predicts a modified Bell inequality:

$$\boxed{|E(a, b) - E(a, c)| + |E(a', b) + E(a', c)| \leq 2 + \varepsilon_{\text{T0}}} \quad (13)$$

with the T0 term:

$$\boxed{\varepsilon_{\text{T0}} = \xi \cdot \frac{2\langle E \rangle \ell_P}{r_{12}}} \quad (14)$$

Numerical estimate: For typical atomic systems with $r_{12} \sim 1$ m:

$$\varepsilon_{\text{T0}} \approx 10^{-34} \quad (15)$$

0.6 Deterministic Quantum Computing

0.6.1 Qubit Representation

T0-energy field qubit:

$$\boxed{\text{qubit}_{\text{T0}} \equiv \{E_0(x, t), E_1(x, t)\}} \quad (16)$$

with field-theoretic amplitudes:

$$\alpha_{\text{T0}} = \sqrt{\frac{E_0}{E_0 + E_1}} \quad (17)$$

$$\beta_{\text{T0}} = \sqrt{\frac{E_1}{E_0 + E_1}} \quad (18)$$

0.6.2 Quantum Gates as Energy Field Operations

Hadamard Gate

Corrected T0 transformation:

$$H_{\text{T0}} : \quad E_0 \rightarrow \frac{E_0 + E_1}{\sqrt{2}} \quad (19)$$

$$E_1 \rightarrow \frac{E_0 - E_1}{\sqrt{2}} \quad (20)$$

Controlled-NOT Gate

T0 formulation:

$$\text{CNOT}_{\text{T0}} : E_{12} \rightarrow E_{12} + \xi \cdot \Theta(E_1 - E_{\text{threshold}}) \cdot \sigma_x E_2 \quad (21)$$

0.6.3 Enhanced Quantum Algorithms

Enhanced Grover Algorithm:

- Standard iterations: $\sim \pi/(4\sqrt{N})$
- T0-enhanced: modification through energy field corrections

0.7 Experimental Predictions and Tests

0.7.1 Enhanced Single-Measurement Predictions

Example - Enhanced spin measurement:

$$\boxed{P(\uparrow) = P_{\text{QM}}(\uparrow) \cdot \left(1 + \xi \frac{E_{\uparrow}(x_{\text{det}}, t) - \langle E \rangle}{E_0}\right)} \quad (22)$$

0.7.2 T0-Specific Experimental Signatures

Modified Bell Tests

Prediction: Bell inequality violation modified by $\varepsilon_{T0} \approx 10^{-34}$

Energy Field Spectroscopy

Prediction:

$$\Delta E = \xi \cdot E_n \cdot \frac{\langle \delta E \rangle}{E_0} \quad (23)$$

Phase Accumulation in Interferometry

Prediction:

$$\phi_{\text{total}} = \phi_0 + \xi \int_0^t \frac{E(x(t'), t')}{E_0} dt' \quad (24)$$

0.8 Resolution of Quantum Interpretation Problems

0.8.1 Problems Addressed by T0 Formulation

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Table 1: Problems addressed by T0 formulation

0.8.2 Enhanced Quantum Reality

T0-Enhanced Quantum Reality

Field-theoretic quantum mechanics with T0 corrections:

- Energy fields as physical basis of wave functions
- Modified Schrodinger evolution with time-energy duality
- Measurements reveal field configurations with T0 modulations
- Continuous unitary evolution without collapse
- Small but measurable deviations from standard QM
- Empirically grounded through muon anomaly parameter