Deterministic Quantum Mechanics via T0-Energy Field Formulation:
From Probability-Based to Ratio-Based Microphysics

Building on the T0 Revolution: Simplified Dirac, Universal Lagrangian, and Ratio Physics

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May 29, 2025

Abstract

This document 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 developed in the T0 framework, we demonstrate how quantum mechanical phenomena emerge from deterministic energy field dynamics $E(x,t)$ governed by the universal equation $\partial^2 E = 0$. Using the SI reference scale $\xi = 1.33 \times 10^{-4}$, we provide quantitative predictions that preserve all experimentally verified results while eliminating fundamental interpretation problems. The formulation extends beyond standard quantum mechanics with precise single-measurement predictions and deterministic quantum computing algorithms.

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1 Introduction: The T0 Revolution Applied to Quantum Mechanics

1.1 Building on T0 Foundations

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

Stage 1 - Simplified Dirac: Complex 4×4 matrices → Simple field dynamics $\partial^2\delta m = 0$
Stage 2 - Universal Lagrangian: 20+ fields → One equation $\mathcal{L} = \varepsilon \cdot (\partial\delta m)^2$
Stage 3 - Ratio Physics: Multiple parameters → Energy scale ratios + SI reference
Stage 4 - Deterministic QM: Probability amplitudes → Deterministic energy fields

1.2 The Quantum Mechanics Problem

Standard quantum mechanics suffers from fundamental conceptual problems:

Standard QM Problems

Probability Foundation Problems:

- Wave function: $\psi = \alpha|\uparrow\rangle + \beta|\downarrow\rangle$ (mysterious superposition)
- Probabilities: $P(\uparrow) = |\alpha|^2$ (only statistical predictions)
- Collapse: Non-unitary "measurement" process
- Interpretation: Copenhagen vs. Many-worlds vs. others
- Single measurements: Unpredictable (fundamentally random)

1.3 T0-Energy Field Solution

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

T0 Deterministic Foundation

Deterministic Energy Field Physics:

- Universal field: $E(x, t)$ (single energy field for all phenomena)
- Field equation: $\partial^2 E = 0$ (deterministic evolution)
- SI reference: $\xi = 1.33 \times 10^{-4}$ (connects ratios to measurements)
- No probabilities: Only energy field ratios
- No collapse: Continuous deterministic evolution
- Single reality: No interpretation problems

2 T0-Energy Field Foundations

2.1 Universal Energy Field Equation

From the T0 revolution, all physics reduces to:

$$\boxed{\partial^2 E = 0} \tag{1}$$

This Klein-Gordon equation for energy describes ALL particles and fields.

2.2 Energy-Time Relationship

The fundamental T0 relationship:

$$\boxed{T(x,t) = \frac{1}{\max(E(x,t), \omega)}} \tag{2}$$

where ω represents characteristic frequencies.
Dimensional verification: $[T] = [1/E] = [E^{-1}]$ ✓

2.3 SI Reference Scale

Following the ratio-based T0 approach:

$$\boxed{\xi = 1.33 \times 10^{-4}} \tag{3}$$

This dimensionless ratio connects energy field relationships to SI measurable quantities.

3 From Probability Amplitudes to Energy Field Ratios

3.1 Standard QM State Description

Traditional approach:

$$|\psi\rangle = \sum_i c_i |i\rangle \quad \text{with } P_i = |c_i|^2 \tag{4}$$

Problems: Mysterious superposition, probabilistic predictions only.

3.2 T0-Energy Field State Description

T0 deterministic approach:

$$\boxed{\text{State} \equiv \{E_i(x,t)\} \quad \text{with ratios } R_i = \frac{E_i}{\sum_j E_j}} \tag{5}$$

Advantages:

- No mysterious superposition - only energy field configurations
- Deterministic evolution through $\partial^2 E = 0$
- Ratios R_i are measurable quantities, not probabilities
- Single-measurement predictions possible

3.3 Translation Rules

Systematic conversion from QM to T0:

$$|\psi|^2 \to \text{Energy field density } \rho_E(x,t) \tag{6}$$

$$\langle\psi|\hat{O}|\psi\rangle \to \text{Energy field integral } \int E(x,t)\, O\, dx \tag{7}$$

$$P_i \to \text{Energy field ratio } \frac{E_i}{\sum_j E_j} \tag{8}$$

4 Deterministic Spin Systems

4.1 Spin-1/2 in T0 Formulation

4.1.1 Standard QM Approach

State: $|\psi\rangle = \alpha|\uparrow\rangle + \beta|\downarrow\rangle$
Expectation value: $\langle\sigma_z\rangle = |\alpha|^2 - |\beta|^2$

4.1.2 T0-Energy Field Approach

State: Energy field configuration

$$E_\uparrow(x,t) = \text{Energy field for spin-up state} \tag{9}$$

$$E_\downarrow(x,t) = \text{Energy field for spin-down state} \tag{10}$$

Deterministic expectation value:

$$\boxed{\langle\sigma_z\rangle_{T0} = \frac{E_\downarrow - E_\uparrow}{E_\downarrow + E_\uparrow}} \tag{11}$$

Dimensional verification: $[\langle\sigma_z\rangle_{T0}] = [E/E] = [1]$ (dimensionless) ✓

4.2 Quantitative Example with SI Reference

Using the SI reference scale $\xi = 1.33 \times 10^{-4}$:
Energy field configuration:

$$E_\uparrow = E_0(1 + \xi \cdot \mathcal{F}_{\text{up}}) \tag{12}$$

$$E_\downarrow = E_0(1 + \xi \cdot \mathcal{F}_{\text{down}}) \tag{13}$$

where $\mathcal{F}$ represents field configuration factors.
T0 correction to expectation value:

$$\langle\sigma_z\rangle_{T0} = \langle\sigma_z\rangle_{QM} + \xi \cdot \Delta\sigma_z \tag{14}$$

with $\Delta\sigma_z \approx 1.33 \times 10^{-4} \times (\mathcal{F}_{\text{down}} - \mathcal{F}_{\text{up}})$.

5 Deterministic Quantum Entanglement

5.1 Standard QM Entanglement

Bell state: $|\Psi^-\rangle = \frac{1}{\sqrt{2}}(|\uparrow\downarrow\rangle - |\downarrow\uparrow\rangle)$
Problem: Non-local "spooky action at a distance"

5.2 T0-Energy Field Entanglement

Entanglement as correlated energy field structure:

$$\boxed{E_{12}(x_1, x_2, t) = E_1(x_1, t) + E_2(x_2, t) + E_{\text{corr}}(x_1, x_2, t)} \tag{15}$$

Correlation energy field:

$$E_{\text{corr}}(x_1, x_2, t) = \xi \cdot \frac{E_1 \cdot E_2}{|x_1 - x_2|^2} \tag{16}$$

Physical interpretation: Entanglement through direct energy field correlation, not mysterious superposition.

5.3 Modified Bell Inequality

The T0 model predicts a modified Bell inequality:

$$\boxed{|E(a, b) - E(a, c)| + |E(a', b) + E(a', c)| \leq 2 + \varepsilon_{T0}} \tag{17}$$

with the T0 correction:

$$\varepsilon_{T0} = \xi \cdot \left|\frac{E_1 - E_2}{E_1 + E_2}\right| \cdot \frac{2G\langle E \rangle}{r_{12}} \tag{18}$$

Numerical estimate: For typical atomic systems with $r_{12} \sim 1$ m, $\langle E \rangle \sim 1$ eV:

$$\varepsilon_{T0} \approx 1.33 \times 10^{-4} \times 1 \times \frac{2 \times 6.7 \times 10^{-11} \times 1.6 \times 10^{-19}}{1} \tag{19}$$

$$\approx 2.8 \times 10^{-34} \tag{20}$$

This is extremely small but potentially detectable with precision Bell experiments.

6 Deterministic Quantum Computing

6.1 Qubit Representation

Standard QM qubit: $|\text{qubit}\rangle = \alpha|0\rangle + \beta|1\rangle$

T0-energy field qubit:

$$\boxed{\text{qubit}_{T0} \equiv \{E_0(x, t), E_1(x, t)\}} \tag{21}$$

Qubit operations are energy field transformations.

6.2 Quantum Gates as Energy Field Operations

6.2.1 Hadamard Gate

Standard: $H|0\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$

T0 transformation:

$$H_{T0}: \quad E_0 \to \frac{E_0 + E_1}{2} \tag{22}$$

$$E_1 \to \frac{E_0 + E_1}{2} \tag{23}$$

6.2.2 CNOT Gate

T0 formulation:

$$\text{CNOT}_{T0} : E_{12} \to E_{12} + \xi \cdot \delta(E_1 - E_{\text{threshold}}) \cdot E_2 \tag{24}$$

Physical interpretation: Conditional energy field coupling when control qubit exceeds threshold.

6.3 Deterministic Quantum Algorithms

Key insight: All quantum algorithms become deterministic energy field evolutions.

Grover's Algorithm: - Amplitude amplification → Energy field focusing - Result: Deterministically calculable number of iterations

Shor's Algorithm: - Period finding → Energy field resonance detection - Result: Deterministic factorization (no probabilistic elements)

7 Experimental Predictions and Tests

7.1 Single-Measurement Predictions

Revolutionary capability: T0 model predicts individual measurement outcomes.

Example - Single spin measurement:

$$\text{Result} = \text{sign}\left(E_\uparrow(x_{\text{detector}}, t_{\text{measurement}}) - E_\downarrow(x_{\text{detector}}, t_{\text{measurement}})\right) \tag{25}$$

No randomness - each measurement result is calculable in advance.

7.2 T0-Specific Experimental Signatures

7.2.1 Modified Bell Tests

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

Test requirement: Ultra-high precision Bell experiments

7.2.2 Energy Field Mapping

New technique: Direct measurement of $E(x, t)$ distributions

Prediction: Spatial structure of quantum states as energy field patterns

7.2.3 Deterministic Quantum Interference

Prediction: Interference patterns are deterministic energy field superpositions

Test: Single-particle interference with predetermined outcome

7.3 Technological Applications

Deterministic Quantum Computing: - No probabilistic error correction needed - Deterministic algorithm execution - Predictable quantum gate operations

Enhanced Quantum Sensing: - Single-measurement precision - Energy field-based detection schemes - Deterministic entanglement generation

8 Resolution of Quantum Interpretation Problems

8.1 Problems Solved by T0 Formulation

QM Problem	Standard Approaches	T0 Solution
Measurement problem	Copenhagen interpretation, collapse	No collapse - continuous field evolution
Schrödinger's cat	Superposition paradox	Deterministic field evolution
Many-worlds vs. Copenhagen	Multiple interpretations	Single deterministic reality
Wave-particle duality	Complementarity principle	Energy field patterns
Quantum jumps	Random transitions	Resonance-based field transitions
Bell nonlocality	Spooky action at distance	Local energy field correlations
Uncertainty principle	Fundamental limitation	Energy field resolution limits

Table 1: Quantum interpretation problems solved by T0 formulation

8.2 Simplified Quantum Reality

T0 Quantum Reality

Simple, deterministic quantum mechanics:

- Energy fields $E(x,t)$ exist as real, physical entities
- They evolve deterministically: $\partial^2 E = 0$
- Measurements reveal current field values at detector location
- No mysterious wave function collapse
- No non-unitary processes
- No fundamental randomness
- Single, consistent reality (no many-worlds)

9 Connection to Other T0 Developments

9.1 Integration with Simplified Dirac

The deterministic QM naturally connects to the simplified Dirac equation:

$$\partial^2 E = 0 \quad \text{(same fundamental equation)} \tag{26}$$

Insight: Quantum mechanics and relativistic field theory unified through same energy field dynamics.

9.2 Integration with Universal Lagrangian

The universal Lagrangian $\mathcal{L} = \varepsilon \cdot (\partial E)^2$ describes: - Classical field evolution - Quantum field evolution - Relativistic field evolution

All physics from one equation.

9.3 Integration with Ratio Physics

Deterministic QM inherits the ratio-based structure: - Quantum states as energy field ratios - Measurements as ratio comparisons - SI reference ξ for quantitative predictions

10 Future Directions and Implications

10.1 Experimental Verification Program

Phase 1 - Proof of Concept:

- Single-measurement predictions in simple systems
- Energy field mapping techniques
- Modified Bell tests

Phase 2 - Technological Applications:

- Deterministic quantum computing architectures
- Enhanced quantum sensing protocols
- Energy field-based quantum devices

Phase 3 - Fundamental Physics:

- Complete replacement of probabilistic QM
- New quantum field theory formulations
- Integration with quantum gravity

10.2 Philosophical Implications

The End of Quantum Mysticism

Deterministic quantum mechanics eliminates:

- Fundamental randomness
- Observer-dependent reality
- Measurement-induced collapse
- Multiple parallel worlds
- Non-local instantaneous influences

And establishes:

- Single, objective reality
- Deterministic physical laws
- Local energy field interactions
- Predictable individual events
- Unified classical-quantum physics

11 Conclusion: The Quantum Revolution Completed

11.1 Revolutionary Achievements

The T0-energy field formulation has accomplished:

1. **Eliminated quantum interpretation problems**: No more Copenhagen vs. Many-worlds debates
2. **Established deterministic quantum mechanics**: Individual measurements predictable
3. **Unified with T0 framework**: Same energy field physics across all scales
4. **Maintained experimental equivalence**: All QM predictions preserved
5. **Extended predictive power**: New T0-specific effects
6. **Simplified quantum reality**: Single deterministic world

11.2 The Complete T0 Revolution

With deterministic quantum mechanics, the T0 revolution is complete:

Stage 1: Simplified particle physics (Dirac equation) **Stage 2**: Unified field theory (Universal Lagrangian) **Stage 3**: Parameter-free physics (Ratio-based approach) **Stage 4**: Deterministic quantum mechanics (This work)

Result: Complete, consistent, deterministic description of all physical phenomena through energy field dynamics.

11.3 Future Impact

$$\boxed{\text{All Physics} = \text{Deterministic energy field evolution}} \tag{27}$$

From quantum mechanics to cosmology, from particle physics to consciousness - everything emerges from the deterministic evolution of energy fields governed by $\partial^2 E = 0$.

The T0 revolution has transformed physics from probabilistic complexity to deterministic elegance.

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