

# **Chapter 1**

## **Deterministic Quantum Mechanics via T0-Energy Field Formulation:**

From Probability-Based to Ratio-Based Microphysics

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

Johann Pascher  
Department of Communications Engineering,  
Higher Technical Federal Institute (HTL), Leonding, Austria  
[johann.pascher@gmail.com](mailto:johann.pascher@gmail.com)

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## **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.

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## 1.1 Introduction: The T0 Revolution Applied to Quantum Mechanics

### 1.1.1 Building on T0 Foundations

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

**Stage 1 - Simplified Dirac Equation:** Complex  $4 \times 4$  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

### 1.1.2 The Quantum Mechanics Problem

Standard quantum mechanics suffers from fundamental conceptual problems:

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)

### 1.1.3 T0-Energy Field Solution

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

## T0 Deterministic Foundation

### Deterministic Energy Field Physics:

- Universal field: 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

## 1.2 T0-Energy Field Foundations

### 1.2.1 Modified Schrodinger Equation

From the T0 revolution, quantum mechanics is governed by:

$$i \cdot T(x, t) \frac{\partial \psi}{\partial t} = H_0 \psi + V_{T0} \psi \quad (1.1)$$

where:

$$H_0 = -\frac{\hbar^2}{2m} \nabla^2 \quad (1.2)$$

$$V_{T0} = \hbar^2 \cdot \delta E(x, t) \quad (1.3)$$

### 1.2.2 Energy-Time Duality

The fundamental T0 relationship:

$$T(x, t) \cdot E(x, t) = 1 \quad (1.4)$$

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

### 1.2.3 Empirical Parameter

Following precision measurements of the muon anomalous magnetic moment:

$$\xi = \frac{4}{3} \times 10^{-4} \approx 1.333 \times 10^{-4} \quad (1.5)$$

## 1.3 From Probability Amplitudes to Energy Field Ratios

### 1.3.1 Standard QM State Description

**Traditional approach:**

$$|\psi\rangle = \sum_i c_i |i\rangle \quad \text{with } P_i = |c_i|^2 \quad (1.6)$$

**Problems:** Mysterious superposition, only probability-based predictions.

### 1.3.2 T0-Energy Field State Description

**T0 field-theoretic approach:**

$$\boxed{\psi(x, t) = \sqrt{\frac{\delta E(x, t)}{E_0 V_0}} \cdot e^{i\phi(x, t)}} \quad (1.7)$$

with probability density:

$$\boxed{|\psi(x, t)|^2 = \frac{\delta E(x, t)}{E_0 V_0}} \quad (1.8)$$

**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

## 1.4 Deterministic Spin Systems

### 1.4.1 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:**

$$\langle \sigma_z \rangle_{T0} = \langle \sigma_z \rangle_{QM} + \xi \cdot \frac{\delta E(x, t)}{E_0} \quad (1.9)$$

### 1.4.2 Quantitative Example

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

**T0 correction to expectation value:**

$$\langle \sigma_z \rangle_{T0} = \langle \sigma_z \rangle_{QM} + \frac{4}{3} \times 10^{-4} \times \delta \sigma_z \quad (1.10)$$

## 1.5 Deterministic Quantum Entanglement

### 1.5.1 Standard QM Entanglement

**Bell state:** Antisymmetric superposition

**Problem:** Non-local spooky action at a distance

### 1.5.2 T0-Energy Field Entanglement

**Entanglement as correlated energy field structure:**

$$E_{12}(x_1, x_2, t) = E_1(x_1, t) + E_2(x_2, t) + E_{corr}(x_1, x_2, t) \quad (1.11)$$

**Correlation energy field:**

$$E_{corr}(x_1, x_2, t) = \frac{\xi}{|x_1 - x_2|} \cos(\phi_1(t) - \phi_2(t) - \pi) \quad (1.12)$$

### 1.5.3 Modified Bell Inequality

The T0 model predicts a modified Bell inequality:

$$|E(a, b) - E(a, c)| + |E(a', b) + E(a', c)| \leq 2 + \varepsilon_{T0} \quad (1.13)$$

with the T0 term:

$$\varepsilon_{T0} = \xi \cdot \frac{2\langle E \rangle \ell_P}{r_{12}} \quad (1.14)$$

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

$$\varepsilon_{T0} \approx 10^{-34} \quad (1.15)$$

## 1.6 Deterministic Quantum Computing

### 1.6.1 Qubit Representation

**T0-energy field qubit:**

$$\boxed{\text{qubit}_{\text{T}0} \equiv \{E_0(x, t), E_1(x, t)\}} \quad (1.16)$$

with field-theoretic amplitudes:

$$\alpha_{\text{T}0} = \sqrt{\frac{E_0}{E_0 + E_1}} \quad (1.17)$$

$$\beta_{\text{T}0} = \sqrt{\frac{E_1}{E_0 + E_1}} \quad (1.18)$$

### 1.6.2 Quantum Gates as Energy Field Operations

**Hadamard Gate**

**Corrected T0 transformation:**

$$H_{\text{T}0} : E_0 \rightarrow \frac{E_0 + E_1}{\sqrt{2}} \quad (1.19)$$

$$E_1 \rightarrow \frac{E_0 - E_1}{\sqrt{2}} \quad (1.20)$$

**Controlled-NOT Gate**

**T0 formulation:**

$$\text{CNOT}_{\text{T}0} : E_{12} \rightarrow E_{12} + \xi \cdot \Theta(E_1 - E_{\text{threshold}}) \cdot \sigma_x E_2 \quad (1.21)$$

### 1.6.3 Enhanced Quantum Algorithms

**Enhanced Grover Algorithm:**

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

## 1.7 Experimental Predictions and Tests

### 1.7.1 Enhanced Single-Measurement Predictions

**Example - Enhanced spin measurement:**

$$\boxed{P(\uparrow) = P_{\text{QM}}(\uparrow) \cdot \left(1 + \xi \frac{E_{\uparrow}(x_{\text{det}}, t) - \langle E \rangle}{E_0}\right)} \quad (1.22)$$

### 1.7.2 T0-Specific Experimental Signatures

Modified Bell Tests

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

Energy Field Spectroscopy

**Prediction:**

$$\Delta E = \xi \cdot E_n \cdot \frac{\langle \delta E \rangle}{E_0} \quad (1.23)$$

Phase Accumulation in Interferometry

**Prediction:**

$$\phi_{\text{total}} = \phi_0 + \xi \int_0^t \frac{E(x(t'), t')}{E_0} dt' \quad (1.24)$$

## 1.8 Resolution of Quantum Interpretation Problems

### 1.8.1 Problems Addressed by T0 Formulation

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

Table 1.1: Problems addressed by T0 formulation

### 1.8.2 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

## 1.9 Connection to Other T0 Developments

### 1.9.1 Integration with Simplified Dirac Equation

The enhanced QM naturally connects with the simplified Dirac equation through the time-energy duality.

### 1.9.2 Integration with Universal Lagrangian

The universal Lagrangian describes:

- Classical field evolution
- Quantum field evolution with T0 corrections
- Relativistic field evolution

## 1.10 Future Directions and Implications

### 1.10.1 Experimental Verification Program

#### Phase 1 - Precision Tests:

- Ultra-high precision Bell inequality measurements
- Atomic spectroscopy with T0 corrections
- Quantum interferometry phase measurements

**Phase 2 - Technological Enhancement:**

- T0-corrected quantum computing architectures
- Enhanced quantum sensor protocols
- Field correlation-based quantum devices

**1.10.2 Philosophical Implications**

Beyond Quantum Mysticism

**T0-enhanced quantum mechanics provides:**

- Physical foundation through energy field theory
- Measurable deviations from pure randomness
- Field-theoretic explanation of quantum phenomena
- Empirical grounding through precision measurements

**While preserving:**

- All successful predictions of standard QM
- Experimental continuity with established results
- Mathematical rigor and consistency

**1.11 Conclusion: The Enhanced Quantum Revolution****1.11.1 Revolutionary Achievements**

The T0-enhanced quantum formulation has achieved:

1. **Physical foundation:** Energy fields as basis for quantum mechanics
2. **Experimental consistency:** All standard QM predictions preserved
3. **Measurable corrections:** T0-specific deviations for tests
4. **T0 framework integration:** Consistent with other T0 developments
5. **Empirical grounding:** Parameter from precision measurements
6. **Enhanced predictive power:** New testable effects

### 1.11.2 Future Impact

$$\text{Enhanced QM} = \text{Standard QM} + \text{T0 Field Corrections} \quad (1.25)$$

The T0 revolution enhances quantum mechanics with field-theoretic foundations while preserving experimental success.

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