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

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Abstract

This document presents a revolutionary alternative to probability-based quantum mechanics through the deterministic T0-energy field formulation. Based on the closed, parameter-free T0 model, we demonstrate how quantum mechanical phenomena can be calculated using deterministic energy fields $T(x,t) = 1/\max(E(x,t), \omega)$, without relying on probability amplitudes and their collapse. The formulation preserves all experimentally verified predictions of standard quantum mechanics while extending these with precise single-measurement predictions and eliminating fundamental interpretation problems. Concrete calculation examples for spin systems, entanglement, and quantum transitions demonstrate the practical applicability of deterministic energy field physics in the microscopic domain.

Contents

1 Introduction: The Probability Problem of Quantum Mechanics

Standard quantum mechanics is based on fundamental probability concepts that lead to a series of interpretation problems:

1.1 Current Problems of Standard QM

Probability Basis:

$$|\psi\rangle = \alpha|\uparrow\rangle + \beta|\downarrow\rangle \tag{1}$$

with probabilities:

$$P(\uparrow) = |\alpha|^2 \tag{2}$$
$$P(\downarrow) = |\beta|^2 \tag{3}$$

Fundamental Problems:

- Only statistical predictions possible
- "Wave function collapse" mysterious and non-unitary
- Many-worlds vs. Copenhagen vs. other interpretations
- Measurement problem: When/how does collapse occur?
- No deterministic single-event predictions

1.2 T0-Energy Field as Alternative

The closed T0 model offers a fundamental alternative:

T0 Fundamental Principle

Instead of indeterminate probability amplitudes, the T0 model uses **deterministic energy fields**:

$$\boxed{T(x,t) = \frac{1}{\max(E(x,t),\omega)}} \tag{4}$$

All quantum mechanical phenomena arise from the deterministic evolution of these energy fields.

2 Foundations of T0-Energy Field Quantum Mechanics

2.1 Fundamental Field Equation

The T0 model is based on the field equation:

$$\nabla^2 E(x,t) = 4\pi G\rho_E(\vec{x},t) \cdot E(x,t) \tag{5}$$

where $\rho_E(\vec{x},t)$ is the energy density and $E(x,t)$ is the fundamental energy field.

Dimensional verification: $[\nabla^2 E(x,t)] = [E^2][E] = [E^3]$ and $[4\pi G\rho_E E(x,t)] = [1][E^{-2}][E^4][E] = [E^3]$ ✓

2.2 Time Field Definition

The intrinsic time field follows from:

$$\boxed{T(x,t) = \frac{1}{\max(E(x,t), \omega)}} \tag{6}$$

Dimensional verification: $[T(x,t)] = [1/E] = [E^{-1}]$ ✓

Physical meaning: The time field is inversely proportional to the characteristic energy scale and represents the local "time texture" of space.

2.3 E = m Identity in Natural Units

In the T0 model, fundamentally:

$$\boxed{E = m \text{ (in natural units)}} \tag{7}$$

This is not a conversion, but an **identity** - different names for the same physical quantity.

3 Elimination of Probability Interpretation

3.1 Standard QM State Description

Standard approach:

$$|\psi\rangle = \sum_i c_i |i\rangle \tag{8}$$

with $P_i = |c_i|^2$ as probabilities.

3.2 T0-Energy Field State Description

T0 alternative:

$$\boxed{\text{State} \equiv \{T(x,t)(\vec{x},t), E(x,t)(\vec{x},t)\}} \tag{9}$$

No probabilities - only deterministic field distributions.

Measurement values result directly from field values:

$$\text{Measurement} = f(T(x,t), E(x,t)) \quad \text{(deterministic)} \tag{10}$$

4 Concrete Calculation Formulations

4.1 Spin-1/2 Systems

4.1.1 Standard QM Formulation

State:

$$|\psi\rangle = \alpha|\uparrow\rangle + \beta|\downarrow\rangle \tag{11}$$

Expectation value:

$$\langle\sigma_z\rangle = \langle\psi|\sigma_z\psi\rangle = |\alpha|^2 - |\beta|^2 \tag{12}$$

4.1.2 T0-Energy Field Formulation

State: Energy field configuration

$$T_\uparrow(\vec{x}) = \frac{1}{E_\uparrow(\vec{x})} \tag{13}$$

$$T_\downarrow(\vec{x}) = \frac{1}{E_\downarrow(\vec{x})} \tag{14}$$

Deterministic expectation value:

$$\boxed{\langle\sigma_z\rangle_{T0} = \frac{T_\downarrow - T_\uparrow}{T_\downarrow + T_\uparrow}} \tag{15}$$

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

4.1.3 Equivalence Proof

For $|\alpha|^2 = T_\downarrow/(T_\downarrow + T_\uparrow)$ and $|\beta|^2 = T_\uparrow/(T_\downarrow + T_\uparrow)$:

$$\langle\sigma_z\rangle_{QM} = |\alpha|^2 - |\beta|^2 \tag{16}$$

$$= \frac{T_\downarrow}{T_\downarrow + T_\uparrow} - \frac{T_\uparrow}{T_\downarrow + T_\uparrow} \tag{17}$$

$$= \frac{T_\downarrow - T_\uparrow}{T_\downarrow + T_\uparrow} = \langle\sigma_z\rangle_{T0} \tag{18}$$

Identical predictions, but deterministically calculable!

4.2 Electron Spin in Magnetic Field

4.2.1 Standard QM with Statistical Predictions

Hamiltonian:

$$H = -\vec{\mu} \cdot \vec{B} = -\gamma(\sigma_x B_x + \sigma_y B_y + \sigma_z B_z) \tag{19}$$

Thermal expectation value:

$$\langle\sigma_z\rangle = \tanh\left(\frac{\mu B}{k_B T}\right) \tag{20}$$

4.2.2 T0-Deterministic Formulation

Energy field configuration in B-field:

$$T_\uparrow = \frac{1}{E_0 + \mu B} \tag{21}$$

$$T_\downarrow = \frac{1}{E_0 - \mu B} \tag{22}$$

Deterministic expectation value:

$$\boxed{\langle\sigma_z\rangle_{T0} = \frac{T_\downarrow - T_\uparrow}{T_\downarrow + T_\uparrow} = \frac{2\mu B}{2E_0} = \frac{\mu B}{E_0}} \tag{23}$$

For $E_0 = k_B T$: $\langle\sigma_z\rangle_{T0} = \frac{\mu B}{k_B T} \approx \tanh\left(\frac{\mu B}{k_B T}\right)$ for small fields.

5 Entanglement without Probability Superposition

5.1 Standard QM Entanglement

Bell state:

$$|\Psi^-\rangle = \frac{1}{\sqrt{2}}(|\uparrow\downarrow\rangle - |\downarrow\uparrow\rangle) \tag{24}$$

Problem: Mysterious "superposition" of non-classical states.

5.2 T0-Energy Field Entanglement

Entanglement as correlated energy field structure:

$$\boxed{T_{12}(\vec{x}_1, \vec{x}_2) = \frac{1}{E_1(\vec{x}_1) + E_2(\vec{x}_2)}} \tag{25}$$

Correlation condition:

$$E_1(\vec{x}_1) + E_2(\vec{x}_2) = \text{const} \tag{26}$$

Physical meaning: Entanglement arises through **energetic correlations** in field structure, not through mysterious superposition.

5.3 Bell Inequality in T0 Formulation

Modified Bell inequality:

$$\boxed{|E(a,b) - E(a,c)| + |E(a',b) + E(a',c)| \leq 2 + \varepsilon(E_1, E_2)} \tag{27}$$

with the T0 correction term:

$$\varepsilon(E_1, E_2) = \alpha_{\text{corr}} \left| \frac{1}{E_1} - \frac{1}{E_2} \right| \frac{2G\langle E \rangle}{r} \tag{28}$$

Dimensional verification: $[\varepsilon] = [1][E^{-1}][E^{-2}][E][E] = [1]$ (dimensionless) ✓

6 Deterministic Quantum Transitions

6.1 Standard QM: Random Jumps

Transition probability:

$$P_{i\to j} = \frac{|\langle j|H_{\text{int}} i\rangle|^2}{\hbar^2} \frac{\sin^2(\omega t/2)}{(\omega/2)^2} \tag{29}$$

Problem: When exactly does the transition occur? (Random)

6.2 T0: Resonance-based Transitions

Transition condition:

$$\boxed{T(E_i) = T(E_j) \Rightarrow \frac{1}{E_i} = \frac{1}{E_j} \Rightarrow E_i = E_j} \tag{30}$$

Transition occurs at energy field resonance, not randomly!
Time deterministically calculable:

$$t_{\text{transition}} = t \text{ for which } E_i(t) = E_j(t) \tag{31}$$

7 Two-Level System: Deterministic Rabi Oscillations

7.1 Standard QM Formulation

Time evolution:

$$|\psi(t)\rangle = e^{-iHt/\hbar}|\psi(0)\rangle \tag{32}$$

Occupation probabilities:

$$P_1(t) = |\langle 1|\psi(t)\rangle|^2 = \cos^2(\Omega t/2) \tag{33}$$

$$P_2(t) = |\langle 2|\psi(t)\rangle|^2 = \sin^2(\Omega t/2) \tag{34}$$

7.2 T0-Deterministic Formulation

Energy field evolution:

$$T_1(t) = T_1(0)\cos^2(\Omega t/2) \tag{35}$$

$$T_2(t) = T_2(0)\sin^2(\Omega t/2) \tag{36}$$

with normalization condition:

$$T_1(t) + T_2(t) = T_{\text{total}} = \text{const} \tag{37}$$

Identical predictions as standard QM, but without probability interpretation!

8 Quantum Computing with T0-Energy Fields

8.1 Qubit Representation

Standard QM qubit:

$$|\text{qubit}\rangle = \alpha|0\rangle + \beta|1\rangle \tag{38}$$

T0-energy field qubit:

$$\boxed{\text{qubit}_{T0} \equiv \{T_0(\vec{x}), T_1(\vec{x})\}} \tag{39}$$

with $T_0 = 1/E_0$ and $T_1 = 1/E_1$.

8.2 Quantum Gates as Energy Field Transformations

8.2.1 Hadamard Gate

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

T0: $H_{T0} : T_0 \to T_0' = \frac{T_0+T_1}{2}$, $T_1 \to T_1' = \frac{T_0+T_1}{2}$

8.2.2 CNOT Gate

T0 formulation:

$$\text{CNOT}_{T0} : T_{12} \to T_{12}' = f(T_1, T_2) \tag{40}$$

with a deterministic function f that establishes energy field correlation.

8.3 Quantum Algorithms Deterministically

Shor's algorithm: Period finding through energy field resonances

Grover's search: Amplitude amplification = energy field focusing

All algorithms run **deterministically** - the result is uniquely predictable for given initial conditions.

9 Experimental Consequences and New Measurement Techniques

9.1 New Measurement Device Concepts

9.1.1 Time Field Detectors

Devices for direct measurement of $T(x,t)(\vec{x})$ instead of statistical frequencies.

9.1.2 Energy Field Mappers

Spatial mapping of energy field distribution $E(x,t)(\vec{x})$.

9.1.3 T0 Interferometers

Interference between different energy field configurations.

9.2 Single-Measurement Predictions

Standard QM: Only statistical predictions possible

T0 model: **Precise prediction for each individual measurement**

$$\text{Single result} = f(T(x,t)(\vec{x}_{\text{detector}}, t_{\text{measurement}})) \tag{41}$$

9.3 T0-Specific Corrections

The T0 model makes specific predictions that distinguish it from standard QM:

- Energy-dependent Bell corrections
- Gravitationally coupled quantum correlations
- Deterministic collapse-free measurements

10 Elimination of QM Interpretation Problems

10.1 Solved Problems

Measurement problem: Eliminated - no "collapse", only continuous field evolution

Schrödinger's cat: Eliminated - deterministic field evolution, no superposition

Many-worlds vs. Copenhagen: Eliminated - single, deterministic reality

Quantum jump problem: Eliminated - continuous transitions at resonances

10.2 Simplified Quantum Reality

T0 Quantum Reality

Simple, deterministic description:

- Energy fields $\{T(x,t), E(x,t)\}$ exist as real entities
- They evolve according to deterministic field equations
- Measurements reveal current field values
- No mysterious probability amplitudes
- No non-unitary collapse processes

11 Practical Implementation

11.1 Rewriting Existing QM Formulas

Systematic translation:

$$|\psi|^2 \to \text{T-field density} \tag{42}$$

$$\left\langle \psi \middle| \hat{O}\psi \right\rangle \to \text{Energy field average} \tag{43}$$

$$P_i \to T_i/T_{\text{total}} \tag{44}$$

11.2 New Calculation Methods

11.2.1 Field Differential Equations

Instead of Schrödinger equation:

$$\frac{\partial T(x,t)}{\partial t} = f(\nabla^2 T(x,t), E(x,t), \ldots) \tag{45}$$

11.2.2 Energy Field Simulations

Numerical integration of T0 field equations for complex systems.

11.2.3 Deterministic Monte Carlo

Statistical methods for deterministic energy field transport.

12 Comparison: Standard QM vs. T0-Deterministic QM

13 Conclusions and Outlook

13.1 Revolutionary Possibilities

The T0-energy field formulation opens fundamental new possibilities:

1. **Deterministic quantum mechanics** without probability mysticism

Aspect	**Standard QM**	**T0-Deterministic QM**
Foundation	Probability amplitudes	Deterministic energy fields
State description	$\|\psi\rangle = \sum_i c_i \|i\rangle$	$\{T(x,t), E(x,t)\}$
Measurement predictions	Only statistical: $P_i = \|c_i\|^2$	Deterministic: $f(T,E)$
Time evolution	Unitary + non-unitary collapse	Continuously deterministic
Interpretation problems	Many (collapse, many-worlds, ...)	None (single deterministic reality)
Single measurements	Unpredictable (random)	Precisely predictable
Entanglement	Mysterious superposition	Energy field correlations
Bell inequality	Standard form	Modified with T0 correction
Experimental equivalence	-	Yes (+ new T0 effects)

Table 1: Comparison Standard QM vs. T0-Deterministic QM

2. **Precise single-measurement predictions** instead of only statistics
3. **Elimination of all QM interpretation problems**
4. **New experimental techniques** (time field detectors, energy field mappers)
5. **Deterministic quantum computer algorithms**
6. **Simplified quantum reality** (single, deterministic world)

13.2 Experimental Verification

The T0 model makes specific, testable predictions:

- Energy-dependent Bell corrections: $\varepsilon(E_1, E_2)$
- Gravitationally coupled quantum correlations
- Deterministic transitions at calculable times
- Direct energy field measurements

13.3 Paradigm Shift in Quantum Physics

Quantum Physics Revolution

From probabilistic to deterministic microphysics:
The T0-energy field model shows that quantum mechanics without probability amplitudes, without mysterious collapse, and without interpretation problems is possible.
All quantum mechanical phenomena arise from the deterministic evolution of energy fields.

13.4 Future Research Directions

- Development of time field measurement devices
- Experimental verification of T0-Bell corrections
- Deterministic quantum computer architectures
- Energy field-based QM textbooks

- Philosophical reconsideration of quantum reality

The T0 model could change quantum mechanics as fundamentally as Einstein revolutionized classical physics.

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