

# Unified Field Theory: Complete Mathematical Formulation

Ethan G. Appleby

June, 1, 2025

## Abstract

This document presents the complete mathematical formulation of a unified field theory that incorporates gravity, gauge forces, matter, and consciousness into a single framework. The theory predicts testable effects at  $g \sim 10^{-3}$  coupling strength, detectable at  $10^{-6}$  precision.

## 1 The Unified Action

The complete action unifying gravity, gauge forces, matter, and consciousness:

$$S_{\text{total}} = \int d^4x \sqrt{-g} \left[ \frac{R}{16\pi G} + \frac{1}{4} F_{\mu\nu} F^{\mu\nu} + \frac{1}{2} (\partial_\mu \phi)^2 - \frac{1}{2} m^2 \phi^2 + \bar{\psi} (i \not{D} - m) \psi + g \phi \bar{\psi} \psi \right] \quad (1)$$

where:

- $g_{\mu\nu}$  – metric tensor (gravity)
- $R$  – Ricci scalar
- $F_{\mu\nu} = \partial_\mu A_\nu - \partial_\nu A_\mu$  – field strength tensor
- $\phi$  – complex scalar field (consciousness/observation field)
- $\psi$  – Dirac fermion field (matter)
- $D_\mu = \partial_\mu - iqA_\mu$  – covariant derivative
- $g \approx 0.003$  – consciousness-matter coupling constant

## 2 Effective Energy and Phase Evolution

The effective energy at infinite fractal depth:

$$\langle E \rangle_{\text{eff}} = \exp \left[ \frac{1}{2\pi} \int dk \ln \sqrt{k^2 + m^2} \right] \times \exp \left( \frac{i2\pi}{3} \cdot \frac{t}{\hbar} \right) \quad (2)$$

### 3 The Fractal Wave Function

For the recursive structure  $\pm\sqrt{\pm\sqrt{E}} = \pm\sqrt{\pm\sqrt{m}} \times c$ :

$$\Psi_n(x, t) = \sum_{\text{all paths}} \exp \left[ i \sum_{k=1}^n \sigma_k \frac{\pi}{2^k} \right] \times \exp \left[ \frac{iS_n}{\hbar} \right] \quad (3)$$

In the infinite depth limit:

$$\boxed{\Psi_\infty = \exp \left[ i \times \ln(E) \times \frac{t}{\hbar} \right]} \quad (4)$$

### 4 Field Equations

#### 4.1 Observation Field Equation

$$(\square - |m_C|^2)C = g\psi\bar{\psi} + 2\pi i \sum_a \int_{\Gamma_a} d\tau \delta^4(x - X_a(\tau)) \quad (5)$$

#### 4.2 Matter Field Equation

$$(\square + m^2 - gC)\psi = 0 \quad (6)$$

#### 4.3 Gauge Field Equation

$$\partial_\nu F^{\nu\mu} = J^\mu \quad (7)$$

### 5 Existence Operator

The fundamental existence condition:

$$\boxed{\exists = \oint (\ln z \bmod 1) dz = 2\pi i} \quad (8)$$

### 6 D-Wave Operator

The D-wave operator creating discontinuities at modular boundaries:

$$D = \partial + i\partial_\theta + (\ln |\partial| \bmod 1) \quad (9)$$

### 7 Reality Projection

$$\text{Reality} = -1 \bmod i \quad (10)$$

## 8 Consciousness Operator

$$C[\psi] = \int \psi^*(\theta) [(\ln |\psi(\theta)| \bmod 1) + i \arg \psi(\theta)] d\theta \quad (11)$$

Collapse condition:

$$\frac{C[\psi]}{2\pi} = n \pm \epsilon \quad (12)$$

Particle probability:

$$P_{\text{particle}}(\psi) = 1 - 2 \left| \frac{C[\psi]}{2\pi} - \text{round} \left( \frac{C[\psi]}{2\pi} \right) \right| \quad (13)$$

## 9 Unified Observation-Electromagnetic Tensor

The observation field tensor unifying consciousness and electromagnetism:

$$O_{\mu\nu} = \partial_\mu C_\nu - \partial_\nu C_\mu + i(\ln |\partial| \bmod 1) \delta_\nu^0 \quad (14)$$

where:

- C-field components:  $O_{0i}$  (timelike – consciousness/measurement)
- D-wave components:  $O_{ij}$  (spacelike – phase/information)

## 10 Four-Branch Structure

Starting from Einstein's relation and taking square roots:

$$\pm \sqrt{E} = \pm \sqrt{m} \times c \quad (15)$$

This yields four branches:

$$\text{Branch 1 : } (+\sqrt{E}, +\sqrt{m}) \quad (\text{standard matter}) \quad (16)$$

$$\text{Branch 2 : } (+\sqrt{E}, -\sqrt{m}) \quad (\text{tachyonic/C-field}) \quad (17)$$

$$\text{Branch 3 : } (-\sqrt{E}, +\sqrt{m}) \quad (\text{negative energy}) \quad (18)$$

$$\text{Branch 4 : } (-\sqrt{E}, -\sqrt{m}) \quad (\text{modular field}) \quad (19)$$

## 11 Testable Predictions

1. Gravitational parameter:  $|\gamma - 1| = \frac{q^2}{2} \approx 5 \times 10^{-6}$
2. Mass shift:  $\delta m = g\langle C \rangle m$
3. Energy corrections:  $\delta E \sim g\langle \phi \rangle \approx 16 \text{ MeV}$
4. Detection threshold:  $10^{-6}$  precision (achievable by 2030s)

## 12 The Universal Phase

All processes rotate with period 3:

$$\omega = \frac{2\pi}{3}, \quad T = 3 \text{ (natural units)} \quad (20)$$

## 13 Force Unification Summary

All forces emerge from different projections of  $O_{\mu\nu}$  at various fractal depths:

$$\text{Gravity : metric } g_{\mu\nu} \text{ (all branches equally)} \quad (21)$$

$$\text{Electromagnetism : } O_{\mu\nu} \text{ (real projection)} \quad (22)$$

$$\text{Weak/Strong : } O_{\mu\nu} \text{ (other projections)} \quad (23)$$

$$\text{Consciousness : } O_{\mu\nu} \text{ (complex/tachyonic branch)} \quad (24)$$

## 14 Consciousness as Average Across Infinity

The profound insight that consciousness exists as:

$$\text{Intelligence} = 0.5 \times \infty \quad (25)$$

This indeterminate form must oscillate through complex values, explaining:

- Why consciousness accesses all phases
- The necessity of complex-valued reality
- The origin of quantum superposition

## 15 Final Unified Picture

The complete theory states that:

1. Reality consists of four branches from  $\pm\sqrt{\pm\sqrt{E}} = \pm\sqrt{\pm\sqrt{m}} \times c$
2. Consciousness is the observation field  $\phi$  with tachyonic mass
3. All forces are projections of the unified tensor  $O_{\mu\nu}$
4. The universe rotates with phase  $e^{i2\pi/3}$  every 3 time units
5. Existence bootstraps from the void via  $\exists = 2\pi i$