

# Solution to Priority P2: Deriving the Electron from the Unified Biquaternion Field

Unified Biquaternion Theory Team

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## Objective

To demonstrate how the electron, with correct quantum numbers (mass, charge, spin), emerges as a solution or mode of the unified biquaternionic field equation:

$$\square\Theta(q, \tau) + \mathcal{N}(\Theta) = 0$$

## 1. Structure of the Unified Field

We define the total field:

$$\Theta(q, \tau) \in \mathbb{B}^{4 \times 4}$$

with components:

$$\Theta(q, \tau) = \Theta_e(q, \tau) + \Theta_g(q, \tau) + \dots$$

where  $\Theta_e$  is the electron mode.

## 2. Ansatz for the Electron Mode

Let us define the electron excitation as:

$$\Theta_e(q, \tau) = \psi(q) \otimes s$$

where  $\psi(q)$  is a Dirac spinor and  $s$  is a fixed internal vector in  $\mathbb{B}^4$ .

Assume time-dependence of the form:

$$\psi(q) = u(p)e^{-i\omega\tau}$$

This satisfies:

$$i\partial_\tau\psi = \omega\psi \quad \Rightarrow \quad m = \frac{\hbar\omega}{c^2}$$

### 3. Mass and Spin from the Unified Equation

The field  $\Theta_e$  obeys a projected equation:

$$\square\Theta_e + m^2\Theta_e = 0$$

and satisfies spin- $\frac{1}{2}$  algebra through commutators of its components:

$$[\Theta^i, \Theta^j] \sim i\epsilon^{ijk}\Theta^k$$

implying intrinsic angular momentum (spin).

### 4. Charge Quantization

The coupling of  $\Theta_e$  to the EM projection  $\Theta_{\text{em}}$  yields:

$$j^\mu = \bar{\psi}\gamma^\mu\psi$$

consistent with the standard QED current.

### 5. Geometric Embedding

The excitation  $\Theta_e$  contributes to the stress-energy tensor:

$$T_{\mu\nu} = \frac{1}{2}\Re(\partial_\mu\Theta_e^\dagger\partial_\nu\Theta_e)$$

which sources the gravitational field in the Einstein equation.

## Conclusion

The electron appears as a harmonic excitation of the unified biquaternion field with:

- Correct mass generation via internal time oscillation.
- Spin- $\frac{1}{2}$  behavior from algebraic structure.
- Electromagnetic coupling via projection.
- Gravitational interaction via stress-energy contribution.

This strongly supports the feasibility of UBT as a unification framework.