UNNS and the Dirac Equation: Toward a Recursive Substrate for Fermions

Abstract

The Dirac equation unifies special relativity and quantum mechanics, introducing spinors and predicting antimatter. We propose an interpretation of the Dirac framework through the lens of UNNS (Unbounded Nested Number Sequences). In this approach, spinor structure arises as recursive doubling, gamma matrices are recast as operator grammars, and gauge interactions become discrete connections across recursive nests. This opens a potential substrate-theoretic bridge between arithmetic recursion and quantum field theory.

1 The Dirac Equation

The Dirac operator
$$(i\gamma^\mu \partial_\mu - m)\psi = 0$$
is fundamental for describing spin-$\frac{1}{2}$ particles. It features:

- A four-component spinor ψ.

- Gamma matrices γ^μ satisfying $\{\gamma^\mu, \gamma^\nu\} = 2\eta^{\mu\nu}$.

- Mass parameter m, linking recursion across components.

2   Spinor Structure as Recursive Doubling

[Recursive Spinor Nest] A Dirac spinor ψ corresponds to a double recursive nest:

$$\psi \; \cong \; \text{Nest}_2^{(\text{spin})} \otimes \text{Nest}_2^{(\text{particle/antiparticle})}.$$

Thus, fermionic structure naturally arises from UNNS-style recursive doubling.
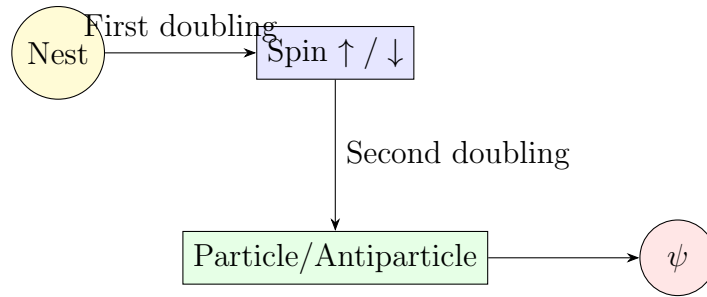
3   Gamma Matrices as Operator Grammar

UNNS operators parallel gamma matrices:

$$\gamma^0 \; \leftrightarrow \; \text{Collapse (time/energy anchor)},$$
$$\gamma^i \; \leftrightarrow \; \text{Inlaying operators (spatial embeddings)}.$$

Thus, the Dirac operator is seen as a composite UNNS grammar linking recursion across nests.

4   Echo Symmetry and Antimatter

Every UNNS recursion produces forward and echo states. Antiparticles correspond to the stabilized echo spectrum of fermionic recursion.

This reframes Dirac's antimatter prediction as an inherent property of recursion symmetry.

5 Gauge Coupling as UNNS Connection

In standard QED, gauge invariance is introduced by replacing $\partial_\mu \to D_\mu = \partial_\mu + ieA_\mu$.

[Discrete Gauge Connection] In UNNS, A_μ is interpreted as a *connection operator* that shifts recursive indices across nests. Gauge invariance thus encodes consistency of recursive embeddings.

This maps electromagnetic interaction into the UNNS substrate as a correction ensuring stable recursion flow.

6 Probability Currents as Recursive Flows

The conserved current

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

is understood as a flow of recursive amplitude across lattice layers. Conservation of j^μ reflects stabilization of recursion under operator coupling.

7 Toward a UNNS-QED Analogy

- Spinor doubling = recursive nests.

- Gamma matrices = operator grammar.

- Antimatter = recursion echoes.

- Gauge fields = connection operators.

- Conserved currents = stabilized recursive flows.

Thus, QED may be re-read as a field theory arising from arithmetic recursion.

Conclusion

The Dirac equation, reinterpreted in UNNS terms, points to a deeper view:

- Fermions as recursive nests.

- Gauge fields as connection stabilizers.

- Currents as recursive flows.

While speculative, this suggests that quantum field structures might ultimately emerge from arithmetic recursion grammars, making UNNS a candidate substrate for fermionic physics.