Matter Universe: According to QM, Nonassociativity $\simeq$ Unobservability

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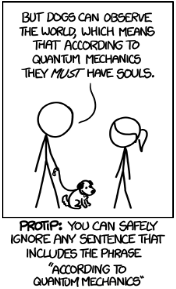

Essential pieces

$$so(1,3) \times u(1) \times su(2) \times su(3)$$

Fermions require Dirac spinors: space-time fields living in $\mathbf{C}^4$.

Dirac spinors require the Dirac algebra:
$\mathbf{D} \simeq \mathbf{C}(4)$, the complexified Clifford algebra of 1,3-space-time.

Parity nonconservation requires $\mathbf{D}$ be thought of as $\mathbf{P}(2)$:
$\mathbf{P} \simeq \mathbf{C}(2) =$ Pauli algebra.

$$\gamma_0 = \begin{bmatrix} 0 & \sigma_0 \\ \sigma_0 & 0 \end{bmatrix}, \ \gamma_k = \begin{bmatrix} 0 & \sigma_k \\ -\sigma_k & 0 \end{bmatrix}, \ \gamma_5 = i \prod \gamma_\mu = \begin{bmatrix} \sigma_0 & 0 \\ 0 & -\sigma_0 \end{bmatrix}$$

Perversion Step 1: New Pauli

$$\mathbf{P} = \mathbf{C} \otimes \mathbf{H} \text{ (redefined)}.$$

So new Dirac algebra: $\mathbf{D} = \mathbf{P}_L(2) = \mathbf{C} \otimes \mathbf{H}_L(2)$.

$$\epsilon = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \ \alpha = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}, \ \beta = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \ \gamma = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}.$$

$$\gamma_0 = q_{L0}\beta, \ \gamma_k = iq_{Lk}\gamma \ \gamma_5 = i\prod \gamma_\mu = \alpha.$$

New spinors:

$$\mathbf{P}^2 = \mathbf{C} \otimes \mathbf{H}^2.$$

Twice the dimensionality of ordinary Dirac spinor: $SU(2)$ doublet. Internal $SU(2)$ from unit elements of $\mathbf{H}_R$. This is new.

Perversion Step 2: Octonions

$$\mathbf{T} = \mathbf{C} \otimes \mathbf{H} \otimes \mathbf{O}$$

New Clifford algebra, a Dirac algebra for 1,9-spacetime:

$$\mathbf{T}_L(2) = \mathbf{C} \otimes \mathbf{H}_L \otimes \mathbf{O}_L(2)$$

New spinor space: $\mathbf{T}^2$.
New Clifford algebra 1-vectors (sort of canonical)

$$\{\beta, \ \gamma q_{Lk} e_{L7}, \ k = 1, 2, 3, \ \gamma i e_{Lp}, \ p = 1, ..., 6\}$$

(Time, 3-space, 6-space).

Unobservable stuff (explanation in larger theory, of which this is a kernel)

Extra 6 dimensions:

$$\gamma i e_{Lp}, \; p = 1, ..., 6$$

Quarks and anti-quarks:

$$\text{Quarks: } \rho_+ \mathbf{T}^2 \rho_-, \text{ and Anti-quarks: } \rho_- \mathbf{T}^2 \rho_+,$$

both linear in $e_p, \; p = 1, ..., 6$.

$$\rho_\pm := \frac{1}{2}(1 \pm i e_7).$$

Project down to Observable stuff

Need to project out anything linear in the e_p, $p = 1, ..., 6$, (or e_{Lp}, $p = 1, ..., 6$).
Spinor space:

$\rho_+ \mathbf{T}^2 \rho_+$ Matter (Leptons), $\rho_- \mathbf{T}^2 \rho_-$ Anti-Matter (Anti-Leptons), .

Clifford Algebra (just Matter): $\rho_{L+}\rho_{R+}\mathcal{CL}(1,9)\rho_{R+}\rho_{L+}$.

$$\text{1-vectors: } \{\beta,\ \gamma q_{Lk} e_{L7},\ k = 1,2,3,\ \gamma i e_{Lp},\ p = 1,...,6\} \longrightarrow$$

$$\{\beta,\ \gamma i q_{Lk},\ k = 1,2,3,\}\rho_{R+}\rho_{L+}.$$

2-vectors: $\rho_{L+}\rho_{R+} so(1,9)\rho_{L+}\rho_{R+} = (so(1,3) \times u(1) \times su(3))\rho_{L+}\rho_{R+}$

What's left?

Total symmetry:

$$(so(1,3) \times u(1) \times su(2) \times su(3))\rho_{L+}\rho_{R+}$$

This, and the 1-vectors of $\rho_{L+}\rho_{R+}\mathcal{CL}(1,9)\rho_{R+}\rho_{L+}$, which is

$$\{\mathcal{CL}(1,3) + \text{ extra bits }\}\rho_{R+}\rho_{L+},$$

act on

$$\rho_+\mathbf{T}^2\rho_+,$$

which is MATTER - no anti-matter.

Interpretation

Projecting everything down to just observable bits yields:

1. A Clifford algebra for 1,3-spacetime with
2. Extra bits, including $u(1) \times su(2) \times su(3)$ internal symmetry,
3. All of which (in this case) see only Matter.

The universe we observe is the same.

A version of this will exist for Anti-Matter.

The extra 6 dimensions carry $SU(3)$ charges, and link the Matter and Anti-Matter 1,3-spacetimes.

Numerous Nobel Prizes ...

await those who come up with
the overarching theory of which
this is but a kernel.
IMHO