Continuation of the Fermion-Number Operator and the Puzzle of Families

Gerald L. Fitzpatrick

PRI Research and Development Corp.
12517 131 Ct. N. E.
Kirkland, WA 98034

Abstract

An “analytic continuation” of a Hermitian matrix representing the conventional fermion-number operator, leads to a new, and unconventional, internal description of quarks and leptons. This phenomenological description, unlike the conventional standard-model description, is capable of explaining, among other things, why there are just three families of quarks and leptons. These facts provide indirect evidence that the analytic continuation in question somehow reflects physics at the Planck level where flavor degrees-of-freedom presumably originate.
Mixtures
- "Topological Constraints on Long Distance Neutrino Puzzles of Families"
- "Continuation of the Fermion Number Operator and the Electric Charge as a Vector Quantity"

Papers available at the LANL Physics-e-Print archive:

Detailed description, two technical reviews, and a table of contents.

Algebraic and Geometric Regularities. See Book: "The Family Problem--New Internal

A Relevant Book and Papers by G. L. Fitzpatrick
Presentations Outline

- Conclusions
- Family Replication, Experimantal Signals
- Distingushiing Quarks and Leptons
- Representing Flavors and Flavor Doublets
- A new internal non-Euclidean 2-space
- Analytic continuation of this operator
- The conventional Fermion-number-number operator
- Introduction and Background
description of quarks and leptons

This extension will lead to a new internal generalizing the fermion-number operator by extending the standard model description by

- Extending the standard model
- Mechanism (family replication)
- The need for a spectrum-generating

Symmetries of the Lagrangian

Global charges associated with accidental

Introduction and Background
This number of fermions makes the number of

\[ F(0) = 0 \]

\[ H = \mu \mu \mu \]

\[ \langle \psi_0 | \psi_0 \rangle = \frac{1}{\mu} \]

\[ \langle \psi_0 | \psi_0 \rangle = \langle \mu | \mu \rangle \]

\[ \mu = \epsilon \]

\[ \mu = \epsilon \]

Number Operator

The Conventional Fermion-Fermion...
Number Operator

The Conventional Fermion
\[ F(z) = (\frac{a}{z}) \]

Thus, for any $F(z)$, we have:

\[ F(z) = (\cos \theta \sin \phi, \sin \theta \cos \phi, \sin \theta \sin \phi) \]

Then, for $\theta = \pi$, $E = 2$, $\gamma = 2$,

\[ F(z) = (\text{sine}^2 \phi, \text{cos}\phi, \text{sine}^2 \phi) \]

This shows that for $\text{sine}^2 \phi$, $\text{cos}\phi$, $\text{sine}^2 \phi$, $\text{cos}\phi$, $\text{sine}^2 \phi$, $\text{cos}\phi$, we must have:

\[ \theta \geq 2 \pi, E \geq 2 \]

To maintain $F(z)$, we need the conditions $\text{sine}^2 \phi \geq \text{cos}\phi$, $\text{sine}^2 \phi \geq \text{cos}\phi$, $\text{sine}^2 \phi \geq \text{cos}\phi$.

Analytic Continuation of the OP.
A New Interior Non-Euclidean 2-Space
$\langle a, b \rangle$, $-a = -a + a = 0$

$\langle 0, b \rangle \subseteq \langle a, b \rangle$ is a subspace of $\mathbb{R}^2$.

Let $-b = a - b$. Then $\langle a, b \rangle$ and $\langle -b, a \rangle$ are complementary subspaces.

Clearly, the vector product $\langle a, b \rangle \mapsto \langle -b, a \rangle$ is linear.

The above shows that $\langle a, b \rangle$ can be transformed as above.

\[ \langle -b, a \rangle \]

---

2-space is the 2-plane in $\mathbb{R}^3$.

The action of $-\text{vec}$ can be understood in the 3-space. The vector $x = \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$ is transformed under the map $-\text{vec}$ to $\begin{pmatrix} -1 \\ -1 \\ 0 \end{pmatrix} = -F(x)$.

Change of the angle of the change - The commutator of $F$, $\langle -x, F(x) \rangle = \langle F(-x), -x \rangle = -F^T(x) - F(x)$.

Then it is easy to see that the non-Euclidean space.

When $a = 0$, $F(a) = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$.

**A New Integral Non-Euclidean**
Representing flavors and Flavor Doublets (Quarks)

\[ Q \text{ is an eigenmictor of } F(v) \]
\[ Q = U + V \text{ represents flavor and flavor doublets.} \]
\[ Q = \{ q_1, q_2 \} \]
\[ U = \{ u_1, u_2 \} \]
\[ V = \{ v_1, v_2 \} \]
\[ Q^2 = U^2 + 2U \cdot V + V^2 \]
\[ 2U \cdot V = 2(u_1v_1 - u_2v_2) \]
\[ U^2 = u_1^2 - u_2^2 \]
\[ V^2 = v_1^2 - v_2^2 \]
 Doubles  

Representing flavors and Flavor
The components of the motion $\vec{v}$ of $\vec{F}$ under

\[
\vec{F} \times \vec{v} = \vec{0},
\]

\[
\vec{F} \cdot \vec{v} = m \vec{c},
\]

Lepetons

Distinguishing Quarks and
\[ 1 + (\frac{1}{f})^2 = (\frac{1}{f})^2 \]

\[ \frac{2(\sqrt{m^2} - f)}{m^2 - 1} \]

\[ \sqrt{m^2 + 1} \]

\[ 0,1,\pm\frac{1}{3} \]

Leptons

Distinguishing Quarks and Leptons
Family Replication,
Experimental Signals

1. According to the 2-space description, there are internal differences between the three neutrinos $\nu_e$ and $\nu_\mu, \nu_\tau$. The $\nu_e$ and $(\nu_\mu + \nu_\tau)$ nectar transits $(Q, U, V)$ have different topologies with respect to the internal transformation $F(u)$. The $\nu_e$ and $(\nu_\mu + \nu_\tau)$ have the topology of a cylinder (nuclear strip).

2. Assuming that a change in topology during neutrino mixing is suppressed, while neutrino mixing without topology change is (relatively) enhanced, one can explain the experimental observation of bi-maximal mixing of $\nu_e$ and $\nu_\mu$.

3. The neutrino mass matrix (and mixing parameters) needed to explain bi-maximal mixing are the result, at least in part, of deeper (internal) topological differences between neutrinos.
Conclusions

The matrix (I) provides a new understanding (non-Fuduedo x-plane)

The new matrix

For example: Fuduedo, Fuduedo x-plane