Leptonic mixing, CP violation and Leptogenesis

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Based collaborations with:
In the Standard Model, according to the equation (B-L) ψ ≤ 2 units.

This is exact in B-L conservation,

No Møgensen mass at higher orders,

No scalar triplet is introduced.

No Møgensen mass at the GUT scale since the GUT scale is not introduced strictly massless

In the Standard Model, Møgensen mass...
Same applies to SU(5) GUT,
where B-L is an accidental symmetry.

No leptonic mixing in the SM:

$$\bar{\nu}_L^0 \gamma \nu L_i^0 \bar{W}_m$$  $$\nu^0_L, l^0_L$$ weak eigenstates

After diagonalization of the charged lepton mass matrix:

$$\bar{\nu}_L^0 \gamma \nu L^0_L$$  $$\nu^0_L, l^0_L$$ mass eigenstates

But $V$ can be eliminated through a redefinition of $\nu^0_L$:  $$\bar{L}_L^0 \gamma l_L^0 \bar{W}_m$$  flavoured diagonal
What happens if we introduce R?  

No. R are introduced.

A "Strange" Feature of the SM:  

A flavor of the SM which allows for new-existing neutrino masses beyond the SM.  

What model strategy of the SM which provides clear evidence for New Physics.  

Discussion of underlying oscillation 3
One may then write the most general degeneration

\[ \frac{\lambda}{\mu} \rightarrow (x) \]

graded:

\[ (x) \rightarrow \phi \rightarrow \psi \]

and since the gauge invariant...
mass.

explanation for the smallness of neutrino masses, predicting a scale and placing SM, simply and more "natural", than the "simple" and more "natural". Thus the SM, sometime directed SMU, is actually

Not that this minimal extension of the

\[ (M)_{\text{heavy}} \approx \frac{M}{e} \]

\[ (m)_{\text{light}} \approx \frac{m}{e^2} \]

...This leads to the so-called mechanism, and...
Often mass and mixing

\[ m, \ \text{must, all information about} \]

\[ \frac{V}{b} = \frac{\pi}{b} \rho \left( \frac{V}{b} \right)^2 m + \text{c.c.} \]

\[ v_{\text{max}} = -\frac{\pi}{b} m r + \frac{\pi}{b^2} c \left( \frac{V}{b} \right)^2 + \text{c.c.} \]

For instance:

Nuclear mass and mixing at

Nuclear limit of the SMU.

For the moment let us consider this low.
m, m' = W l, W k

m, m' transform as: W, W* unitary matrices

W = W l, W k: \phi = W \phi:\ X = W^\dagger X W

transform matrix:

The freedom to make Wick-Bars (WB)
physical. This redundancy stems from
so not all of the physical parameters are
Then in a great redundancy in my, m
- symmetric complex matrices
- arbitrary complex matrices

in general

\phi = W \phi
One can determine in phases from

\[ \varphi \left( \gamma \right) \in \mathbb{E} \left( \gamma \right) \]

transform as:

\[ \mathcal{R} = \mathcal{L} \left( \mathcal{R} \right) \]

With \( \mathcal{K} = \mathcal{L} \left( \mathcal{R} \right) \). Then the

\[ \mathcal{K} \left( \mathcal{R} \right) = \mathcal{L} \left( \mathcal{R} \right) \]

In this basis, one can still make a reframing:

\[ \mathbf{m} = \mathbf{r} \rightarrow \mathbf{d} \in \text{diagonal and rank} \]

transformed to go to a basis where

One can use the freedom to make MB
The indistinguishable phases of \( n \)? Have no physical meaning because they are not distinguishable. But can we construct physically meaningful phases of \( n \) ?

\[
\begin{align*}
\phi & \to \frac{\phi}{N} \\
\phi & \to \frac{\phi}{N} \\
\phi & \to \frac{\phi}{N} \\
\phi & \to \frac{\phi}{N} \\
\phi & \to \frac{\phi}{N} \\
\phi & \to \frac{\phi}{N}
\end{align*}
\]

For \( n = 3 \) can have \( N \phi = 3 \). So after this:

\[
\frac{2}{i} n + (i - 1) \frac{2}{i} n = \frac{2}{i} n = \phi N
\]
The charged leptons of the light family are:

\[ Y' \rightarrow Y = x \phi (r, p) \]

In this basis, there is still freedom to multiply the PMNS matrix:

\[ \nu = \nu' \cdot P \]  
\[ W = \frac{1}{g} \phi \left( x \nu \right) \]

The effective mixing in the charged current:

\[ \frac{1}{p} = \frac{1}{p'} \left( m \right), \frac{1}{p} \left( m \right) \]

Examples of relevant invariant operators:
\[ w = -\frac{1}{9} \frac{1}{x^2 - \frac{1}{2}} \]

\[ \frac{\partial}{\partial x} \frac{1}{x^2 - \frac{1}{2}} = \frac{-2}{(x^2 - \frac{1}{2})^2} \]

The matrix argument basis:

\[ \text{Majorsana map frame invariant: } \chi^T C \chi \]

The reframing:

\[ \chi \rightarrow \chi' = \chi q (\chi^T \chi)^{1/2} \]

\[ q = (\alpha \chi \chi^T \alpha)^{1/2} \]

\[ \alpha \chi \alpha^T = \chi \]

\[ \alpha \text{ to the Majorsana nature of particles} \]
Recall the situation in the quark sector.

Rephrasing invariant quantities.

Verify

Why is the PMNS matrix not unitary?

Note that in the context of $\Delta \Sigma^e$

For the moment we do not introduce the continuous

\[ X = 0 \text{ a mod 9} \]

\[ 8 \text{ a mod 9} \]

\[ 8 \text{ a mod 9} \]

\[ X = \text{ a mod 9} \]

\[ X = \text{ a mod 9} \]

\[ X = \text{ a mod 9} \]
a number of right-handed neutrinos.

To a grand-feynsman with an arch thorax.
It's not comparable in LEPNS. It's arch.

This is Yosef into which untouchab
Then six independent Majoora theory

Majoora theory

(No summary)

(No repetition)

(refocusing in the sector of the UK)

Majoora summary:

Need fixation in the physique sector unch
Given the diagram, we can choose the following four independent:

\[ \Phi_2 = \text{ang} (u_2', u_2^z) \]

\[ \Phi_1 = \text{ang} (u_1', u_1^z) \]

\[ \xi_1 = \text{ang} (u_1', u_1^z) \]

\[ \xi_2 = \text{ang} (u_2', u_2^z) \]

The possible choice for the six independent:

A possible choice for the six independent.
of unitary matrices.

an important role. "Proofs" begin up

Normalization of rows and columns yield

no precise

afford from the six independent majors
the full adjacency matrix can be

I4 en account 3x3 unitary of unitary,

"Surprise": A
Convenient for the analysis of $\text{Oy/p}$

$U = \Lambda \Psi$, \quad \Lambda = \text{diag} \left( 1, 1 e^{i \theta} \right)$

by writing:

One can eliminate the phase from the first row

$\begin{bmatrix}
2 - C_{33} & \cdots & 0 \\
0 & \ddots & \vdots \\
0 & \cdots & 2 - C_{33}
\end{bmatrix} \Psi = \Lambda \Psi$

$\text{by : } \quad \Lambda = \text{diag} \left( 1, e^{i \theta}, e^{-i \theta} \right)$
$T_{33} : u_{e2} u_{e3} + u_{e2} u_{w3} + u_{e3} u_{w2} = 0$

$T_{33} : u_{e1} u_{e3} + u_{e1} u_{w3} + u_{w2} u_{w3} = 0$

$T_{22} : u_{e1} u_{e2} + u_{w1} u_{w2} + u_{e1} u_{w2} = 0$

$T_{22} : u_{e1} u_{e2} + u_{w1} u_{w2} + u_{w1} u_{w2} = 0$

Mozosona unitarity triangle

$T_{12} : u_{w1} u_{e1} + u_{w2} u_{e2} + u_{e3} u_{w3} = 0$

$T_{12} : u_{e1} u_{e2} + u_{e2} u_{w2} + u_{e3} u_{w3} = 0$

$T_{e2} : u_{e1} u_{e2} + u_{e2} u_{w2} + u_{e3} u_{w3} = 0$

$T_{e2} : u_{e1} u_{e2} + u_{e2} u_{w2} + u_{e3} u_{w3} = 0$

$T_{e1} : u_{w1} u_{e1} + u_{w2} u_{e2} + u_{w3} u_{e3} = 0$

$T_{e1} : u_{w1} u_{e1} + u_{w2} u_{e2} + u_{w3} u_{e3} = 0$

$\Theta$ Rac and Mozosona unitarity triangle

\( \Theta \)
Example of a Mörsenon Triangle

can be represented by our markers. For example, the 3

A. The sides of the Mörsenon unitary

\[ \text{Mörsenon Phase} = \frac{1}{x} - (x_3 - x) \]

Decay -

\[ \text{Decay} = \frac{x_3}{x} \]

\[ \text{Example of a Mörsenon Triangle} \]
The limit of CP invariance.

Invariance of all the "celer_processes".

Orientation of the imaginary axis.

If one of these branches

\[ A = \frac{1}{2} \left| \text{Im} 0 \right| \]

Von Staudt's theorem common area.

Importance with Weyl's function.

and sufficient condition for having CP

Magnetic triangles periodic occurrence.

Tik is parallel to the imaginary axis, that
Not that the angle \( (\theta, \phi) \) is not a rotation of \( (\theta', \phi') \) about the argument \( \theta \).

\[
\frac{1}{2} \left( \frac{3m^2}{\text{sec}^2 \theta} - \frac{3m^2}{\text{sec}^2 \theta^*} \right) + 2m^2 \left( \frac{1}{\text{sec}^2 \theta} - \frac{1}{\text{sec}^2 \theta^*} \right)
\]

\[
+ \frac{1}{2} \left( \frac{m^2}{\text{sec}^2 \theta} - \frac{m^2}{\text{sec}^2 \theta^*} \right) + \frac{1}{2} \left( \frac{m^3}{\text{sec}^2 \theta} - \frac{m^3}{\text{sec}^2 \theta^*} \right) + \frac{1}{2} \left( \frac{m^2}{\text{sec}^2 \theta} - \frac{m^2}{\text{sec}^2 \theta^*} \right)
\]

\[\text{me}_{\theta} = \text{me}_{\theta^*} + \text{me}_{\theta} + \text{me}_{\theta^*}\]

\[\text{me}_{\phi} = \text{me}_{\phi^*} + \text{me}_{\phi} + \text{me}_{\phi^*}\]

\[0 \leq \theta, \phi \leq \pi/2\]

\[\text{Neutron-proton correlation decay (OY/P)}\]

\[\text{Neutron-proton correlation decay (OY/P)}\]
This is the reason why the parameterization

\[
\begin{align*}
\alpha & = e^{\frac{r}{\alpha^2}} \\
\beta & = e^{-\frac{r}{\alpha^2}} \\
\gamma & = e^{\frac{r^2}{\alpha^2}} \\
\delta & = e^{-\frac{r^2}{\alpha^2}} \\
\end{align*}
\]

\[
\begin{pmatrix}
\alpha & \beta & \gamma & \delta \\
\end{pmatrix}
\]

\[
\begin{pmatrix}
C_{12} & C_{13} & S_{12} & C_{13} \\
C_{23} & C_{23} & S_{23} & C_{23} \\
S_{12} & C_{13} & C_{12} & S_{13} \\
1 & 0 & 0 & 1 \\
\end{pmatrix}
\]
Algorithm: 6 read panamatic + 3 phases = 9

Read, but new, mean, new complex.

Can use finding function to make mean, mean, met

\[
\begin{bmatrix}
2w & \ldots & 2w \\
\ldots & \ldots & \ldots \\
2w & \ldots & 2w \\
\text{mean} & \text{mean} & \text{mean}
\end{bmatrix}
\]

\[W = \text{diag}(\text{mean}, \text{mean}, \text{mean})\]

We have seen that in the WLS when the

charged stock mean mass matrix is diagonal, read

We have seen that in the WLS when the

from experiment

choosing the curvature mean matrix

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\( O_{vp} \rightarrow \text{me} \)

\[ \text{Im} \alpha \leftarrow \text{Cpy} \text{ld} \text{ckn} \]
\[ \theta_1, \theta_2, \theta_3, \theta_{13} \]
\[ A \frac{m_1^2}{2}, A \frac{m_2^2}{2}, A \frac{m_3^2}{2} \]

(Gravem's method)

genuitx

\( \not\equiv \) manomkdtch

Is obtained through measurable experiment.

Are many physical quantities in W, can be...
Not familiar with $M$, let $M^r = 0$.

- Prove that $\exists u_i \in \text{im}(M)$ such that $u_i \in A$.
- Consider the set of all vectors $x$ such that $x^T A x = 0$.

Some of the work out:

- More matrix experiments can fully determine the nuance.
- That no precisely constructive act of feasiblity exists.

We arrive at the dreadful conclusion:

S. Glauber, Formulation

\[ z > 9 \]
The gauge interactions

The degranulation which commences CP

namely

various fields are dictated by the part of

The CP transformation properties of the

\[ \frac{\beta}{\gamma} + \frac{\gamma}{\beta} \leq \frac{\gamma}{\beta} \leq \frac{\gamma}{\beta} \in \mathbb{R} \]

The redshift part of the degranulation is:

The redshift part with Morgan's notation

\[ C_{\text{odd}} \text{ Week - basis variables in this} \]

\[ C_{\text{odd}} \text{ Week - basis variables in this} \]
An important point is that CP transformations which leave the SM gauge sector intact do not distinguish between gauge sectors of fermions. The neutral fermions of the SM do not distinguish between fermions which transform under CP in a way consistent with the CP transformation of the gauge sector.
Primacy implies:

\[ W^* \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \gamma_3 \end{bmatrix} = \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} \]

\[ W^+ \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} = \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} \]

For any \( \gamma_1, \gamma_2, \gamma_3 \):

\[ \gamma_1 = \gamma_2 = \gamma_3 \]

\[ W^* \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} = \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} \]

\[ W^+ \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} = \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} \]

The diagonalization of the matrix \( W \):

\[ W = \begin{bmatrix} \gamma_1, \gamma_2, \gamma_3 \end{bmatrix} \]

\[ W^* W = W W^* = I \]

\[ \gamma_1 = \gamma_2 = \gamma_3 \]

\[ W^+ W = W W^+ = I \]

\[ \gamma_1 = \gamma_2 = \gamma_3 \]

The diagonal elements \( \gamma_1, \gamma_2, \gamma_3 \) satisfy:

\[ W^* W = W W^* = I \]

\[ \gamma_1 = \gamma_2 = \gamma_3 \]
For 3 gr. electrode, the vanishing of the invariant

The invariant is similar to the trace graph promotion

\[ I_{\text{m}} = \frac{1}{2} \sin(2\theta_x) \sin(2\theta_y) \sin(2\theta_z) \]

For digit. diagram for the graph sector by C.G. Zurn. 

Valid for an arbitrary number of gr. electrode

\[ \frac{\partial}{\partial y} \left[ T, y \right]_3 = 0 \]
The important to very smart II

\[ \eta = \begin{bmatrix} \sin \theta \cos \phi \\ \cos \theta \cos \phi \end{bmatrix} \]

\[ I_{\text{CP}} = \frac{1}{2} \int \text{d}m^2 \left( \frac{m^2 - m_e^2}{2} \right) \sin(2\theta) \sin \phi \]

In the case of 2 generations of Majorana neutrinos:

- In the case of CP violation, CP violation is defined by introducing a Majorana CP violation, which is checked that \( I_{\text{CP}} \) is smaller.

\[ I_{\text{Majorana}} = \int \text{d}m^2 \left( m^2 + M_{\nu} + m_{\nu} \right) \]

For CP violation:

The CP violation is defined as the following unnatural parity transform into Majorana (C.G., J. Laverne, M. Rebelo).

Hence the previous method can be done.

What about Majorana-CP violation?
Generation of the Baryon Asymmetry of the Universe (BAU)

The ingredients to dynamically generate BAU from an initial state with zero B.A. were formulated by Sakharov (1967)

(i) Baryon number violation

(ii) C and CP Violation

(iii) Departure from thermal equilibrium
Seek BbUV:

The SM, we cannot genericize the SM but it has been extended such that in past 15 years, the SM.

All these ingredients exist in the SM,
\[
\begin{align*}
  \text{m_H} & \geq 70 \text{GeV} \\
  \text{which would require a light Higgs mass} \\
  \text{strongly first order phase transition} \\
  \text{Successful baryogenesis requires} \\
  \left[ \mu_{H_+ H_-} \right] \approx 10^{-20} \\
  \text{CP violation in the SM is too small}
\end{align*}
\]
by (8-L) interactions, but (8-L) constraints
in an unimodular into a proper symmetry
which
Out of equilibrium decor of right-handed

To general BAU:

The simplest and most attractive mechanism
by Frinkinger and Yamagida to one
beyond the SM. Let's connect, suggested
New Physics

One concludes that an explanation of

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\[
\begin{align*}
\text{with } n_l = n_0 \begin{bmatrix} \frac{1}{1 + \frac{z_0}{n_0 M_0} + \frac{1}{2} n_0 M_0} + h.c. \\
\frac{1}{n_0 M_0} - \frac{z_0}{n_0 M_0} + h.c. \end{bmatrix}
\end{align*}
\]

\[
\begin{align*}
\Delta m &= -\frac{\sqrt{2}}{\sqrt{\alpha}} n_0 M_0 + \frac{1}{2} n_0 M_0 \alpha \gamma_r
\end{align*}
\]
The full neutrino mass matrix is

\[
W = \begin{pmatrix}
\begin{array}{ccc}
0 & m_1 & m_2 \\
m_1 & m_3 & m_{13} \\
m_2 & m_{13} & m_3
\end{array}
\end{pmatrix}
\]

The diagonalized by:

\[D = \text{diag}(\mu, \tau, \nu_e)\]

The unitary 6×6 matrix:

\[
U = \begin{pmatrix}
\begin{array}{ccc}
\frac{5}{6} & \frac{1}{6} & 0 \\
\frac{1}{6} & \frac{5}{6} & 0 \\
0 & 0 & 1
\end{array}
\end{pmatrix}
\]

\[V = \begin{pmatrix}
\begin{array}{ccc}
K & 0 & 0 \\
0 & K & 0 \\
0 & 0 & 1
\end{array}
\end{pmatrix}\]
\( \frac{3l}{9} \left( \alpha \ell + \alpha \ell + \alpha \ell \right) \) 

The effective charged current interaction

\[ -K \frac{1}{m} \frac{m}{m} K = \mathcal{L} \]

\[ S \approx K \frac{1}{m} \frac{1}{m} \]

One can show that:

\[ \mathcal{L} \]
So altogether: 9 forces in $\nabla$ can be determined by replacing $9$ forces in $\nabla$ can be determined by replacing $\nabla$ forces in $\nabla$. For an arbitrary complex matrix $x$, if the matrix $x$ is diagonalisable in the $\mathbb{C}$-plane, then there exists a $\mathbb{C}$-plane matrix $X$ satisfying: $X$ is diagonal, and the right hand side matrix is diagonal. In this basis, matrix $X$ is diagonal, and above the right hand side

*Matrix $X$ is diagonal, and above the right hand side*
But together - independent of IL

\[ \text{and } m_d = -1 \text{ or } m_d = 1 \text{ or } m_d \text{ or } 0 \]

\[ m_d = 1 \text{ or } m_d = 0 \]

An \[ m \text{ or } c \text{ or } s \]

Case and I have parameterization:

\[ A^2 = \frac{\sum N + \sum N + \sum N}{\sum N - \sum N} \]

\[ A \]

Lifted equation - Lagrange\n
\[ H + \frac{A}{N} \]

Fly through of the Heavy neutrinos:

Other - Again mainly generated through C P inv.

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The connection may be established with further threshold adjustment.

On many have preferences for cry, to read.

Detected in nutrition metabolism needed for lipogenesis and CP regeneration, a connection between CP pathways.

In general, it is not possible to...
Can one have a WB invariant which is sensitive to the CP violating phases in unflavoured lepton mixing? 

But... at first mention, but...? The framework of SM? Do frustrated to 240 which can occur in another framework or an alternative framework... a conclusion...
"The appraohe unfortnately tine-tmp".

It would be very nice if some years.

It would be very nice if some years.

Today, may be he would be tomorrow.

Difficult but not impossible.

Quantities understood by Experiments etc.

99 percent in the brain.

It is urgent to concede "feasible"