

Proposed Plan of work:

It is desired to attempt and explore the following issues:

1. **Implications of textures and Weak Basis Transformations for fermion mass matrices and mixing phenomenon:** As a follow up of the present work, it is desired to investigate the most general phenomenological mass matrices emanating from Weak Basis Transformations and S_3 transformations and check their compatibility with the existing data as well as to find general guidelines which any model in the top-down approach has to satisfy. Currently exploring the reduction of general mass matrices to texture 2 zero or texture 3 zero mass matrices using the freedom of Weak Basis transformations and attempting to achieve **exact diagonalization of such matrices*** using the condition of naturalness on these viz. $e < a < f < d < b < c$.

$$* \begin{bmatrix} e & |a|e^{i\alpha} & 0 \\ |a|e^{-i\alpha} & d & |b|e^{i\beta} \\ 0 & |b|e^{-i\beta} & c \end{bmatrix}, \begin{bmatrix} 0 & |a|e^{i\alpha} & |f|e^{i\gamma} \\ |a|e^{-i\alpha} & d & |b|e^{i\beta} \\ |f|e^{-i\gamma} & |b|e^{-i\beta} & c \end{bmatrix}, \begin{bmatrix} 0 & |a|e^{i\alpha} & |f|e^{i\gamma} \\ |a|e^{-i\alpha} & 0 & |b|e^{i\beta} \\ |f|e^{-i\gamma} & |b|e^{-i\beta} & c \end{bmatrix}$$

It is desired to investigate the implications of the additional non zero elements in these matrices, in comparison with Fritzsch like 4 zero matrices, for fermion mixing data both in the quark as well as the lepton sectors involving normal and inverted hierarchy of neutrinos (Dirac as well as Majorana cases). In particular, it is desired to find simplified expressions involving next to leading order terms for the various elements of the mixing matrices and CP violating parameters exhibiting explicit dependence on the fermion masses, hierarchy characterizing parameters of mass matrices $\zeta_1 = e / m_1$, $\zeta_2 = d / c$ and $\zeta_3 = f / m_3$ as well as phases involved in these.

2. **Understanding the implications of textures, Weak Basis transformations and Majorana phases on Neutrino-less Double Beta Decay** and exploring the nature of neutrino mass hierarchy especially in the light of recent refinements in the measurement of neutrino mixing angle s_{13} . It is also planned to investigate CP violation in the leptonic sector as well as leptogenesis for explaining the Baryon asymmetry problem.
3. **Investigating the compatibility of Weak Basis Zeros with SO(10) based Mass Matrices:** It is intended to undertake the study of compatibility of the 2 zero and 3 zero hermitian mass matrices obtained through Weak Basis Transformations in the framework of renormalizable SO(10) involving 10, 120 and 126 Higgses as well as non-renormalizable SO(10) scenario with the additional 210 Higgs. In particular, the role of the anti-symmetric contributions 120 and 210 as well as the various see-saw mechanisms are intended to be explored.
4. Significant progress has already been made to develop perturbative techniques for **studying hermitian and non-hermitian perturbations on the mass matrices**. It is desired to understanding the implications of these on Fermion mixings.
5. It is also desired to attempt **to understand the rationale for the Weak basis textures from the point of view of discrete flavour symmetries**.