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Which Neutrino Texture Zeros Are Viable in the Hermitian Dirac Sector?

Reducing the number of free parameters while retaining the ability to explain the observed phenomenology of the lepton sector remains an important task in flavor physics. In particular, viable theoretical frameworks must reproduce the measured neutrino mass squared differences and mixing angles, while providing predictions or constraints on the still not fully determined CP violating phase. In this context, texture-zero approaches provide a useful framework for identifying predictive patterns in the neutrino mass matrices by imposing vanishing entries and thereby reducing the number of independent parameters.

In this work, we investigate different texture zero patterns and analyze their compatibility with current neutrino oscillation data for both normal and inverted mass orderings. We first consider the case of Dirac neutrinos and identify texture structures capable of reproducing the observed lepton sector phenomenology. We then extend the analysis to the Type-I seesaw mechanism, imposing texture zeros in the Dirac neutrino mass matrix while working in a basis where the right handed Majorana mass matrix is diagonal. The phenomenological viability of the resulting textures is systematically examined against the current neutrino oscillation observables. Our results provide a framework for identifying the most predictive texture structures and for reducing the parameter space associated with neutrino mass generation.

Academic position of the presenting author

Professor

Primary authors: BENAVIDES, Richard (ITM); Prof. GÓMEZ, Jhon (ITM); Prof. PONCE, William (UdeA)

Presenter: BENAVIDES, Richard (ITM)

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