

Exact neutrino mixing angles from three subgroups of SU(2) and the physics consequences

Wednesday, 21 June 2017 15:50 (15 minutes)

Neutrino mixing may be the most important clue revealing that the 3 lepton families actually represent the different but related discrete symmetries of 3 specific finite groups. This clue could be interpreted to not add a single horizontal flavor symmetry but to have each lepton family represent a different finite subgroup of the electroweak $SU(2) \times U(1)$, thereby staying within the realm of the present successful Standard Model gauge group. If so, only five possibilities exist: the subgroups $2T$, $2O$, $2I$, D_{2n} , C_n (n odd), of the unit quaternions. The first three are binary polyhedral groups with three generators each and 24, 48, and 120 group elements for operations in a 3-D real space R^3 . The assignment of $2T$ to the electron family, $2O$ to the muon family, and $2I$ to the tau family flavor states allows one to use their generators to calculate the neutrino mixing angles $\theta_{12} = 34.281^\circ$, $\theta_{23} = 42.859^\circ$, and $\theta_{13} = -8.578^\circ$, by making these three binary groups act together in combination to be equivalent mathematically to one $SU(2)$ group and its three Pauli generators. If this assumption is correct, some important physics consequences seem to be dictated: exactly three lepton families exist; no sterile or fourth neutrino state is possible; the PMNS matrix is unitary; the normal neutrino mass state hierarchy is preferred; the neutrino CP phase angle can be 0° or -90° only; the muon and tau are not excited states of the electron; no neutrinoless double beta decay is expected because these are Dirac neutrino states; the lepton flavor states are defined in R^3 to suggest that leptons may not be point particles; and the Standard Model lagrangian may be viable down to the Planck scale. A first principles procedure to calculate the charged lepton and neutrino mass state values is yet to be determined.

Summary

A different approach to the neutrino mixing angles produces exact values agreeing with experiment. Three different discrete symmetry subgroups of $SU(2)$ combine their generators to mimic $SU(2)$ as the fundamental reason for neutrino mixing. Many physics consequences follow directly. This method remains within the realm of the present Standard Model lagrangian without added horizontal symmetries.

Primary author: Dr FRANKLIN, Potter (Frmly: UC Irvine Physical Sciences)

Presenter: Dr FRANKLIN, Potter (Frmly: UC Irvine Physical Sciences)

Session Classification: Working Group: Neutrino Physics

Track Classification: Neutrino Physics Working Group