Non-zero nature of Theta 13 - Generating Neutrino Reactor Mixing Angle via perturbation **(θ13)**

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*Abstract*— Thermonuclear fusion reactions happening at the core of the sun lead to the creation of a huge amount of energy and a large number of neutrinos. At very high temperatures and pressure, two protons come and fuse to each other leading to the creation of a deuteron which consists of one proton and one neutron, it means two protons not only fuse together but also a beta decay happens in which a proton gets converted into neutron leading to the emission of a positron and an electron neutrino. This is part of a brooder proton-proton cycle of reactions which is one of the dominant cycles of nuclear fusion reaction that happens at the core of the sun. Moreover, the Standard Model of Particle Physics describes the behaviours of elementary particles by considering three fundamental forces, suggesting the massless and chargeless nature of neutrino which was quite satisfactory till neutrino oscillation comes into play. Neutrino oscillation comes up with the hint of non-zero mass of neutrino. Earlier it was Homestake's experiment that provides us with the hint of neutrino oscillation when the observed flux of neutrinos detected on earth miss matches with the flux of neutrinos proposed by the standard solar model and becomes the key to the solar neutrino problem. It is simply the discrepancy that exists between the theoretically predicted flux of neutrinos emitted from the sun and the experimentally measured flux of neutrinos on earth. The approach of Neutrino Oscillations was given as the resolution of the solar neutrino problem. Former experimental data of the neutrino oscillations was precisely explained by the Tri–Bimaximal Mixing Ansatz. One of the major predictions of TBM ansatz was the vanishing reactor angle theta - 13. It is after the discovery of Daya Bay and RENO experiments along with Double Chooz, MINOS and T2K experiments, the TBM texture does not remain experimentally feasible. These hand over to us the non-zero nature of theta - 13. However, in the current study, we still make use of TBM as the leading order matrix and try to explore the perturbations of various terms of TBM to generate the non-vanishing reactor angle. We preferentially go for the first-order perturbation.

Keywords— Neutrino Oscillation, Perturbation, Tribimaximal Matrix, PMNS Matrix, CP Violation, Majorana Masses, Daya Bay Experiment, RENO experiment.