Contribution ID: **107**   Type: **Presentation**

Unitarity Test for Lepton Mixing

Thursday 4 September 2025 14:10 (25 minutes)

We study a method to test the unitarity of the PMNS matrix by using only the long baseline neutrino oscillation experiment, such as the combination of the T2HK experiment and the one with the ν_e beam from a future neutrino factory at J-PARC. Without a specific parametrization, one can directly extract the elements of the lepton mixing matrix by observing the energy dependence of the oscillation probabilities. A non-trivial test of the unitarity under the three-generation assumption can thus be made possible by examining the orthogonality in a similar manner to the unitarity triangle in the quark sector. As the first trial, we perform the analysis based on the simplified situation where the matter effects in the neutrino oscillation are absent. The simplification is not expected to significantly affect the results since we use the $\nu_\mu \to \nu_e$ and $\nu_e \to \nu_\mu$ channels, whose difference is sensitive to the CP phase, while it is insensitive to the matter effects. Under this simplified analysis, we find that the combination of T2HK and neutrino factory experiments can exclude, for example, four-generation based models to explain anomalies in short baseline experiments by the unitarity test at the 3σ level for a sufficient (but realistic) flux of the ν_e beam.

Authors: SATO, Joe; KITANO, Ryuichiro; SUGAMA, Sho (Yokohama National University)

Presenter: SUGAMA, Sho (Yokohama National University)

Session Classification: WG1+WG5

Track Classification: NuFACT 2025: WG5 - Neutrinos Beyond PMNS