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Tension between the T2K and NOvA appearance data and hints to new physics

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The tension between the T2K and NOvA long-baseline experiments arises mostly due to the mismatch in the $\nu_\mu \to \nu_e$ and $\bar{\nu}_\mu \to \bar{\nu}_e$ appearance data. Assuming vacuum oscillation as the reference point, with maximal θ_{23} and $\delta_{CP} = 0$, we compute the $\nu_e/\bar{\nu}_e$ appearance events for each of the experiments. T2K observes a large excess in the ν_e appearance event sample compared to the expected ν_e events at the reference point, whereas NOvA observes a moderate excess. The large excess in T2K dictates that δ_{CP} be anchored at -90° and that $\theta_{23} > \pi/4$ with a preference for normal hierarchy (NH). The moderate excess at NOvA leads to two degenerate solutions: (a) NH, $0 < \delta_{CP} < 180^\circ$, and $\theta_{23} > \pi/4$; (b) inverted hierarchy (IH) with $-180^\circ < \delta_{CP} < 0$, and $\theta_{23} > \pi/4$. This is the main cause of tension between the two experiments. We show that beyond the standard model (BSM) physics scenarios such as non-unitary neutrino mixing, Lorentz invariance violation, and non-standard neutrino interactions, may resolve the tension.

Attendance type

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