P3.084 Towards a complete $\Delta(27) \times SO(10)$ SUSY GUT

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We propose a renormalisable model based on $\Delta(27)$ family symmetry with an $SO(10)$ grand unified theory (GUT) leading to a novel form of spontaneous geometrical CP violation. The symmetries, including $\Delta(27)$ and $Z_9 \times Z_{12} \times Z_4^R$, are broken close to the GUT breaking scale to yield the minimal supersymmetric standard model (MSSM) with the standard $R$-parity. $SO(10)$ is broken via $SU(5)$ with doublet-triplet splitting achieved by a version of the Dimopoulos-Wilczek (missing VEV) mechanism. Low-scale Yukawa structure is dictated by the coupling of matter to $\Delta(27)$ antitriplets $\bar{\psi}$ whose VEVs are aligned in the CSD3 directions by the superpotential. Light physical Majorana neutrinos masses emerge from a specific implementation of the seesaw mechanism within $SO(10)$. The model predicts a normal neutrino mass hierarchy with the best-fit lightest neutrino mass between 0.32 – 0.38 meV, CP-violating oscillation phase $\delta^I = (275 – 280)^\circ$ and the remaining neutrino parameters all within $1\sigma$ of their best-fit experimental values.