

## Universal two-zero texture in $SO(10)$ : implications of JUNO and realization from non-invertible symmetries

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We apply the universal two-zero texture (UTZT) to all quark and lepton mass matrices in the  $SO(10)$  grand unified framework. With charged fermion masses fixed at their best-fit values, this texture contains only seven free parameters to account for nine flavor observables, rendering it highly predictive. Motivated by the recent JUNO indication in favor of the normal ordering of light neutrino masses, we perform an updated analysis of the UTZT in  $SO(10)$ . The texture remains fully compatible with all current flavor data. The Dirac phase is predicted mainly in two regions, one of which matches very well with current data. A meV-scale  $m\beta\beta$  is predicted, beyond the sensitivity bound of future neutrinoless double beta decay measurements. We further explore the origin of the UTZT from non-invertible symmetries, without introducing additional low-energy degrees of freedom. We show that the UTZT can be realized through non-invertible selection rules arising from the  $Z_3$  gauging of  $Z_N$ , with a minimal realization corresponding to  $N = 7$ .

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