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Pinning down the Flavour Structure of Hidden Photons

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Extensions of the Standard Model with an abelian gauge group are constrained by gauge anomaly cancellation, fermion masses and mixing angles. These constraints only allow for a limited number of $U(1)_X$ groups. We categorise these extensions and determine the allowed textures of Yukawa and Majorana mass matrices. If neutrinos are Dirac, the only possible choice satisfying all conditions is the $U(1)_{B-L}$ group, whereas all other $U(1)_X$ extensions require Majorana masses. This generically results in flavour changing couplings of the X gauge boson to neutrinos. In the future, FASERν 2 could play a crucial role in constraining these groups from searching for deviations of the flavour composition of the incoming neutrino flux from the SM prediction.

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