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Family Symmetries and the Flavour Problem

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Why are there three families of quarks and leptons and the mass hierarchies and mixing matrices so different for these two types of particles? And why does the gauge sector have only a few parameters while the flavour sector has a much larger set of external parameters? These are still some unanswered questions by the Standard Model, the current model of particle physics. Their solution might be in the introduction of discrete family symmetries. In my master thesis, I will use multiple modular symmetries to construct a high energy theory, which is then broken to a low energy model with a single modular symmetry. This scheme allows multiple moduli fields to acquire different VEV's, leading to the realisation of different mass textures in the charged lepton and neutrino sectors. It is then possible to obtain a realistic mixing matrix and mass hierarchies for the leptons using a much smaller set of free parameters.

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