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One-loop corrections to the fermion masses and flavour symmetries

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An open question in flavour physics is whether a fundamental principle is responsible for the fermion mass hierarchies and the mixing matrices. One idea for such a principle is to implement so called flavour symmetries in the mass generating mechanisms, yielding predictable mixing angles. Our aim is to investigate radiative corrections to mixing angles and masses in a variety of new physics models that feature such flavour symmetries. We want to clarify for which parameter choices the corrections remain small and tree-level predictions are unspoilt.

For this purpose, we first study a toy model with an arbitrary number of real scalars and either Majorana or Dirac fermions, where the masses are generated via spontaneous symmetry breaking. The mixing angles are determined via the diagonalization of the mass matrix given in this way. We will show our results for the one-loop corrections to the masses and mixing anlges and discuss the specifics of the renormalization programme. The goal of these calculations is to eventually elevate the toy model to a gauge theory and apply the results to showcase models known from the literature, yielding numerical results that can be compared to experimental data (i.e. the lepton masses and PMNS matrix). Moreover, we hope to contribute to the general understanding of a renormalization programme when strong flavour mixing is present, which is not only important for new physics models, but already for the leptonic sector of the Standard Model.

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