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Relations between basis sets of fields in the renormalization procedure

It seems that the literature suggests to go in two opposing directions simultaneously. On the one hand, many papers construct basis-independent quantities, since exactly these quantities appear in the expressions for observables. This means that the mixing angles such as $\tan\beta$ in the Two Higgs Doublet Model must drop out when calculating anything physical. On the other hand, there are many attempts to renormalize such mixing angles — this is in the opposite direction of basis-dependence. In terms of renormalization of mixing angles, the basis-dependent direction seems to be the far more popular one, despite the fact that there are no natural renormalization conditions and additional effort must be put in to take care of gauge-dependence and the singular degenerate mass limit. We give arguments for choosing the basis-independent direction beyond tree-level. In particular, we show that identifying bare mixing angles with the renormalized ones avoids inconsistencies, shows basis-independent features, naturally gets rid of unwanted gauge-dependence, and that the degenerate mass limit is non-singular.

Collaboration / Activity

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