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Reasons for HEFT: why we may need more than SMEFT

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The electroweak symmetry-breaking sector is one of the most promising and uncharted parts of the Standard Model; but it seems likely that new electroweak physics may be out of reach of the present accelerator effort and the hope is to observe small deviations from the SM. Given that, Effective Field Theory becomes the logic method to use, and SMEFT has become the standard. However, the most general theory with the known particle content is HEFT, and whether SMEFT suffices should be investigated in future experimental efforts. Building on investigations by other groups that established geometric criteria to distinguish SMEFT from HEFT (useful for theorists examining specific beyond-SM completions), we seek more phenomenological understanding and present an analogous discussion aimed at a broader audience. We discuss various aspects of (multi-) Higgs boson production from longitudinal electroweak gauge bosons
$W_L W_L \to n \times h$ in the TeV region as the necessary information to characterise the Flare function, $\mathcal{F}(h)$, which determines whether SMEFT or HEFT is needed. We also present tree-level amplitudes including contact and exchange channels, as well as a short discussion on accessing F from the statistical limit of many bosons. We discuss the status of the coefficients of the series expansion of $\mathcal{F}(h)$, its validity, whether its complex-h extension can be used to predict or not a tell-tale zero, and how they relate to the dimension-6 and -8 SMEFT operators in the electroweak sector. We derive a set of new correlations among BSM corrections to the HEFT coefficients that help decide, from experimental data, whether we have a viable SMEFT. This analysis can be useful for machines beyond the LHC that could address the challenging final state with several Higgs boson.

Type of talk

Theory

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