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Higgs properties with JHUGen and MELA

Study of the CP parity of a Higgs boson and its anomalous couplings to gauge bosons or fermions is one of the priorities of the LHC. We present a coherent framework for the measurement of Higgs boson couplings to two weak vector bosons using its decay, vector boson fusion production, and associated production with a vector boson. Both on-shell and off-shell Higgs boson productions are considered, including their interference with background processes, where relevant. The framework also allows the study of the anomalous couplings of the Higgs boson to fermions in $t\bar{t}H$, $b\bar{b}H$, tH production and in $H \rightarrow \tau\tau$ decays. Particular attention is given to the analysis tools, which include the Monte Carlo generator, re-weighting techniques for a fast simulation of anomalous interactions, and matrix element techniques for the optimal analysis of the processes. The formalism is presented using both the effective field theory and effective scattering amplitudes, where the dependence on the virtuality of weak and Higgs bosons is also tested with form factors. The capabilities of the framework are illustrated with projections for measuring CP-violating properties of the Higgs boson at the LHC. The tool can be applied to future e^+e^- colliders as well.

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