Highlights of the HL-LHC physics projections by ATLAS and CMS

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The ATLAS and CMS experiments at the High-Luminosity LHC will drive significant advances in our understanding of fundamental physics, with 3 ab^{-1} of physics-quality data per experiment. This unprecedented dataset will enable precision measurements of rare Higgs decays - such as $H \rightarrow \mu^{+}\mu^{-}$ and $H \rightarrow Z\gamma$ - at accuracies of 3-7%, and the determination of Higgs boson couplings to fermions and vector bosons with 1.6-3.6% precision.
Additionally, the experiments expect to observe Standard Model di-Higgs production with a significance exceeding 7σ and measure the Higgs trilinear self-coupling with better than 30% accuracy. The observation of longitudinally polarized vector boson scattering and its cross section at less than 20% uncertainty will provide an independent test of the electroweak symmetry breaking mechanism.
Measurements of rare processes, such as four-top-quark production at 6% precision, and constraints on anomalous top-quark interactions probing new physics up to 2 TeV, further extend the HL-LHC's reach. Interpretations of these results will inform models of baryogenesis involving heavy neutral scalars, constrain beyond Standard Model scalar potentials, and elucidate the stability of the electroweak vacuum, ensuring that these measurements remain at the forefront of particle physics research for decades to come.