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Probing vector-like quark models with Higgs-boson pair production

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Higgs boson pair production in the standard model is a rare process, with rates beyond the reach of the currently collected LHC data. The cross section can however be appreciably modified by new physics effects, in particular when the theory contains vector-like quarks, so that di-Higgs boson production could be detectable at the LHC within current data.

We use a phenomenological model containing vector-like quarks to study di-Higgs boson production at the LHC, including next-to-leading-order QCD corrections, and focus on all possible production modes allowed by the new quarks. We in particular show the relevance of higher-order corrections at high vector-like quark masses. We consider the decay of the di-Higgs boson system into two pairs of bottom quarks and demonstrate that the existing Run II ATLAS and CMS analyses could be already sensitive to such a model. We further show that there is a possibility of distinguishing among the various di-Higgs boson production mechanisms by exploiting the kinematic properties of the different production modes.

Summary

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