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ttH production in the Higgs characterisation model at NLO in QCD with full off-shell effects

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Since its discovery at the Large Hadron Collider in 2012 the Higgs boson has arguably become the most famous of the Standard Model particles and many measurements have been performed in order to assess its properties. Among others, these include measurements of the Higgs boson's $calCP$ -state which is predicted to be $calCP$ -even. Even though a pure $calCP$ -odd state has been ruled out, a possible admixture of a $calCP$ -odd Higgs state has yet to be excluded. In this talk we will present predictions for the associated production of a leptonically decaying top quark pair and a stable Higgs boson $pp \rightarrow e^+ \nu_e \mu^- \bar{\nu}_\mu b \bar{b} H$ with possible mixing between $calCP$ -even and $calCP$ -odd states at NLO in QCD for the LHC with $\sqrt{s} = 13$ TeV. Finite top-quark width effects as well as all double-, single- and non-resonant Feynman diagrams including their interference effects are taken into account. We compare the behaviour of the $calCP$ -even, -odd and -mixed scenarios for the integrated fiducial cross sections as well as several key differential distributions. In addition, we show that both NLO corrections and off-shell effects play an important role even at the level of integrated fiducial cross sections and that these are further enhanced in differential distributions. Even though we focus here on the Standard Model Higgs boson, the calculations could be straightforwardly applied to models that have an extended Higgs sector and predict the existence of $calCP$ -odd Higgs-like particles, such as the two-Higgs-doublet model.

In-person participation

Yes

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