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Enhancing the $t\bar{t}$ Higgs signal through top-quark spin polarization effects at the LHC

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We compare the impact of top-quark spin polarization effects in Higgs (H) boson production in association with top-quark pairs and in corresponding backgrounds at the LHC. Because of the spin-zero nature of the Higgs boson, one expects, in the chiral limit for the top quarks, a substantial complementarity in $t\bar{t}$ spin correlations for a Higgs decaying into fermions/gauge-bosons and $t\bar{t}$ spin correlations for the corresponding irreducible $t\bar{t}f\bar{f}/VV$ backgrounds. Although top mass effects in $t\bar{t}$ H production are in general dominant, and seriously spoil the chiral-limit expectations, one can find observables that capture the $t\bar{t}$ angular spin correlations and can help in separating the signal from irreducible backgrounds. In particular, we show that, for both $H\rightarrow b\bar{b}$ and $H\rightarrow\gamma\gamma$, taking into account $t\bar{t}$ spin correlations in $t\bar{t}$ H production and irreducible backgrounds could appreciably improve the LHC sensitivity to the $t\bar{t}$ H channel.

Summary

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