

Rethinking Quantum Field Theory



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**Rethinking
Quantum Field Theory**

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Top pair production with a jet with NLO QCD off-shell effects at the LHC

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Top quark physics is entering a precision era with the LHC Run II. A comprehensive study of top quark pair production in association with one hard jet in the di-lepton decay channel is presented for a center-of-mass energy of 13 TeV. The NLO QCD calculation takes into account all resonant and non-resonant and interference contributions for off-shell top quarks, and W and Z bosons. Theoretical uncertainties are addressed through an independent variation of the renormalization and factorization scales, where fixed-valued and dynamical scales have been investigated. In addition, the uncertainties induced by the parametrization of parton distribution functions have been addressed. Finally, a detailed comparison of the uncertainties for integrated and differential cross sections is presented.

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