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Precision Predictions in Top-quark Width

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We will present our recent work on the first full analytic results of NNLO QCD corrections to the top-quark decay in the Standard Model by applying the optical theorem to three-loop self-energy diagrams. The results are expressed in terms of harmonic polylogarithms. We also analytically compute the decay width including the off-shell W boson effect up to NNLO in QCD for the first time. Combining these contributions with electroweak corrections and the finite b -quark mass effect, we determine the most precise top-quark width to be 1.331 GeV for $m_t = 172.69$ GeV. The total theoretical uncertainties including those from renormalization scale choice, top-quark mass renormalization scheme, input parameters, and missing higher-order corrections are scrutinized and found to be less than 1%. All the formulae are incorporated in a portable Mathematica program TopWidth (<https://github.com/haitaoli1/TopWidth>).

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