

# High Precision Results for Top-Quark Decay at N3LO in QCD

*Saturday 20 July 2024 08:48 (18 minutes)*

We present the first complete high-precision results for the top-quark decay width  $\Gamma_t$ ,  $W$ -helicity fractions and semi-inclusive distributions for the top-quark decay process to the third order in the strong coupling constant  $\alpha_s$ . We find, in particular, that the pure  $\mathcal{O}(\alpha_s^3)$  correction decreases  $\Gamma_t$  by 0.8% of the previous  $\mathcal{O}(\alpha_s^2)$  result, exceeding considerably the error estimated by the usual scale-variation prescription. With this critical piece of correction incorporated, our to-date most precise theoretical prediction meets the request by future colliders. This computation is achieved by a very efficient approach, applied recently also to the calculation of  $\mathcal{O}(\alpha_s^3)$  QCD correction to lepton-pair invariant-mass spectrum in B-meson semi-leptonic decay.

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