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Precise Determination of the Strong Coupling Constant from Dijet Cross Sections up to the Multi-TeV Range

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We determine the value of the strong coupling α_s and study its running over a wide range of scales as probed by the dijet production process at hadron colliders. The analysis is performed using the complete next-to-nextto-leading order (NNLO) predictions in perturbative QCD and is based on dijet data published by ATLAS and CMS at center-of-mass energies of 7, 8, and 13 TeV. From a large subset of these data we infer a value of $\alpha_s(m_Z)=0.1178\pm0.0022$ for the strong coupling at the scale of the Z-boson mass m_Z.

Complementing the LHC data with dijet cross sections measured at HERA, we extend the range to test the predicted running of the strong coupling towards smaller scales. Our results exhibit excellent agreement with predictions based on the renormalization group equation of QCD. This study represents the a very comprehensive test of the asymptotic behaviour of QCD, spanning over three orders of magnitude in energy scale from 7GeV up to 7TeV. (work based on arXiv:2412.21165)

Secondary track

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