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A precise α_s determination from the R-improved QCD Static Energy

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The strong coupling α_s is the most important parameter of Quantum Chromodynamics (QCD) and therefore it is essential to determine it with high precision. This work presents an improved approach for extracting α_s comparing numerical lattice QCD simulations to the perturbative expansion of the QCD color-singlet static energy. We "R-improve" the $\mathcal{O}(\alpha_s^4)$ fixed-order prediction by removing the $u = 1/2$ renormalon and summing up the corresponding large logarithms at N^{3}LL. We also resum large ultrasoft logs to N^{3}LL accuracy using renormalization group equations. A new and more flexible parametrization of the renormalization scales has been implemented, allowing us to extend perturbation theory to distances of the order of 1 fm. Perturbative uncertainties are estimated randomly varying the parameters that specify the various renormalization scales. Performing R-evolution in different subtractions schemes such as the MSR, the PS mass, and the RS mass, we show that the extracted value of α_s is strongly correlated with the prediction for the residue of the $u = 1/2$ singularity in the Borel plane. Finally, we combine Lattice data from different simulations into a single dataset, thus simplifying the fitting procedure. Using this approach, we determine the strong coupling with a precision comparable to that of the world average.

Secondary track

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