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Renormalization group improved pQCD prediction for Upsilon(1S) leptonic decay

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The complete next-to-next-to-next-to-leading order short-distance and bound-state QCD corrections to Upsilon(1S) leptonic decay rate has been finished by Beneke et al. Based on those improvements, we present a renormalization group (RG) improved pQCD prediction for the decay width by applying the principle of maximum conformality (PMC). Based on RG-invariance, PMC provides a rigorous method for eliminating renormalization scheme-and-scale ambiguities for perturbative QCD predictions. The PMC scale-setting procedure utilizes the RGE recursively to unambigously identify the occurrence and pattern of nonconformal beta-terms at each order in a pQCD expansion, and determines the optimal renormalization scales by absorbing all occurrences of the beta-terms into the scales of the running coupling at each order of perturbation theory. After applying the PMC, all known-type of beta-terms at all orders, which are controlled by the RG-equation, are resummed to determine optimal renormalization scale for its strong running coupling at each order. We then achieve a scale-fixed, scheme-independent and more accurate pQCD prediction. The pQCD convergence could, in principle, be greatly improved due to the elimination of divergent renormalon terms. The PMC prediction for the Upsilon(1S) leptonic decay reads, 1.270^ {+0.137} _ {−0.187} keV, where the uncertainty is the squared average of the mentioned pQCD errors. This RG-improved pQCD prediction agrees with the experimental measurement within errors, i.e. 1.340(18) keV.

Biography

Jian-Ming Shen is pursuing his PhD in Chongqing University. His research interests are in Physics at the Large Hadron Collider and other experiments, including precision QCD to improve the standard model prediction and searching for the new physics beyond the standard model. He has published more than 10 papers in reputed journals.

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