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Achieving complete renormalization of observables using the Principle of Observable Effective Matching

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In this presentation, we introduce an innovative method for achieving comprehensive renormalization of observables, such as theoretical predictions for cross sections and decay rates in particle physics. Despite previous efforts to address infinities through renormalization techniques, theoretical expressions for observables still exhibit dependencies on arbitrary subtraction schemes and scales, preventing full renormalization. We propose a solution to this challenge by introducing the Principle of Observable Effective Matching (POEM), enabling us to attain both scale and scheme independence simultaneously. To demonstrate the effectiveness of this approach, we apply it to the total cross section of electron-positron to hadrons, utilizing 3- and 4-loop MS scheme expressions within perturbative Quantum Chromodynamics (pQCD). Through POEM and a process termed Effective Dynamical Renormalization, we achieve full renormalization of these expressions. Our resulting prediction, 1.052431+0.0006−0.0006 at Q=31.6GeV, closely aligns with the experimental value of Rexpe+e−=1.0527+0.005−0.005, showcasing the efficacy of our method.

Keyword-1

Renormalization

Keyword-2

Observables

Keyword-3

Quantum Field Theory

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