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Asymptotic freedom in the BV formalism

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Asymptotic Freedom in the BV Formalism

Chris Elliott, Brian Williams, and Philsang Yoo

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Abstract

We define the β-function of a perturbative quantum field theory in the mathematical framework introduced by Costello – combining perturbative renormalization and the BV formalism – as the cohomology class of a certain functional measuring scale dependence of the effective interaction. We show that the one-loop β-function is a well-defined element of the obstruction-deformation complex for translation-invariant and classically scale-invariant theories, and furthermore that it is locally constant as a function on the space of classical interactions and computable as a rescaling anomaly, or as the logarithmic one-loop counterterm. We compute the one-loop β-function in first-order Yang–Mills theory, recovering the famous asymptotic freedom for Yang–Mills in a mathematical context.

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