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Renormalization of the Yukawa and Quartic Couplings in $\mathcal{N} = 1$ Supersymmetric QCD

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In this work we perform calculations in order to determine the renormalization factors and the mixing coefficients of the Yukawa and the quartic couplings in $\mathcal{N} = 1$ Supersymmetric QCD. The Yukawa couplings describe the interactions between gluino, quark and squark fields whereas the quartic couplings describe four-squark interactions. We discretize the action on a Euclidean lattice using the Wilson formulation for the gluino, quark and gluon fields; for squark fields (scalar fields) we employ naïve discretization. At the quantum level Yukawa and quartic interactions suffer from mixing with other operators which have the same transformation properties. Exploiting parity and charge conjugation symmetries of the Supersymmetric QCD action, we reduce the allowed mixing patterns. We compute, perturbatively to one-loop and to the lowest order in the lattice spacing, the relevant three-point Green's functions so as to fine tune the Yukawa couplings and the relevant four-point Green's functions to fine tune the quartic couplings. We use both dimensional and lattice regularizations as required for implementing the Modified Minimal Subtraction scheme. This work is a sequel to our earlier investigations on SCQD and completes the one-loop fine-tuning of the SQCD action on the lattice, thus paving the way for numerical simulations of SQCD.

Topical area

Particle Physics Beyond the Standard Model

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