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Fine-Tuning of the Yukawa and Quartic Couplings in Supersymmetric QCD

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In this work, we calculate the fine tuning of parameters in N = 1 Super- symmetric QCD, discretized on a Euclidean lattice. Specifically, we study the renormalization of the Yukawa (gluino-quark-squark interactions) and the quar- tic (four-squark interactions) couplings. At the quantum level, these interactions suffer from mixing with other operators which have the same transformation properties. We exploit the symmetries of the action, such as charge conjuga- tion and parity, in order to reduce the list of the mixing patterns. To deduce the renormalizations and the mixing coefficients we compute, perturbatively to one-loop and to the lowest order in the lattice spacing, the relevant three-point and four-point Green's functions using both dimensional and lattice regulariza- tions. Our lattice formulation involves the Wilson discretization for the gluino and quark fields; for gluons we employ the Wilson gauge action; for scalar fields (squarks) we use naive discretization. We obtain analytic expressions for the renormalization and mixing coefficients of the Yukawa couplings; they are func- tions of the number of colors Nc, the gauge parameter α, and the gauge coupling g. Furthermore, preliminary results on the quartic couplings are also presented.

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