Contribution ID: **21** Type: **not specified**

One-loop calculations in Supersymmetric Lattice QCD

Tuesday, August 30, 2016 9:20 PM (20 minutes)

Super QCD Lagrangian and Feynman rules; self energies of quark, gluon, squark and gluino fields; 2-pt Green's functions of quark bilinears; lattice perturbation theory.

Summary

We study the self energies of all particles which appear in a lattice regularization of supersymmetric QCD ($calN = 1$). We compute, perturbatively to one-loop, the relevant two-point Green's functions using both the dimensional and the lattice regularizations. Our lattice formulation involves a variety of discretizations for the gluino and quark fields, including Wilson, clover and overlap fermions. For gluons we employ the Wilson action, as well as Symanzik improved variants. For scalar fields (squarks) we use naive discretization. The gauge group that we consider is $SU(N_c)$ while the number of colors, N_c and the number of flavors, N_f, are kept as generic parameters. We have also searched for relations among the propagators which are computed from our one-loop results. We have obtained analytic expressions for the renormalization functions of the quark field (Z_ψ), gluon field (Z_A), gluino field (Z_λ) and squark field (Z_ϕ). In this study we also describe the perturbative calculation of the renormalization of quark bilinear operators which, unlike the non-supersymmetric case, exhibit a rich pattern of operator mixing at the quantum level.

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Session Classification: Poster Session and Wine Tasting

Track Classification: Poster session