On Improvement in the Study of the Lattice Gluon Propagator

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Abstract

The infrared behaviour of the gluon propagator has been the subject of much speculation over the last twenty years. The non-linear nature of Quantum Chromodynamics combine with its characteristic strong coupling to make calculations difficult. Lattice gauge theory is the only known, *ab initio* way of nonperturbatively calculating the objects of a quantum field theory, such as the propagators. Lattice gauge theory has had many successes, but the computational cost of simulating a large volume means that the long range (low momentum) behaviour of the gluon propagator is difficult to reliably access. Through the use of an improved action, with corresponding Landau gauge fixing and tree-level improvement, we obtain good signal on a set of coarse lattices, for modest computational cost. This enables us to simulate a large volume, and hence obtain good resolution in the infrared. We obtain a gluon propagator that, in Landau gauge, is finite in the infrared, and a detailed analysis indicates that the lattice artefacts are small.