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Coarse Graining in Effective Theories of Lattice QCD in Low Dimensions

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In the strong coupling and heavy quark mass regime, lattice QCD reduces to a 3 dimensional theory of Polyakov loops. We apply coarse graining techniques to such theories in 1 and 2 dimensions at finite temperature and non-zero chemical potential.
In 1 dimension the method is applied to the effective theory up to $\mathcal{O}(\kappa^4)$, where κ is the hopping parameter of the original Wilson action. Using the transfer matrix, the recursion relations are solved analytically. The thermodynamic limit is taken for some intensive observables. Afterwards, continuum extrapolation is performed numerically and results are discussed.
In 2 dimensions the coarse graining method is applied in the pure gauge and static quark limit. Running couplings are obtained and the fixed points of the transformations are discussed. Finally, the critical coupling of the deconfinement transition is determined in both limits. Agreement to about 15% with Monte Carlo results from the literature is observed.

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