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Confinement-deconfinement transition and Z_3 symmetry in SU(3)-Higgs theory

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We study the effect of Higgs in the fundamental representation, on Z_3 symmetry in SU(3)-Higgs theory. In the presence of the Higgs, the Euclidean action breaks the Z_3 symmetry explicitly. The determination of the strength of explicit breaking requires integration of the matter fields. We carry out this using lattice Monte Carlo simulations, near the confinement-deconfinement transition. The partition function averages of observables that are sensitive to the Z_3 symmetry, i.e the Polyakov loop, gauge Higgs interaction terms etc. show that the strength of Z_3 explicit breaking decreases steadily with the lattice cut-off, and is possibly vanishingly small in the continuum limit. Simultaneously the strength of the confinement-deconfinement transition grows stronger. These results suggest that similar studies in QCD are necessary to determine the explicit breaking of Z_3 symmetry in the QGP-hadron transition. For small explicit breaking Z_3 meta-stable states are expected near the transition and may be relevant for heavy-ion collisions.

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