Verifying the Kugo-Ojima criterion by the larger lattice Landau gauge simulation

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Numerical simulation in the lattice Landau gauge $SU(3)$ QCD is performed in larger lattice, 24^4, in view of the various confinement problems posed in the Landau gauge formulations. We compare two options of gauge field definition, $\log U$, U-linear in $\beta = 6$ simulation. Kugo-Ojima colour confinement parameter $u^{ab} = -c\delta^{ab}$ which is predicted to be $-1\delta^{ab}$ for the confinement, turns out to be $-0.8\delta^{ab}$ in case of $\log U$, $-0.7\delta^{ab}$ in case of U-linear. Infrared behaviours of the dressing functions (propagators multiplied by $(qa)^2$) of the gluon $Z(qa)$ and the ghost $G(qa)$ are analysed, where a is the lattice spacing. Their dependence on the gauge field definitions appears only in their global scale factors, and both ZG^2 agree within errors. We plot the value of c as the function of $\log Z(1)$ i.e. the value at $q = 1/a$. The continuum limit of the Kugo-Ojima parameter c would be obtained by the crossing point of the extrapolation line in $\log U$ and that in $U-$linear. The infrared property of the running coupling α_s measured on the lattice will be also commented.

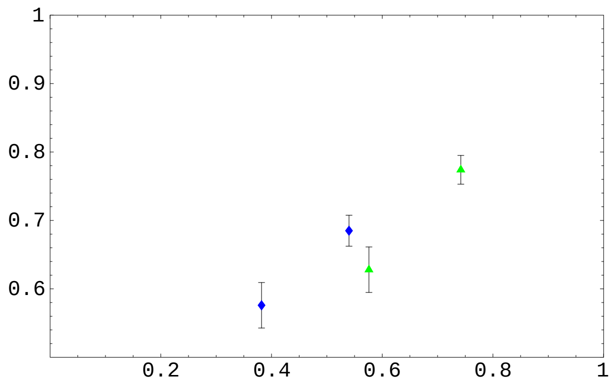

Figure 1: Kugo-Ojima parameter c of 16^4 lattice (left) and of 24^4 lattice (right) in $\log U$ definition(triangle) and in $U-$linear definition(diamond). The ordinate is the value of $\log Z(1)$.

References

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