Finite temperature phase transition in lattice QCD with $N_f = 2$ nonperturbatively improved Wilson fermions at $N_t = 8$

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We present results of the first extensive study of $N_f = 2$ lattice QCD with nonperturbatively $O(a)$ improved Wilson fermions on $16^3 \cdot 8$ lattice. This research aims at the analysis of the phase diagram in full QCD and derivation of transition temperature in the continuum limit. We make simulations at $N_t = 8$. Measurements were performed at $m_\pi/m_\rho \approx 0.8$ on a fine lattice with $r_0/a \approx 4.4$, $\beta = 5.2$ and 5.25, $\kappa = 0.1330 \sim 0.1360$.

We use Polyakov loop as an order parameter to determine the transition temperature. It is known from the studies of the pure gauge theories that the transition temperature can be determined with higher precision with the help of abelian and monopole Polyakov loops calculated after fixing Maximally abelian gauge. We employ this approach in our study. Better signal of the susceptibility of the monopole Polyakov loop is obtained in comparison with that in the non-abelian case. Fig.1 shows the monopole Polyakov loop susceptibility for $\beta = 5.2$. We found the transition temperature $T_c = 216(5)$ Mev at $\beta = 5.2$ and $T_c = 220(3)$ Mev at $\beta = 5.25$. These values are in agreement with those obtained by Bielefeld and CP-PACS collaborations using different lattice actions and different N_t.

We also discuss the role of monopoles in the transition.

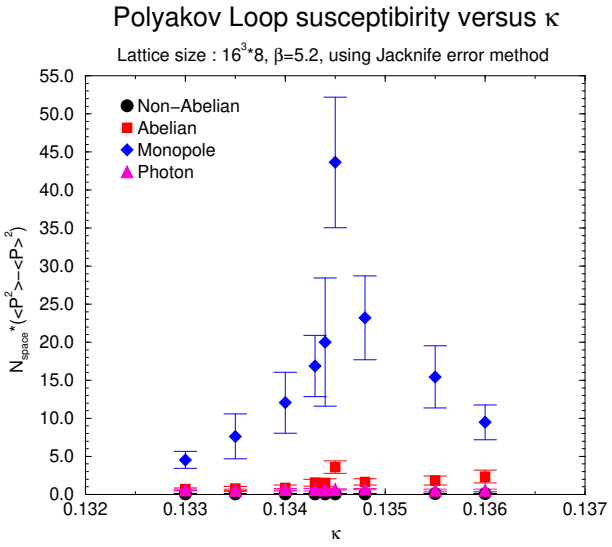

Figure 1: