Entropy of spatial monopole currents in pure SU(2)QCD at finite temperature

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We study properties of space–like monopole [1] trajectories in the Maximal Abelian gauge [2] of quenched SU(2) QCD at the finite temperature. We concentrate on infrared monopole clusters [4] which are responsible for the confinement properties of the theory. We determine numerically the effective action of the monopoles [3] projected onto the three-dimensional time–slice using an inverse Monte-Carlo method. Then we derive the length distributions of the monopole loops [5] and fix their entropy.

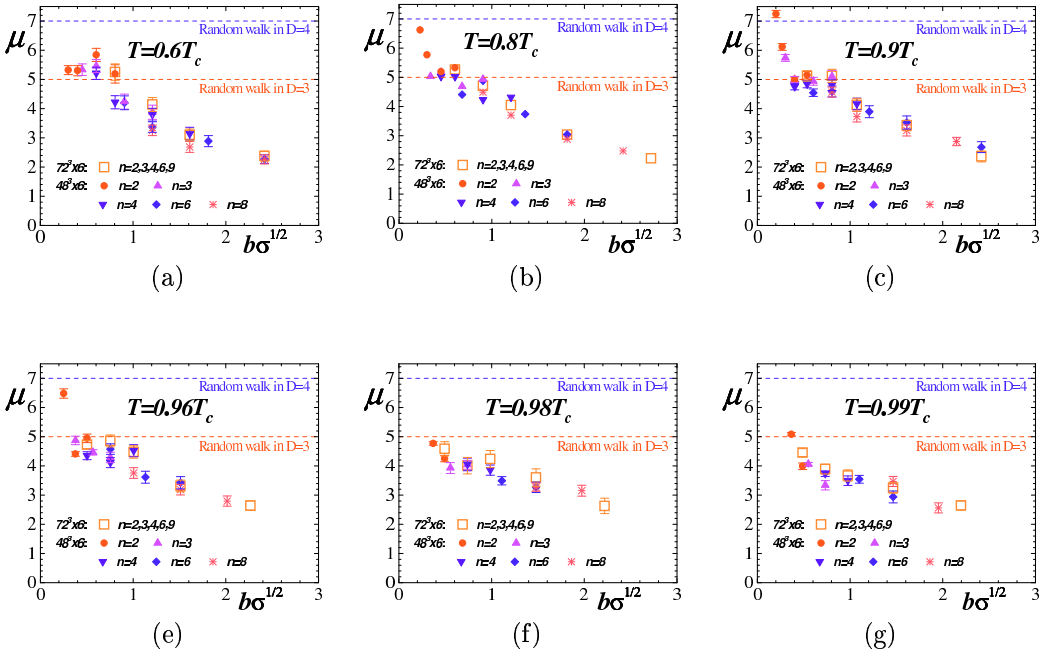

Figure 1: Entropy factor of the spatially projected monopole currents as the function of the scale b at various temperatures.

We show that the entropy factor in Fig.1 has a plateau at sufficiently small values of b and at $T < 0.96T_c$. A reason for the temperature restriction of our result is that our analysis may not be valid close to the second order phase transition point because of the increase of correlation lengthes at (and, consequently, because of strong finite-volume effects) $T \approx T_c$. At $b > 1$ the entropy is a descending function of $b = na$, indicating that the effective degrees of freedom of the projected and blocked monopoles are getting smaller as the blocking scale b increases. This effect is very similar to the zero temperature case, in which the monopole motion corresponds to the classical picture: the monopole with the large blocking size b becomes a macroscopic object and the motion of such a monopole gets close to a straight line. The details of this description were reported in Ref.[6].

The numerical simulations have been performed on NEC SX-5 at RCNP, Osaka University.

References

[1] T. A. DeGrand, D. Toussaint, Phys. Rev. **D22**, 2478 (1980).
[2] A. S. Kronfeld, M. L. Laursen, G. Schierholz and U. J. Wiese, Phys. Lett. **B198**, 516 (1987); A. S. Kronfeld, G. Schierholz, U. J. Wiese, Nucl. Phys. **B293**, 461 (1987).
[3] H. Shiba, T. Suzuki, Phys. Lett. **B351** 519, (1995.
[4] A. Hart, M. Teper, *Phys. Rev.*, **B58**, 014504 (1998). M. N. Chernodub, V. I. Zakharov, Nucl. Phys. **B669**, 233 (2003); V. G. Bornyakov, P. Yu. Boyko, M. I. Polikarpov, V. I. Zakharov, Nucl.Phys. **B672**, 222 (2003).
[5] M. N. Chernodub, K. Ishiguro, K. Kobayashi, T. Suzuki, Phys. Rev. D **69**, 014509 (2004).
[6] M. N. Chernodub, K. Ishiguro and T. Suzuki Phys. Rev. **D71**, 094506 (2005).