Perfect lattice monopole action from the continuum in hot SU(2) gluodynamics

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The confinement of color in Quantum Chromodynamics (QCD) remains one of unexplained non–perturbative phenomena in quantum field theory. At zero temperature, the dual superconductor hypothesis [1] suggests that the color confinement is caused by magnetic monopoles condensation which implies squeezing of the color–electric flux between quarks (dual Meissner effect). Monopoles are identified with the help of an Abelian projection based on a partial gauge–fixing [2]. In SU(2) and SU(3) gauge theories, the contribution of the monopoles to the string tension reproduces the original string tension. This effect – known as the monopole dominance – suggests that the Abelian monopoles play an important role for confinement.

In the deconfinement phase the monopoles are not condensed and the quarks are liberated (the Quark–Gluon Plasma is formed). This does not mean, however, that the monopoles do not play a non–perturbative role in this phase. It is known that in the deconfinement phase the vacuum is dominated by static monopoles while monopoles running in spatial directions are suppressed. According to numerical simulations in deconfinement phase [3], the static monopoles provide a dominant contribution to the spatial string tension which is a coefficient in front of the area term of large spatial Wilson loops.

In this work we investigate the physics of the lattice monopole currents in SU(2) gluodynamics at high temperature (deconfinement phase). Namely, we associate the lattice monopoles with the continuum monopoles by the procedure known as blocking from the continuum field theory to the lattice [4]. We show that the numerical data both for the charge density and for the action of lattice monopoles can be very well described in terms of a Coulomb gas of monopoles in the continuum [5].

References

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