



Contribution ID: 6

Type: **Parallel Talk**

## Monopoles of the Dirac type and color confinement in QCD \\ - Study of the continuum limit -

*Tuesday, 1 August 2023 17:40 (20 minutes)*

Non-Abelian gauge fields having a line-singularity of the Dirac type lead us to violation of the non-Abelian Bianchi identity. The violation as an operator is equivalent to violation of Abelian-like Bianchi identities corresponding to eight Abelian-like conserved magnetic monopole currents of the Dirac type in  $SU(3)$  QCD. It is very interesting to study if these new Abelian-like monopoles are responsible for color confinement in the continuum  $SU(3)$  QCD, since any reliable candidate of color magnetic monopoles is not known yet. If these new Abelian-like monopoles exist in the continuum limit, the Abelian dual Meissner effect occurs, so that the linear part of the static potential between a quark-antiquark pair is reproduced fully by those of Abelian and monopole static potentials. These phenomena are called here as perfect Abelian and monopole dominances. It is shown that the perfect Abelian dominance is reproduced fairly well, whereas the perfect monopole dominance seems to be realized for large  $\beta$  when use is made of the smooth lattice configurations in the maximally Abelian (MA) gauge. Making use of a block spin transformation with respect to monopoles, the scaling behaviors of the monopole density and the effective monopole action are studied. Both monopole density and the effective monopole action which are usually a two-point function of  $\beta$  and the number of times  $n$  of the block spin transformation are a function of  $b = na(\beta)$  alone for  $n = 1, 2, 3, 4, 6, 8, 12$ . If the scaling behavior is seen for up to larger  $n$ , it shows the existence of the continuum limit, since  $a(\beta) \rightarrow 0$  when  $n \rightarrow \infty$  for fixed  $b = na(\beta)$ . Along with the previous results without any gauge fixing, these new results obtained in MA gauge suggest that the new Abelian-like monopoles play the role of color confinement in  $SU(3)$  QCD.

### Topical area

Vacuum Structure and Confinement

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**Session Classification:** Vacuum Structure and Confinement