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Abelian monopoles of the Dirac type and color confinement in QCD

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When non-Abelian gauge fields in SU(3) QCD have a line-singularity leading to non-commutativity with respect to successive partial-derivative operations, the non-Abelian Bianchi identity is violated. The violation as an operator is shown to be equivalent to violation of the Abelian-like Bianchi identities. Then there appear eight Abelian-like conserved magnetic monopoles of the Dirac type in SU(3) QCD. Using lattice Monte-Carlo simulations, perfect Abelian and monopole dominances are shown to exist upon this idea when we define lattice Abelian-like monopoles following the DeGrand-Toussaint method adopted in the study of the Dirac monopole in lattice compact QED. The Abelian dual Meissner effect around a pair of static quark and antiquark is caused by the solenoidal Abelian monopole current. The continuum limit of the lattice monopoles is proved with the help of the block-spin renormalization group study.

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