Gauge independence of Abelian confinement mechanism in SU(2) gluodynamics

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Abelian mechanism of color confinement is observed in a gauge-independent way in SU(2) gluodynamics. A new noise-reduction method using random gauge transformations as well as the multi-level method are adopted. A static potential derived from Abelian Polyakov loop correlators gives us the correct string tension. Moreover only the monopole part in the Abelian Polyakov loop is responsible for the string tension. Abelian electric fields defined in an arbitrary color direction are squeezed and the corresponding monopole currents play the role of magnetic super currents. The penetration and the coherence lengths are consistent with those observed previously after Abelian projections. Since an Abelian neutral state in all color channels is restricted to a color-singlet state alone, the non-Abelian color confinement in SU(2) gluodynamics can be understood as the Abelian dual Meissner effect due to monopoles.