

## Emergence of magnetic monopoles for quark confinement due to violation of the non-Abelian Bianchi identity

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The dual superconducting picture is one of the most promising scenario for quark confinement, where magnetic monopoles play a dominant role for confinement. Indeed, we have shown numerical evidence for the magnetic monopole dominance in the string tension on the lattice in gauge invariant way based on the gauge-covariant decomposition due originally to Cho-Duan-Ge-Shabanov and Faddeev-Niemi.

In this presentation, we show a direct relation between the violation of the non-Abelian Bianchi identity (NABI) and the emergence of the magnetic monopole which is driven through the non-Abelian Stokes theorem. As a consequence, emergence of magnetic monopoles relates to violation of the NABI's.

Finally, we apply this formula to the  $SU(2)$  gauge-scalar model to reexamine the phase transition between the confinement and Higgs phases in the gauge independent way in view of higher form symmetry. We will further investigate the connection between the mass gap of the gauge field and the emergence of the magnetic monopoles.

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