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# New gauge-independent transition dividing the confinement phase in the lattice gauge-adjoint scalar model

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The lattice gauge-scalar model with the scalar field in the adjoint representation of the gauge group has two completely separated confinement and Higgs phases according to the preceding studies based on numerical simulations which have been performed in the specific gauge fixing based on the conventional understanding of the Brout-Englert-Higgs mechanism.
In this talk, we re-examine this phase structure in the gauge-independent way based on the numerical simulations for the model with SU(2) gauge group performed without any gauge fixing which is motivated to confirm the recently proposed gauge-independent Brout-Englert-Higgs mechanics for the mass of the gauge field without relying on any spontaneous symmetry breaking.
For this purpose we investigate correlation functions between gauge-invariant operators obtained by combining the original adjoint scalar field and the new field called the color-direction field constructed from the gauge field based on the gauge-covariant gauge-field decomposition due to Cho-Duan-Ge-Shabanov and Faddeev-Niemi.
We reproduce gauge-independently the transition line separating confinement and Higgs phase, and discover surprisingly a new transition line that divides the confinement phase into two parts.
Finally, we discuss the physical meaning of the new transition and implications to confinement mechanism.

## Topical area

Vacuum Structure and Confinement

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