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The lattice Yang-Mills theory with a gauge-invariant gluon mass in view of the gauge-invariant BEH mechanism towards confinement

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At the last lattice conference, we have proposed to investigate the massive Yang-Mills model, namely, Yang-Mills theory with a gauge-invariant gluon mass term, in order to clarify the mechanism of quark confinement in the Yang-Mills theory with massgap. The gluon mass term simulates the dynamically generated mass to be extracted in the low-energy effective theory of the Yang-Mills theory and plays the role of a new probe to study the phase structure and confinement mechanism.
In this talk, we first review the massive Yang-Mills model, whose gauge-invariant gluon mass term is deduced from a specific gauge-scalar model with a single radially-fixed scalar field under a suitable constraint called the reduction condition, and why such a gauge-scalar model is constructed without breaking the gauge symmetry through the gauge-independent description of the Brout-Englert-Higgs mechanism which does not rely on the spontaneous breaking of gauge symmetry. Then, we discuss how the numerical simulations for the proposed massive Yang-Mills theory can be performed by taking into account he reduction condition in the complementary gauge-scalar model on a lattice.

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