Contribution ID : **19** Type : **Oral Presentation**

Finiteness of the Yang-Mills-Chern-Simons action in linear covariant gauges by taking into account gauge copies

Friday, 5 December 2025 11:30 (0:30)

Content

In recent years, the effects of removing infinitesimal Gribov copies from the path integral of gauge-fixed Yang-Mills-Chern-Simons theories formulated in three-dimensional Euclidean space have been investigated. Part of the interest resides in the fact that such an elimination of gauge copies introduces a mass parameter, the Gribov parameter, which is relevant when the assumptions of the Faddeev-Popov procedure are not well grounded. Such a parameter enters the propagator of the gauge field, which is topologically massive due to the Chern-Simons term. The resulting action, which eliminates infinitesimal Gribov copies in this context, has been constructed in linear covariant gauges, and the interplay between the aforementioned mass parameters allows for a rich phase diagram in which confining and deconfining signatures are observed in the gauge-field propagator. In the present work, we establish the renormalization properties of such a theory at all orders in perturbation theory by means of the algebraic renormalization framework and show that the removal of infinitesimal Gribov copies does not affect the standard nonrenormalization properties of standard gauge-fixed Yang-Mills-Chern-Simons theories, i.e., the theory is finite.

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