

This article is a follow-up paper of the previous one [1] in which the Gribov problem in  $U(1)$  gauge theories in noncommutative spaces is studied. In the conventional (commutative) spaces, it is well-known that we can circumvent the Gribov problem in abelian gauge theories. This problem basically arises from gauge-choice ambiguities in non-abelian gauge theories. For mathematical treatments of this problem one may refer to Nair's textbook [2]; see chapter 14.

In the first part of this paper the authors review these basics of the Gribov problem and also introduce some elements of  $U(1)$  gauge theories on the noncommutative (NC) spaces. The authors then apply a definition of the products in the NC spaces, the so-called star-products, to the Landau gauge condition in the NC  $U(1)$  gauge theory. The authors conclude that the NC gauge condition leads to a infinite number of Gribov copies, implying that in the NC spaces there may exist the Gribov ambiguities even in abelian gauge theories. The author also argue that these features do not arise in the commutative limit, as expected.

The arguments in the latter half of the paper deal with naive applications of the star-products to the NC  $U(1)$  gauge condition without sufficient discussion on topology or geometry, in contrast to the first part of the paper. So the reader may find an impression that the authors come to a rather abrupt conclusion in section 4.

## References

- [1] F. Canfora, M. Kurkov, L. Rosa and P. Vitale, "The Gribov problem in Noncommutative QED," JHEP **1601**, 014 (2016) doi:10.1007/JHEP01(2016)014 [arXiv:1505.06342 [hep-th]].
- [2] V. P. Nair, "Quantum field theory: A modern perspective," New York, USA: Springer (2005).