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Extracting Instantons from the Lattice

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In this talk, I summarize phenomenological results on topology, in particular the extraction of distinct topological sectors that resemble instantons, and support the picture of the QCD vacuum being filled with highly localized topological excitations.
Combining the identification of topological sectors (connected regions of either left- or right-handed winding in $n_f = 2+1+1$ configurations) with a simple charge gradient approach increases the number of instanton sectors found. Such sectors deviate from the background by a distinct charge-volume behavior and, in addition, by a high degree of self-duality.
Defining the topological charge density with an improved $O(a^6)$ field strength removes leading UV lattice artifacts that would otherwise contribute to the multiplicative renormalization constant. As a result, we find that the total charge of the configurations Q is very close to integers and the charge content of the instanton sectors is close to ± 1.

In addition, I show that the topological charge density contains a wave standing in the simulation box and present evidence for a physical phenomenon as well as hints in favor of a link to the (auto)correlation oscillations introduced by the HMC [1].

[1] https://pos.sissa.it/430/045/pdf

Topical area

Vacuum Structure and Confinement

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