



Contribution ID: 455

Type: **Poster**

D2: Topology of the $O(3)$ non-linear sigma model under the gradient flow

Wednesday 28 July 2021 15:15 (15 minutes)

The $O(3)$ non-linear sigma model (NLSM) is a prototypical field theory for QCD and ferromagnetism, featuring topological qualities. Though the topological susceptibility χ_t should vanish in physical theories, lattice simulations of the NLSM find that χ_t diverges in the continuum limit. We study the effect of the gradient flow on this quantity using a Markov chain Monte Carlo method, finding that a logarithmic divergence persists. This result supports a previous study and indicates that either the definition of topological charge is problematic or the NLSM has no well-defined continuum limit. We also introduce a θ -term and analyze the topological charge as a function of θ under the gradient flow.

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Session Classification: Poster

Track Classification: Theoretical developments and applications beyond particle physics