

Visualizations of Centre Vortex Structure in Lattice Simulations

Tuesday, July 24, 2018 4:10 PM (20 minutes)

This presentation examines the structure of centre vortices in Monte-Carlo generated gauge-field configurations using modern visualization techniques. We'll begin with a brief review of how centre vortices underpin dynamical chiral symmetry breaking and how their removal restores chiral symmetry.

Centre vortices are identified through gauge transformations maximizing the centre of the gauge group. Focusing on the thin vortices identified by Wilson loops having a non-trivial centre phase, the vortex structure is illustrated through renderings of oriented spatial plaquettes. Time oriented plaquettes are illustrated by identifying spatial links associated with these non-trivial plaquettes.

Of particular interest is the correlation of the vortex structure and the topological-charge structure of the gauge fields, vital to dynamical chiral symmetry breaking and its associated mass generation. The results provide new insights into the role of centre vortices in underpinning non-trivial topology in gauge fields. They reveal how the removal of centre-vortices necessarily destroys non-trivial topology, immediately restoring chiral symmetry and destabilizing would-be instantons under smoothing algorithms. In contrast, vortex-only backgrounds provide gauge-field degrees of freedom sufficient to create instantons upon smoothing.

The observed correlations further strengthen the idea that centre vortices are the seeds of dynamical chiral symmetry breaking.

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