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The twisted gradient flow strong coupling with parallel tempering on boundary conditions

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We present a proposal for calculating the running of the coupling constant of the $SU(3)$ pure gauge theory, which combines the Twisted Gradient Flow (TGF) renormalization scheme with Parallel Tempering on Boundary Conditions (PTBC). The TGF is a gradient flow-based renormalization scheme formulated in an asymmetric lattice with twisted boundary conditions. Combined with step scaling, it has been successfully used to calculate the SU(3) Λ parameter. As with all gradient flow-based schemes, the coupling constant is highly correlated with the topological charge and affected by topology freezing, an issue addressed by projecting the determination of the coupling onto the zero topological sector. As an alternative to the zero charge projection, we combine TGF with PTBC, we combine TGF with PTBC by replicating multiple copies of the same lattice, interpolating between periodic and open boundary conditions in a parallel-tempered manner. We present a first exploration of these ideas by analyzing specific ensembles of $SU(3)$ lattices with and without PTBC.

Topical area

Theoretical Developments

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