Contribution ID: **23** Type: **not specified**

Mitigating signal-to-noise problems using learned contour deformations

Monday, 26 June 2023 10:00 (25 minutes)

Complex contour deformations of the path integral have previously been used to mitigate sign problems associated with non-zero chemical potential and real-time evolution in lattice field theories. This talk details their application to lattice calculations where the vacuum path integral is instead real and positive – allowing Monte Carlo sampling – but observables are afflicted with a sign and signal-to-noise problem. This is for example the case for many lattice calculations targeting QCD phenomenology. In this context, contour deformations allow one to rewrite observables to minimize sign fluctuations while preserving their expectation value. We apply machine learning techniques to define and optimize families of contour deformations for SU(N) variables and demonstrate exponential improvements in the signal-to-noise ratio of Wilson loops in proof-of-principle applications to U(1) and SU(N) lattice gauge theories.

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