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Information, dualities, and deconfinement

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The lack of an order parameter in Yang-Mills theory with dynamical fundamental quarks is a long-standing problem in QCD. We exploit a web of dualities and information-theoretic techniques to study the phase structure of QCD from a new perspective. In particular, we examine the deconfinement transition in a deformed model of QCD: this is QCD compactified over a circle and considered at temperatures near the confinement/deconfinement transition. This setup is equivalent, via dualities, to an “affine” XY spin system, which can be studied via Monte Carlo simulations. Our simulations show that mutual information/entanglement entropy calculations can be used as an alternative probe to designate different phases of QCD. This picture is further supported by analytical investigation of the dual Sine-Gordon model, which is also equivalent to the deformed QCD and XY spin system.

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