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Potential and Width of Effective Strings Beyond Noninteracting Models

We investigate the Casimir energy and the width of the quantum delocalization of the QCD flux-tube for string actions beyond free Nambu-Goto approximation. We perform our numerical study on the 4-dim pure SU(3) Yang-Mills lattice gauge theory and focus on color source separation distance before the string breaks in full QCD.

The analysis of the precise numerical data of the quark-antiquark potential reveals that attributing rigid properties to the QCD string along with the self- interactions can resolve the subtleties associated with establishing a correct dependency of the string tension on the temperature. In addition, the boundary action corrections were found convenient to rule out the delicate discrepancies of the quark-antiquark potential at high temperature and relatively short distances, but where the long string approximation still applies.

These results suggest to seek a set of analytic solutions for the broadening character of the energy profile, which presents a probe of the fundamental properties of the confining force as well. In this work we analytically calculate the flux-tube divergence with the inclusion of both Lüscher boundary action and Polyakov-Kleinert rigid action at two orders. This equipped with the formalism necessary to draw a direct comparison with the numerical data of action densities of QCD vacuum. We find the model to successfully eliminate the deviations of the free bosonic string from the numerical lattice Mont-Carlo data at high temperature.

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