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The static energy of a quark-antiquark pair from Laplacian eigenmodes

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We compute the static energy of a quark-antiquark pair in lattice QCD using a method which is not based on Wilson loops, but where the trial states are formed by eigenvector components of the covariant lattice Laplace operator. The computational effort of this method is significantly lower than the standard Wilson loop calculation, when computing the static potential not only for on-axis, but also for many off-axis quark-antiquark separations, i.e., when a fine spatial resolution is required, e.g., for string breaking calculations. We further improve the signal by using multiple eigenvector pairs, weighted with Gaussian profile functions of the eigenvalues, providing a basis for a generalized eigenvalue problem (GEVP), as it was recently introduced to improve distillation in meson spectroscopy. We show results from the new method for the static potential with dynamical fermions and demonstrate its efficiency compared to traditional Wilson loop calculations.

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