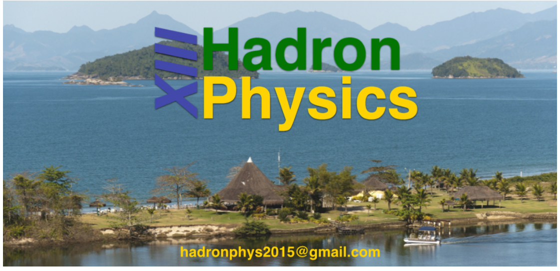

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Heavy-quarkonium potential from the lattice gluon propagator

There is interest in the study of heavy-quark systems since the decays of heavy-quarks can be used in the search of Beyond the Standard Model physics [1]. A commonly used approximation to the spin-independent interquark potential for heavy quarks is the so-called Cornell (or Coulomb plus linear) potential, which interpolates the perturbative regime and non-perturbative regime by considering the potential a sum of two terms [2, 3, 4]. The first term is a Coulomb
potential multiplied by a numerical factor and is obtainable through the one-gluon-exchange approximation (OGE), i.e. perturbation theory applied at first order only [5]. The second term is a linearly-rising potential and inspired by lattice simulations. It corresponds to the static quark potential from the Wilson loop at strong-coupling approximation. Recent results using lattice simulations and Bethe-Salpeter equation show agreement of the interquark potential with the Cornell potential in the infinitely heavy quark limit[6].

In order to see if nonperturbative information can improve the Coulomb-like term of the potential, we propose to substitute the free gluon propagator
by a nonperturbative one, obtained from lattice simulations. The propagator used is obtained from a simulation of a pure SU(2) gauge theory available in Ref. [7], corrected by a numerical (color) factor. We fix the normalization by imposing that at large momentum q, the propagator should behave as $1/q^2$. The model has as free parameters the string force F_0, and the masses of charm m_c and bottom m_b quarks. The spectrum can be obtained by numerical solution of the Schrödinger equation and then fitted to experimental data. State wave functions and consequently the average radius are also obtainable. Our conclusion is that the potential obtained this way shows small but visible improvements over the Cornell potential, indicating that it carries information not present in the Cornell potential. We presented partial results previously in Refs. [8, 9].

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