1. High precision study of B*B pi coupling in unquenched QCD

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The $B^*B\pi$ coupling is a fundamental parameter of chiral effective Lagrangian with heavy-light mesons and can constrain the $B \to \pi l\nu$ form factor in the soft pion limit which will be useful for precise determination of $|V_{ub}|$. We compute the $B^*B\pi$ coupling with the static heavy quark and the $O(a)$-improved Wilson light quark. Simulations are carried out with $n_f = 2$ unquenched $12^3 \times 24$ lattices at $\beta = 1.80$ generated by CP-PACS collaboration. Following the quenched study by Negishi et al., we employ the all-to-all propagator with 200 low eigenmodes as well as HYP smeared link to improve the statistical accuracy.

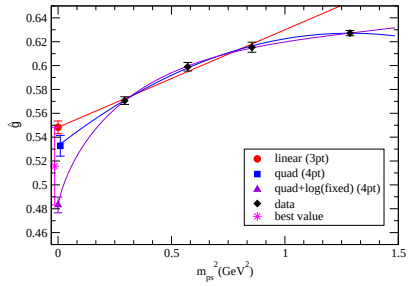

Figure 1: The chiral extrapolation of the physical $B^*B\pi$ coupling . for $\beta = 1.95$ (right).

2. Topological susceptibility in two-flavor lattice QCD with exact chiral symmetry High precision study of B*B pi coupling in unquenched QCD

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We determine the topological susceptibility χ_t in two-flavor QCD using the lattice simulations at a fixed topological sector. The topological charge density is unambiguously defined on the lattice using the overlap-Dirac operator which possesses exact chiral symmetry. Simulations are performed on a $16^3 \times 32$ lattice at lattice spacing ~ 0.12 fm at six sea quark masses m_q ranging in $m_s/6$–m_s with m_s the physical strange quark mass. The χ_t is extracted from the constant behavior of the time-correlation of flavor-singlet pseudo-scalar meson two-point function at large distances, which arises from the finite size effect due to the fixed topology. In the small m_q regime, our result of χ_t is proportional to m_q as expected from chiral effective theory. Using the formula $\chi_t = m_q\Sigma/N_f$ by Leutwyler-Smilga, we obtain the chiral condensate in $N_f = 2$ QCD as $\Sigma^{\overline{\rm MS}}(2{\rm GeV}) = [254(5)(10){\rm MeV}]^3$, in good agreement with our previous result obtained in the ϵ-regime.

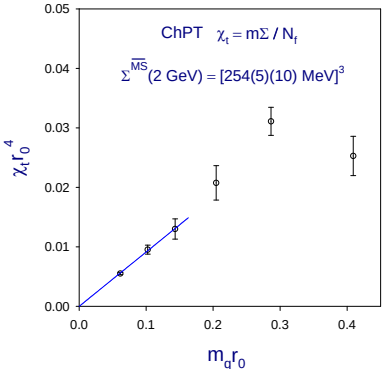

Figure 2: Topological susceptibility $\chi_t r_0^4$ versus sea quark mass $m_q r_0$.

References

[1] H. Ohki, H. Matsufuru and T. Onogi, "Determination of B*B pi coupling in unquenched QCD," arXiv:0802.1563 [hep-lat].

[2] S. Aoki *et al.* [JLQCD and TWQCD Collaborations], Topological susceptibility in two-flavor lattice QCD with exact chiral symmetry," arXiv:0710.1130 [hep-lat].