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Probing $N_f = 2$ chiral dynamics with topological zero-modes in the mixed chiral regim

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Lattice QCD benefits nowadays from numerous progess thanks to algorithmic enhancements to push down the quark masses to reach the physical masses and to increase the lattice geometry to avoid finite volume effects. However using fermions which do not break the chiral symmetry both in valence and sea sector is still a challenge. An alternative is to consider mixed action simulations, where one uses for example Ginsparg-Wilson respecting chiral symmetry to describe the valence quark whereas the sea is described by Wilson fermions, which break chiral symmetry and which are numerically cheaper but even in this case, using large volumes do avoid finite-volume effects is rather expensive.
Chiral perturbation theory (ChPT) can be done in finite-volume so that it can take into account the finite-volume effects. But we can use quarks that do not belong to the same chiral regime : some quarks can be in the so-called epsilon regime of ChPT which allows to compute large finite-size effects while other quarks are in the usual p regime. We thus consider a theory with N_v quarks in the epsilon regime and N_s quarks in the p-regime. These results can be used to match lattice QCD and the chiral effective theory in a large but finite box in which the Compton wavelength of the lightest pions is of the order of the box size. This approach allows us to test the chiral regime. I will present some results obtained in the case of the PP correlator.

Summary

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