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Kaon leptonic and semileptonic decays with N_f=2+1+1 HISQ fermions

Wednesday 5 November 2025 09:40 (20 minutes)

Current precision tests of the Standard Model (SM) show a deficit in the first row unitarity of the CKM matrix. At the current level of precision, the only relevant CKM matrix elements that contribute to first row unitarity are $|V_{ud}|$ and $|V_{us}|$. Without resorting on nuclear inputs, those can be extracted from the experimental decay width of kaon and pion leptonic decays along with the theoretical calculation of their decay constants, and semileptonic kaon decays along with the corresponding form factor at zero momentum transfer. In this talk we will discuss progress towards a correlated analysis of the lattice inputs needed for this test using highly improved staggered quarks (HISQ) on the MILC $N_f = 2 + 1 + 1$ configurations.

We will present the status of a new analysis of light-meson decay constant data where chiral-continuum fits are guided by Staggered Chiral Perturbation Theory (SChPT). The goal of SChPT is twofold: it allows us to use not only physical pion mass data but also unphysical data; moreover, it will also provide values of ChPT Low Energy Constants (LECs) as well as their correlations. We will also present a reanalysis of our previous kaon semileptonic form factor calculation, aiming to estimate correlations between the form factor and light-meson decay constants. We will discuss the new methodology, new data included, and we will also present some preliminary results.

Parallel Session (for talks only)

Quark and lepton flavor physics

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