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Lattice Input on the V_us from inclusive hadronic tau decay data

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The determination of V_us via finite energy sum rule analyses of flavor-breaking combinations of non-strange and strange hadronic tau decay data yields values of V_us ~3 sigma below both expectations based on 3-family unitarity and results obtained from analyses of Gamma[K_{ell 3}] and Gamma[K_{mu 2}]/Gamma[pi_{mu 2}]. A key issue in understanding whether this low value represents new physics or just an underestimate of the uncertainties in the existing analyses is the very slow convergence of the leading D=2 contribution to the OPE representation of the relevant flavor-breaking correlator difference. A sign of this slow convergence is the fact that switching from the "local scale" CIPT prescription to the "fixed scale" FOPT prescription for the relevant D=2 contour integrals leads to results for V_us differing by an amount ~0.0020 much larger than most total theory error estimates existing in the literature. Here we investigate the issue of which (if either) of the two prescriptions for the D=2 series is more reliable by studying lattice data for the relevant correlator differences, obtained using RBC/UKQCD n_f=2+1 domain wall fermion ensembles covering a range of light quark masses and lattice spacings. We then use the lessons learned from this comparison to improve and update two flavor-breaking sum rule determination of V_us.

Summary

We describe a lattice investigation focussed on understanding how to best treat the very slowly converging D=2 OPE series entering flavor-breaking correlator combinations relevant to the determination of V_us from hadronic tau decay data.

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