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$B^{(*)}, D^{(*)}, B_s^{(*)}, D_s^{(*)}$ Decay Constants and Hyperfine Splittings from Lattice QCD using the Heavy-HISQ Method

Wednesday, 18 December 2024 22:00 (10 minutes)

Decay constants parametrise non-perturbative strong interactions in leptonic weak decays of mesons. Here, we present new lattice QCD results for the vector-to-pseudoscalar and tensor-to-vector ratios of decay constants of the $B^{(*)}, B_s^{(*)}, D^{(*)}$ and $D_s^{(*)}$ mesons. Many correlated uncertainties cancel in these ratios, yielding high-precision results. We use the Highly Improved Staggered Quark (HISQ) action for all valence quarks, second-generation MILC $n_f = 2 + 1 + 1$ HISQ gauge configurations, lattice spacings ranging from 0.15fm down to 0.045fm, and pion masses ranging from $\approx$ 300MeV down to the physical value. The mass dependence of these ratios is determined using the heavy-HISQ method: heavy-quark masses range from the physical charm up to the physical bottom on the finest lattices we use. We also calculate hyperfine splittings — mass differences between pseudoscalar mesons and their associated vectors. All values presented are preliminary. These quantities provide stringent tests of Standard Model flavour phenomenology, sensitivity to new physics, and important inputs to future theoretical calculations.

Presenter: MILLER, Kerr (University of Glasgow)

Session Classification: Poster Session & Dinner