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Precision Scale Setting in Lattice QCD Using Baryon Spectra and Decay Constants

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The determination of the lattice scale with high precision is a prerequisite for extracting reliable physical results from lattice QCD. We present an analysis of scale setting using 2+1-flavor Wilson–clover ensembles generated by the JLab/W&M/LANL/MIT/Marseille collaborations with the Hybrid Monte Carlo algorithm. These ensembles span a broad range of lattice spacings ($0.056 \leq a \leq 0.127$ fm), pion masses ($M_\pi \approx 130$ – 270 MeV), and volumes ($3.7 \leq M_\pi L \leq 6.2$), enabling controlled chiral, continuum, and infinite-volume extrapolations.

We use baryon spectra and pseudoscalar decay constants to determine the lattice spacing, assess systematic uncertainties, and cross-validate scale-setting procedures. The analysis includes a study of two-point correlation functions computed with the CHROMA software package, the extraction of masses and decay constants, and a combined fit strategy for extrapolating to the physical point. The resulting precision determination of the lattice scale provides a solid foundation for ongoing and future calculations of hadron structure and matrix elements on these ensembles.

Parallel Session (for talks only)

Structure of hadrons and nuclei

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