

Preliminary results of Delta I=1/2 and 3/2, $K \rightarrow \pi\pi$ decay amplitudes from Lattice QCD

Monday 19 July 2010 11:30 (30 minutes)

We report a direct lattice calculation of the $K \rightarrow \pi\pi$ decay matrix elements for both Delta I=1/2 and 3/2 channels on 2+1 flavor, domain wall fermion, $16^3 \times 32$ lattices. This first direct calculation of the Delta I=1/2 channel is made possible by collecting very large statistics and studying the decay at $\pi\pi$ threshold with 420 MeV pions in a small, 1.8 fm box. All possible contractions are carefully listed and calculated and identities among them are verified. The decay into the isospin zero $\pi\pi$ final state, which receives contributions from the disconnected graphs, is very difficult to calculate, but a clear signal in the similar disconnected $\pi\pi$ correlator can be seen. We also demonstrate that a large explicit subtraction of the divergent ($\bar{s} \gamma_5 d$) contribution is necessary even for the case of kinematics which are nominally energy conserving.

Preliminary results, some with large errors, will be presented for the various contributions to the renormalized weak matrix elements A_0 and A_2 in the case of $M_\pi=420\text{MeV}$. Delta I=1/2 Rule is demonstrated from our calculation.

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