Contribution ID: 122

## Long-distance contribution to neutrinoless double beta decays in pion sector

Wednesday, 5 August 2020 14:20 (20 minutes)

Neutrinoless double beta decay, if detected, would prove that neutrinos are Majorana fermions and provide the direct evidence for lepton number violation. If such decay would exist in nature, then  $\pi$ - $\pi$ - $\rightarrow$  ee and  $\pi$ - $\rightarrow$   $\pi$ +ee (or equivalently  $\pi$ -e+ $\rightarrow$   $\pi$ +e-) are the two simplest processes accessible via first-principle lattice QCD calculations. In this work, we calculate the long-distance contributions to the  $\pi$ 

 $- \rightarrow \pi$ +ee transition amplitude using four ensembles at the physical pion mass with various volumes and lattice spacings. We adopt the infinite-volume reconstruction method to control the finite-volume effects arising from the (almost) massless neutrino. Providing the lattice QCD inputs for chiral perturbation theory, we obtain the low energy constant  $g\pi\pi\nu(m\rho) = -10.89(28)$ stat(74)sys, which is close to  $g\pi\pi\nu(m\rho) = -11.96(31)$ stat determined from the crossed channel  $\pi$ - $\pi$ - $\rightarrow$  ee decay.

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Session Classification: Weak Decays and Matrix Elements

Track Classification: Weak Decays and Matrix Elements