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Calculating $K_L \to \gamma\gamma$ using lattice QCD

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Determining the standard model prediction for the decay amplitude of a long-lived neutral kaon into two photons is an important step toward the goal of calculating the two-photon contribution to $K_L \to \mu^+\mu^-$ decay. In this talk we will describe a computational strategy to determine this decay amplitude using lattice QCD. While the lattice QCD calculation is carried out in finite volume, the emitted photons are treated in infinite volume and the resulting finite-volume errors decrease exponentially in the linear size of the lattice volume. Only the CP conserving contribution to the decay is computed and we must subtract unphysical contamination resulting from single pion and eta intermediate states which grows exponentially as the time separation between the initial and final lattice operators is increased. First results from a calculation on a $24^3 \times 64$ lattice volume with $1/a = 1$ GeV and physical quark masses will be presented.

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