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A study of the radiative transition $\pi\pi \to \pi\gamma^*$ with lattice QCD

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Lattice QCD calculations of radiative transitions between hadrons have in the past been limited to processes of hadrons stable under the strong interaction. Recently developed methods for $1 \to 2$ transition matrix elements in a finite volume now enable the determination of radiative decay rates of strongly unstable particles. Our lattice QCD study focuses on the process $\pi\pi \to \pi\gamma^*$, where the ρ meson is present as an enhancement in the cross-section. We use 2+1 flavors of clover fermions, initially at a pion mass of approximately 320 MeV and a lattice size of approximately 3.6 fm. The required 2-point and 3-point correlation functions are constructed from a set of forward, sequential and stochastic light quark propagators. In addition to determining the ρ meson resonance parameters via the Lüscher method, the scattering phase shift is used in concert with the $1 \to 2$ transition matrix element formalism of Briceño et al. to compute the $\pi\pi \to \pi\gamma^*$ amplitude at several values of the momentum transfer and $\pi\pi$ invariant mass.

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