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Higher partial wave contamination in finite-volume formulae for 1-to-2 transitions

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It is common practice to truncate the finite-volume formula for $K \rightarrow \pi\pi$, and other one to two transitions, to only include the lowest partial wave, as in the original derivation by Lellouch and Lüscher. However, as the precision of lattice calculations increases, it may become important to assess the systematic effect of this approximation. With this motivation, we compare the S-wave-only ($\ell = 0$) results with those truncated at the next lowest value of angular momentum. Using the general framework for $1 + j \rightarrow 2$ transitions we look at the zero-momentum case, with both periodic and twisted boundary conditions (both of which couple to $\ell = 4$) and the moving frame case (which leads to mixing with $\ell = 2$). In addition to general estimates for various scattering parameters, we also give quantitative results for realistic $\pi\pi$ amplitudes.

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