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Multi-channel 1 to 2 matrix elements in finite volume

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We derive a model-independent expression for finite-volume matrix elements. Specifically, we present a relativistic, non-perturbative analysis of the matrix element of an external current between a one-scalar in-state and a two-scalar out-state. Our result, which is valid for energies below higher-particle inelastic thresholds, generalizes the Lellouch-Luscher formula in two ways: we allow the external current to inject arbitrary momentum into the system and we allow for the final state to be composed an arbitrary number of strongly coupled two-particle states with arbitrary partial waves (including partial-wave mixing induced by the volume). We also illustrate how our general result can be applied to some key examples, such as heavy meson decays and meson photo production.

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