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# Breakdown of Lüscher Formalism near Left Hand Cuts

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Understanding three-body dynamics is crucial in comprehending the behavior of hadronic states that decay into three or more particles under strong interactions. Recent advances in Lattice QCD techniques allow us to calculate three-particle interactions from QCD and access finite volume energies. Connecting these energies to physical observables involves multiple steps. Firstly, we use the Lüscher formalism and its extensions to map these energies to intermediate quantities in infinite volume. These quantities serve as input in a set of integral equations, yielding the three-body scattering amplitude. Before applying this method to actual Lattice QCD calculations, we must verify its consistency with various toy models. In this study, we numerically solve relativistic three-body integral equations for a toy model of three identical scalar bosons. The model's two-body sub-channel, defined by scattering length, permits bound states. Our results for a bound-state+particle system are compared to established results using Lüscher formalism for the same toy model. We discuss methods of solving the integral equations above the bound-state+particle threshold and provide a prescription for analytically continuing solutions below threshold. Although our solutions agree well with previous results, we find evidence of Lüscher formalism breaking down near the left-hand cut resulting from exchange particle interactions. This talk primarily focuses on our solution techniques and the breakdown of the finite volume formalism.

## Topical area

Hadronic and Nuclear Spectrum and Interactions

**Primary authors:** ISLAM, Md Habib E (Old Dominion University); DAWID, Sebastian (University of Washington); BRICENO, Raul (Berkeley)

**Presenter:** ISLAM, Md Habib E (Old Dominion University)

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