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Towards the finite-volume spectrum of the Roper resonance

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We investigate the energy levels corresponding to the Roper resonance based on a two-flavor chiral effective Lagrangian at leading one-loop order. We show that the Roper mass can be extracted from these levels for not too large lattice volumes.

Further, to include three body dynamics, such as $N\pi\pi$, we introduce a non-relativistic effective field theory for the Roper resonance within a covariant particle-dimer picture. This particle-dimer approach is a suitable framework to investigate three particle scattering relevant for the Roper channel. We analyze the appearing dimer fields, calculate the energy levels of the Roper resonance in a finite volume and compare the obtained energy levels with the results from the fully relativistic chiral effective Lagrangian.

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