

Luis Raul Torres Rojas: Five-body systems with Bethe-Salpeter equations

We extend the Bethe-Salpeter formalism to systems made of five valence particles. Restricting ourselves to two-body interactions, we derive the subtraction terms necessary to prevent overcounting. We solve the five-body Bethe-Salpeter equation numerically for a system of five scalar particles interacting by a scalar exchange boson. To make the calculations tractable, we implement properties of the permutation group S_5 and construct an approximation based on intermediate two- and three-body poles. We extract the five-body ground and excited states along with the spectra obtained from the two-, three-, and four-body equations. In the limit of a massless exchange particle, the two-, three, four- and five-body states coexist within a certain range of the coupling strength, whereas for heavier exchange particles the five-body system becomes Borromean. Our study serves as a building block for the calculation of pentaquark properties using functional methods.