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Relativistic studies of few-body systems using the Bethe-Salpeter approach

Understanding the hadronic interactions from basic principles is one of the most important challenges in modern nuclear/particle physics.
This task is very difficult and it is therefore important to perform non-perturbative studies of few-body systems using simple models, in order to understand the response of such systems to different contributions to the interaction.
For example, ladder and cross-ladder diagrams for two-body systems, and effective three-body forces in the case of three-body systems.
Furthermore, it is well-known that in the non-relativistic treatment of three-boson systems interacting through a zero-range interaction, the binding energy is unbound from below (Thomas collapse).
However, it has been shown [1,2] that in a relativistic treatment this collapse is prevented.

The Bethe-Salpeter equation provides an approach to study few-body systems in the non-perturbative regime.
In this contribution we will briefly review some recent results [3,4] computed for two- and three-boson systems using the aforementioned formalism.
For the two-body system we will discuss the response to cross-ladder exchanges in the interaction kernel [3].
Regarding the three-body system having a zero-range interaction we discuss the response of to higher Fock components, and thus effective three-body forces [4]. We present results for systems where two of the particles can form a bound state and in addition for so-called Borromean systems, where no two-body bound state exists. The latter kind of systems of was not treated in previous works [1,2] and therefore the true ground state is found for the first time.

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