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Three particles in a finite volume

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The spectrum of a bound state of three identical particles with a mass m in a finite cubic box is studied within the effective field theory approach. It is shown that in the limit of a large two-body scattering length, the energy shift of a shallow bound state is given by
$\Delta E = c(\kappa^2/m)(\kappa L)^{-3/2}|A|^2 \exp(-2\kappa L/\sqrt{3})$,
where κ is the bound-state momentum, L is the box size,
$|A|^2$ denotes the three-body analog of the asymptotic normalization coefficient of the bound state wave function and c is a numerical constant. The formula is valid for $\kappa L \gg 1$. We further compare these predictions to the results of numerical calculations of the three-body spectrum in a finite volume. Using this approach to study the nature of the three-body bound states on the lattice is discussed.

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