# Quantum Monte Carlo studies with microscopic two- and three-body interactions of a trimer scaling function

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Loosely bound few-body quantum systems close to unitarity, when the two-body scattering length diverges, have the corresponding densities distributed over a much larger region beyond the range of their mutual interactions. In this situation, the details of the inter-particle potential become almost irrelevant once the interaction can reproduce the ground-state spectrum. These basic quantum properties are fundamental in understanding few-body effects such as the Thomas collapse or the related well-known Efimov effect. Efimov physics deals with the emergence of three-body bound states in systems of identical bosons with short-range resonant interactions. Much progress has been made in studying Efimov trimers in the limit of zero-range interactions, and several works in the literature aim at including finite-range corrections. In this work, we present an energy scaling function to predict, in a specific range, the energy of bosonic trimers with large scattering lengths and finite range interactions, which is validated by quantum Monte Carlo calculations using microscopic Hamiltonians with two- and three-body potentials. The proposed scaling function depends on the scattering length, effective range, and a reference energy, which we chose as the trimer energy at unitarity. We obtained the scaling function as a limit cycle from the solution of the renormalized zero-range model with effective range corrections. We proposed a simple parameterization of the energy scaling function. Besides the intrinsic interest in theoretical and experimental investigations, this scaling function allows one to probe Efimov physics with only the trimer ground-states, which may open opportunities to identify Efimov trimers whenever access to excited states is limited.

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