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Applications of the explicitly correlated Gaussian approach to cold few-atom systems[1]

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The explicitly correlated Gaussian basis set expansion approach has been applied to a wide range of few-body systems relevant to particle, nuclear, atomic and molecular physics. This talk summarizes our theoretical investigations of universal aspects of ultracold gaseous and liquid few-atom systems using explicitly correlated Gaussians. In the ultracold regime, where the de Broglie wave length is large compared to the range of the interaction potentials, the collisions between particles become so slow that the details of the interactions are, to leading order, neglegible. In this regime, the dynamics of few-atom systems is governed by just a few "effective parameters," such as the s-wave scattering length, and largely independent of the details of the underlying two-body potentials. As a first example, we present results for harmonically trapped few-fermion systems with infinitely large interspecies s-wave scattering length consisting of up to ten particles. As a second example, we investigate the behavior of weakly-bound Bose droplets with a light impurity and elucidate how the properties of these droplets are related to the three-body Efimov effect in heavy-heavy-light trimers.

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