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Applications of the Stochastic Variational Method

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The variational method complemented with the use of explicitly correlated Gaussian basis functions is one of the most powerful approaches currently used for calculating the properties of few-body systems. Despite its conceptual simplicity, the method offers great flexibility, high accuracy, and can be used to study diverse quantum systems, ranging from small atoms and molecules to light nuclei, hadrons, quantum dots, and Efimov systems. One of the biggest computational issue is the optimal choice of basis parameters. The stochastic variational method is a random trial and error approach which proved to be very efficient in minimizing the variational energy. The basic computational foundations are discussed, recent advances in the applications of the stochastic variational method in physics and chemistry are reviewed, and the strengths and weaknesses of the explicitly correlated Gaussians approach are compared with other few-body techniques.