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# Bogoliubov coupled cluster theory for open-shell nuclei

The objective of the so-called ab initio approach to nuclear structure is to provide an accurate and universal description of nuclear systems from first principles [1]. In this context, solving the many-body Schrödinger equation requires systematically improvable many-body methods. Over the past 20 years, the development of novel expansion methods displaying a mild computational scaling with systems size have allowed access to mid-mass closed-shell nuclei. Such methods typically expand the exact ground-state wave-function around a reference/unperturbed Slater determinant and include correlations through elementary particle-hole excitations. This can be obtained from perturbative techniques [2] or from non-perturbative approaches such as coupled-cluster (CC) theory [3]. While closed-shell nuclei are well under control, the extension to open-shell nuclei remains a major challenge.

Only very recently, a novel many-body method coined as Bogoliubov coupled cluster (BCC) theory [4] has been formulated that extends the standard coupled cluster scheme to singly open-shell nuclei. This is achieved by breaking particle-number symmetry of the unperturbed state as a way to already incorporate crucial static correlations into it. In my talk I will present recent results obtained for the ground-state of oxygen isotopes based on nuclear interaction models derived from chiral effective field theory.

Once fully implemented, the non-perturbative (equation-of-motion) BCC method will allow for high-precision ab initio calculations of ground and excited states in medium-mass nuclei.

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