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Short-Range correlations studies using the nuclear contact formalism

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Due to their complexity, atomic nuclei are traditionaly studied using effective theories. While these tend to describe the low-momentum part of the nucleon momentum distribution well, they fail to describe two-nucleon short-range correlations (SRC). The latter account for approximately 20% of nucleons in the nucleus and dominate the many-body wave function at short distances. The Contact formalism is an effective theory developed for the study of the high-momentum behavior of dilute ultra-cold two-component atomic gases. Even though nuclei don't fully satisfy the conditions of this theory, there is experimental evidence that shows it can be applied to nuclear systems. Here, we preset a generalization of the contact formalism to nuclear systems and extract spin and isospin dependent nuclear contact coefficients from ab-initio 2-body momentum distributions. We compare the contact-derived distributions to 1-body momentum distributions in the region sensitive to SRC, and to experimental data. We then discuss applications of this formalism to the extraction of nuclear correlation functions by combining the short and long distance nucleon behaviors using a blending function. We argue that this model can be used to calculate neutrinoless double beta decay matrix elements for nuclei lacking ab initio calculations.

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