Universality of Short-Range Correlations: One- and Two-Body Momentum Distributions

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In this contribution we report on recent developements on the calculations of ground-state properties of nuclei using realistic nuclear wave functions. We will argue that universality of short range correlations can be seen both in coordinate and in momentum space, in one- and two-body densities and momentum distributions. Calculations for few-body nuclei, namely ^{3}He and ^{4}He, have been performed using exact wave functions obtained with Argonne NN interactions, while the cluster expansion technique is used for medium-heavy nuclei. The center of mass motion of an NN pair in the nucleus, described by $n^{NN}(\vec{k}_{rel}, \vec{K}_{CM})$, is shown to exhibit the universal behaviour predicted by the two-nucleon correlation model (TNC), in which the NN pair moves inside the nucleus as a deuteron in a mean-field. Moreover, the deuteron-like spin-isospin (ST) = (10) contribution to the pn two-body momentum distribution is obtained, and shown to exactly scale to the deuteron momentum distribution. Universality of correlations in two-body momentum distributions is obviously cast on the one-body distribution $n(k)$: in particular, the approximate scaling of $n(k)$ to the deuteron distribution predicted within the TNC model is shown to be exact if the distribution is obtained integrating the two-body $n^{pn}(\vec{k}_{rel}, \vec{K}_{CM})$ restricted to the deuteron-like quantum numbers. Scaling to the deuteron can also be shown to hold in the case of final state interactions in $A(e, e'p)X$. This processes can be reasonably described by the distorted momentum distributions of nuclei obtained within the Glauber formalism. We find that $n_D^A(|\vec{p}_{mis}|, \theta)$ exhibits scaling to the deuteron $n_D^{^2H}(|\vec{p}_{mis}|, \theta_{mis})$ for any value of the angle θ_{mis} between the missing momentum and the transferred momentum, as a function of $|\vec{p}_{mis}|$. We interpret this scaling as a clear signature of a single rescattering of the proton in the final state or, in other words, of final state interaction confined within the correlated pair. This interpretation is corroborated by explicit calculations of the single rescattering term contributing to $n_D(|\vec{p}_{mis}|, \theta_{mis})$, shown to be the largest contribution to the total distorted distribution in the high missing momentum region.

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