Quantifying Short-Range Correlations in Nuclei

M. Vanhalst, **J. Ryckebusch**, **W. Cosyn**

Department of Physics and Astronomy, Ghent University Proeftuinstraat 86, B-9000 Gent, Belgium

A method to quantify the number of two-nucleon (2N) and three-nucleon (3N) short-range correlations (SRC) in nuclei is suggested. The proposed method relies on the universality of the SRC and their short range. The mass dependence of the 2N and 3N SRC is studied from He to heavy nuclei. The theoretical predictions are compared to the ratio of the inclusive inelastic electron scattering cross sections of nuclei to ^{2}H and ^{3}He at large values of the Bjorken variable. These measurements give access to the amount of 2N and 3N SRCs. To date, none of the available many-body techniques allows one to compute the 1N and 2N momentum distributions for the full mass range. We do not attempt a high-precision calculation but rather exploit stylized features of the nucleon momentum distributions in order to quantify the 2N and 3N SRCs for an arbitrary $A(N, Z)$. It has been argued that the 2N correlations represent a local property. This implies that the correlations are universal or only weakly A dependent [1]. Hence, the tensor correlation operator in a nucleus A is not dramatically different from the one that fixes the $^{3}D_{1}$ and $^{3}S_{1}$ wave-function components in deuterium. Second, it was observed that for moderate relative pair momenta, ($300 \leq k_{12} \leq 600$ MeV), the effect of the tensor correlations is dominant [2, 3]. The central subject of this talk asserts that the amount of 2N pairs and 3N triples prone to SRC in nuclei can be reasonably quantified by counting the number of nucleon pairs and triples in a relative S state in a mean-field ground-state wave function [4]. We also address the issue to what extent the mass dependence of the 2N correlations can be captured by some approximate principles. Lastly, we address the issue of how one can connect the observed scaling behavior of the inclusive $A(e, e')$ cross section at large Bjorken x_{BJ} to the number of correlated pairs and triples.

References

[1] H. Feldmeier, W. Horiuchi, T. Neff and Y. Suzuki, *Phys.Rev.* **C84** (2011) 054003.
[2] S. Janssen, J. Ryckebusch, W. Van Nespen and D. Debruyne, *Nucl. Phys. A* **672** (2000) 285.
[3] R. Schiavilla, R. Wiringa, S. Pieper and J. Carlson, *Phys.Rev.Lett.* **98** (2007) 132501.
[4] M. Vanhalst, W. Cosyn and J. Ryckebusch, *Phys.Rev.* **C84** (2011) 031302.