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# HIGH ENERGY PHYSICS COLLOQUIA

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## THREE DIMENSIONAL PARTON STRUCTURE OF NUCLEI

### Abstract

Recent experimental and theoretical ideas are laying the ground for a new era in the knowledge of the elusive parton structure of nuclei. I will report on two promising directions beyond inclusive deep inelastic scattering experiments, aimed at, among other goals, unveiling the three dimensional structure of the bound nucleon [1,2]. The 3D structure in coordinate space can be accessed through deep exclusive processes, whose non-perturbative content is parametrized in terms of generalized parton distributions. In this way the distribution of partons in the transverse plane will be obtained, providing a pictorial view of the realization of the so-called European Muon Collaboration (EMC) effect, i.e., the medium modification of the nucleon parton structure. Analogously, the momentum space 3D structure can be accessed by studying transverse momentum dependent parton distributions in semi-inclusive deep inelastic scattering processes. Novel coincidence measurements at high luminosity facilities, such as Jefferson Laboratory at 12 GeV and the future Electron Ion Collider, will be presented. The crucial role played by light nuclei, for which realistic calculations are possible, in exposing possible novel quark and gluon effects in nuclei, will be addressed summarizing recent theoretical results [3,4].

Based on:

- <sup>1</sup> R. Dupré, S. Scopetta, “3D Structure and Nuclear Targets”, *Eur. Phys. J. A52* (2016) no.6, 159 [[arXiv:1510.00794](#)].
- <sup>2</sup> I. C. Cloët et al., “Exposing Novel Quark and Gluon Effects in Nuclei”, *J. Phys. G46* (2019) no.9, 093001 [[arXiv:1902.10572](#)].
- <sup>3</sup> A. Del Dotto et al., “Final state interactions and the extraction of neutron single spin asymmetries from semi-inclusive deep-inelastic scattering by a transversely polarized <sup>3</sup>He target”, *Phys. Rev. C96* (2017) no.6, 065203 [[arXiv:1704.06182](#)].
- <sup>4</sup> S. Fucini, S. Scopetta, M. Viviani, “Coherent deeply virtual Compton scattering off <sup>4</sup>He”, *Phys. Rev. C98* (2018) no.1, 01520 [[arXiv:1805.05877](#)].

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