

# Three-dimensional partonic structure of hadrons and nuclei

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**Topics of interest:** Theoretical and phenomenological studies of hadrons and hadronic matter. The main topic under investigation is the three-dimensional parton structure, in coordinate and in momentum space, accessed through the study of exclusive and semi-inclusive hard processes.

**Current research lines:** Hadronic structure investigated with high energy electromagnetic probes, at high luminosity facilities, such as Jefferson Lab. The complementary information contained in multiple parton interactions at the LHC is also under investigation. Special attention is dedicated to realistic studies of the parton structure of nucleons in nuclei, thinking in particular to the use of light ion beams at the future Electron Ion Collider. Besides, possible effects in dense hadronic matter, relevant to study the core of compact stars, will be addressed. The theoretical framework is mainly based on the Poincaré covariant description of the dynamics inside hadrons and nuclei, both with fixed and infinite degrees of freedom. In particular, in the first case, relativistic Hamiltonian dynamics is the basic tool. The QFT side is addressed by exploiting a recent approach for solving both Bethe-Salpeter and Dyson-Schwinger equations in Minkowski space. Candidates with expertise in different calculation schemes are in any case encouraged to apply. In general, realistic wave functions of light nuclei represent important tools in the addressed studies.

## Recent publications

- [1] A. Courtoy, S. Noguera and S. Scopetta, "Two-current correlations in the pion in the Nambu and Jona-Lasinio model," EPJC, 2020, in press [arXiv:2006.05300 [hep-ph]].
- [2] S. Fucini, S. Scopetta and M. Viviani, "Catching a glimpse of the parton structure of the bound proton," Phys. Rev. D **101** (2020) no.7, 071501.
- [3] A. Courtoy, S. Noguera and S. Scopetta, "Double parton distributions in the pion in the Nambu–Jona-Lasinio model," JHEP **12** (2019), 045.
- [4] M. Rinaldi, "Double parton correlations in mesons within AdS/QCD soft-wall models: a first comparison with lattice data," Eur. Phys. J. C **80** (2020) no.7, 678.
- [5] M. Rinaldi and F. A. Ceccopieri, "Double parton scattering and the proton transverse structure at the LHC," JHEP **09** (2019), 097.
- [6] J. H. Alvarenga Nogueira, D. Colasante, V. Gherardi, T. Frederico, E. Pace and G. Salmè, "Solving the Bethe-Salpeter Equation in Minkowski Space for a Fermion-Scalar system," Phys. Rev. D **100** (2019) no.1, 016021.
- [7] R. Baldini Ferroli, A. Mangoni, S. Pacetti and K. Zhu, "Strong and electromagnetic amplitudes of the  $J/\psi$  decays into baryons and their relative phase," Phys. Lett. B **799** (2019), 135041.
- [8] J. Hammelmann, A. Soto-Ontoso, M. Alvioli, H. Elfner and M. Strikman, "Influence of the neutron-skin effect on nuclear isobar collisions at energies available at the BNL Relativistic Heavy Ion Collider," Phys. Rev. C **101** (2020) no.6, 061901.