The quark spin in the hadronisation process

The fragmentation of quarks into hadron jets is a non-perturbative QCD process and as such still poorly understood theoretically. For this reason, several models have been developed and used in simulations of unpolarized scattering processes to account for the main jet properties, prepare high energy experiments and analyze their results. Very recently, a model formulated on the basis of the Lund string fragmentation Model and including the $^3P_0$ mechanism of quark pair production has been implemented in a Monte Carlo program in collaboration with Lyon. It allows to simulate for the first time the hadronisation of polarized quarks, and to reproduce the transverse spin effects recently observed in Semi-Inclusive Deep Inelastic Scattering (SIDIS) and e^+e^- annihilation to hadrons experiments. The model and its Monte Carlo implementation are in continuous development and allow for a wide field of completely new phenomenological studies in several processes, sensitive to the transverse spin and momentum structure of the nucleons. More information can be found in [1-2].

The PhD activity would include: theoretical developments aimed to improve the model, e.g. implement the polarized baryon production and decay in the string fragmentation chain; introduction of quark spin effects in modern Monte Carlo Event Generators; simulation of the nucleon structure in terms of the transverse momentum dependent partonic distributions; global analysis of the existing SIDIS, e^+e^-, and pp hard scattering data; predictions for measurements at future facilities. The work will be done in collaboration with experimentalists, theoreticians and Monte Carlo developers active in the field.

[1] A. Kerbizi, X. Artru, A. Martin, "Production of vector mesons in the String+$^3P_0$ model of polarized quark fragmentation", Phys. Rev. D 104 (2021) 11, 114038, arXiv:2109.06124.

[2] A. Kerbizi, L. Lönnblad, "StringSpinner - adding spin to the PYTHIA string fragmentation", Comput. Phys. Commun. 272 (2022) 108234, arXiv:2105.09730.

Contact: dott. Albi Kerbizi, prof. Anna Martin