The COMPASS Experiment at CERN

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The COMPASS experiment at CERN is investigating hadron structure by deep inelastic scattering processes and in addition pursues different aspects of hadron spectroscopy using hadron beams. Comparison with calculations based on operator product expansion or lattice techniques with model predictions based on chiral symmetry or effective degrees of freedom will help to improve our understanding of hadrons. To reach this objective a new state-of-the-art fixed-target spectrometer, capable of standing beam intensities of up to $2 \cdot 10^8$ particles/spill and with excellent particle identification was set-up and has been commissioned through 2001.

One central issue of the experimental effort is a first direct measurement of the contribution of gluons to the nucleon spin (ΔG). Previous experiments at CERN, DESY and SLAC made decisive advances towards the understanding of the nucleon spin in terms of its quark constituents, but the role of the gluons still needs more clarification. With COMPASS we focus on a measurement of a cross-section asymmetry for open charm production in deep inelastic scattering of polarized muons on polarized nucleons of a ^{6}LiD- or NH_3-target to extract ΔG.

In parallel the experiment follows a second track to determine ΔG in such a way that it measures the asymmetry of oppositely charged hadron pairs at high transverse momentum. Here the basic underlying diagram is also the photon-gluon fusion like in open charm production, but the hardness of the process is now guaranteed by the large transverse momentum and not by the mass of the charm quarks. The resulting error on ΔG from this approach is dominated by systematics uncertainties, whereas the uncertainties resulting from open charm production are limited by statistics.

An additional promising measurement with the COMPASS detector is the helicity dependent quark distribution which can be accessed in semi-inclusive deep-inelastic scattering with the target in transversal polarization mode. About this distribution, widely called transversity, almost nothing is known experimentally today.

Different aspects of the experimental program of the COMPASS collaboration address investigations of non-perturbative facets of QCD by using hadronic beams. Here polarisability of mesons will be studied in Primakoff scattering as well as glueball and exotic meson production in hadron-hadron collisions.