Polarizations of Λ and $\bar{\Lambda}$ hyperons measured at HERMES

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Polarizations of Λ and $\bar{\Lambda}$ hyperons have been measured in semi-inclusive leptoproduction and quasi-real photoproduction regime. Data were accumulated by the HERMES Experiment in the years 1996 -2000 using the 27.5 GeV polarized HERA positron beam and unpolarized (polarized) internal gas targets with a storage cell.
In semi-inclusive reactions $\vec{e}+A \rightarrow e'+\vec{\Lambda}+X$ with $Q^2 > 1$ GeV^2, about 10^4 Λ's have been collected in unpolarized target runs. At an average fractional energy of the produced Λ's of $< z >= 0.45$ the longitudinal spin transfer S^Λ from the polarized virtual photon to the Λ is found to be $S^\Lambda = 0.04 \pm 0.08(stat) \pm 0.03(syst)$, assuming that the Λ polarization is parallel to the Λ momentum. The result is practically unchanged if the virtual photon momentum is chosen as the quantization axis.
Based on $SU(3)$ flavor symmetry and experimental data for the proton , Burkardt-Jaffe model of the Λ spin structure with $\Delta u^\Lambda \simeq -0.2$, $\Delta s^\Lambda \simeq 0.6$ predicts in HERMES kinematics $S^\Lambda = -0.12$ which, having been corrected for contributions from the $\Sigma^0 \rightarrow \Lambda\gamma$ and $\Sigma^* \rightarrow \Lambda\pi$ decays, results in $S^\Lambda \simeq 0.02$. The depenedence of S_Λ on z does not confirm an increase of the spin transfer coefficient at $z \rightarrow 1$ predicted by the pertubative QCD and $SU(6)$ quark-diquark models.
The HERMES experiment has also measured the transverse polarization of Λ and $\bar{\Lambda}$ hyperons produced inclusively in quasi-real photon-nucleon interaction with $Q^2 \approx 0$. The average transverse polarizations were found to be $P_n^\Lambda = 5.3 \pm 0.5(stat) \pm 1.4(syst)\%$ and $P_n^{\bar{\Lambda}} = -4.0 \pm 1.2(stat) \pm 3.0(syst)\%$ for Λ and $\bar{\Lambda}$, respectively.The measured polarizations exhibit different behavior in the target in current fragmentation kinematics of the produced Λ and $\bar{\Lambda}$.

References

[1] A.Airapetian et.al. ,HERMES Collaboration, Phys Rev **D64** (2001) 112006