Measurement of ΔS in the Nucleon from Semi-inclusive DIS on Deuterium

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The polarization of the strange quark sea is of great interest as a probe of the spin properties of the quark sea in the nucleon. Because strange quarks carry no isospin, the total strange quark helicity density $\Delta S(x)=\Delta s(x)+\Delta sbar(x)$ can be extracted from measurements of scattering of the deuteron alone which is isoscalar. Measurement of the inclusive spin asymmetries provides an estimate of the helicity density $\Delta Q(x)=\Delta u(x)+\Delta ubar(x)+\Delta d(x)+\Delta dbar(x)$ of the non-strange sea. Using the spin asymmetries measured for charged kaons as the second experimental data set, it is possible to extract $\Delta S(x)$. By measuring the charged multiplicities with the same data, the fragmentation functions relevant to the extraction process can be obtained without resort to other experiments. Aside from that of isospin asymmetry between the proton and neutron, the only assumption required in the analysis is charge-conjugation invariance in the fragmentation process. A precise "isoscalar" extraction of $\Delta S(x)$ using semi-inclusive DIS on the deuteron has been carried out at HERMES.

The measured charged kaon double spin asymmetry is small and slightly positive, and yields a strange quark helicity distribution which is consistent with zero over the measured range. The non-strange helicity distribution is in excellent agreement with previously published data. The first moments of the measured distributions are given in Table 1. The first moment of $\Delta S(x)$ is consistent with zero in the measured region. Because of the very small density of strange quarks above x=0.3 the contribution of any non-zero helicity density in the

TABLE 1. First moments of various helicity distributions in the Bjorken range 0.02-0.6

	Moment in measured range
ΔQ	0.286±0.026±0.011
ΔS	0.006±0.029±0.007
Δq_8	0.274±0.039±0.018

region is negligible compared to the systematic error in the measurement. Consequently the value for ΔS can be safely taken as the moment over the Bjorken x range 0.02-1.0. The vanishing values recently reported for $g_{1,d}(x)$ at lower values of x, suggest that any contribution to the first moment of $\Delta Q(x)$ below x=0.02 will be very small. While an anomalously large contribution to the strange moment at $x<0.02$ can not be ruled out, the data here suggests that the first moment vanishes. The result for the moment of the octet axial charge $\Delta a_8=\int (\Delta Q(x)-2\Delta S(x))dx$ is substantially less that the value from hyperon decay.