Strange Quark Contribution To The Proton Spin, From Elastic *ep* And *νp* Scattering

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The strange quark contribution to the proton spin has been a subject of investigation ever since the first polarized inclusive deep-inelastic measurements at EMC of the spin dependent structure function $g_1(x)$ demonstrated that the Ellis-Jaffe sum rule did not hold true. Subsequent measurements at CERN and SLAC supported the initial EMC measurements, and a global analysis[1] of these data suggested $\Delta s \sim -0.15$. This analysis carries with it a significant theoretical uncertainty because the deep-inelastic data must be extrapolated to $x = 0$ and an assumption of SU(3) flavor symmetry must be invoked.

In the meantime, the E734[2] experiment at Brookhaven measured the elastic *νp* scattering cross section in the momentum-transfer range $0.45 < Q^2 < 1.05$ GeV^2. This cross section is very sensitive to the strange axial form factor of the proton, $G_A^s(Q^2)$, which is related to the strange quark contribution to the proton spin: $G_A^s(Q^2 = 0) = \Delta s$. Assuming the strange axial form factor had the same Q^2-dependence as the isovector axial form factor, E734 also extracted a negative value for Δs. However, this measurement was hampered by large systematic uncertainties and a lack of knowledge of the strange vector form factors, and no definitive determination of Δs was possible --- this conclusion was confirmed by subsequent reanalyses of these data[3].

The HERMES experiment[4] measured the helicity distribution of strange quarks, $\Delta s(x)$, using polarized semi-inclusive deep-inelastic scattering and a leading order "purity" analysis, and found $\Delta s(x) \sim 0$ in the range $0.03 < x < 0.3$. This seems to disagree with the analysis of the inclusive deep-inelastic data. This disagreement could be due to a failure of one or more of the assumptions made in the analysis of the inclusive and/or semi-inclusive data, or it could be due to a more exotic physics mechanism such as a "polarized condensate" at $x = 0$ not directly observable in deep-inelastic scattering[5].

It is clear that another method is needed to shed light on the strange quark contribution to the proton spin. Recently[6] it has become possible to determine the strange vector and axial form factors of the proton by exploiting constraints on the strange vector form factors provided by the program of elastic parity-violating *ep* scattering experiments at MIT-Bates, Mainz, and Jefferson Laboratory. I will present a combined analysis of the *νp* scattering data from E734 and the parity-violating *ep* scattering data from HAPPEx[7] and G0[8]. This analysis

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gives a first look at the Q^2-dependence of the strange axial form factor, $G_A^s(Q^2)$, in the range $0.45 < Q^2 < 1.05$ GeV^2. However, the large uncertainties in the E734 data and the lack of data points at sufficiently low Q^2 prevent a determination of Δs at this time.

Better νp scattering data (with much smaller uncertainties and extended to lower Q^2) are needed to fulfill the promise of this analysis technique, which can determine Δs in a theoretically clean way and shed light on the apparent disagreement between the inclusive and semi-inclusive deep-inelastic data. I will preview the possibility of such new measurements in the United States and in Japan.