ν-Nucleon Elastic Scattering

- Sensitive to strange quarks in form factors
- \( J_\mu = <N|G_a \gamma_\mu \gamma_5 + F_1 \gamma_\mu + F_2 \sigma_{\mu\nu} q^\nu|N> \)
- EMC polarized DIS \( \rightarrow \) ”spin crises” and strange quarks may carry some of proton’s spin, \( \Delta s \)
- \( G_a(q^2) = g_a \tau_3/(1+q^2/M_a^2)^2 + G_a^s(q^2) \)
- \( G_a^s(q^2 \rightarrow 0) = \Delta s \)
- BNL 735 (1986) measured ν-p cross sec. Error in \( M_a \) hindered extraction of \( G_a^s \)
- LSND (Los Alamos) measured ν-p to ν-n ratio but had background problems.
Parity V. Electron Scattering probes vector currents

- HAPPEX (JLAB) forward angle e-p finds $F_1^s(q^2=0.5\text{GeV}^2)$ is small.
- SAMPLE (MIT BATES) back angle e-p and e-d finds $F_2^s$ consistent with zero and large radiative correction or anapole moment.

- Also large anapole seen in Cs atomic parity nonconservation
Can make definitive (elastic) strange quark measurement

- Control systematic errors and sensitivity to $M_a$ by measuring ratio of neutral current to charged current.
- \[ R = \frac{\sigma(\nu p \rightarrow \nu p)}{\sigma(\nu n \rightarrow \mu p)} \]
- Measuring $R$ to 5% gives $\Delta s$ to $\sim 0.03$ [BNL 735 measured $R$ to 11% averaged over $q^2$.]
- Also measure $R$ for anti-$\nu$. Combination gives both $G_a^s$ and $F_2^s$ independent of P.V. radiative corrections.