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The Measurement of K_{NN} and K_{LL} in $\vec{p}\vec{p} \rightarrow \vec{n}X$ at 800 MeV*

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ABSTRACT

The spin transfer parameters, K_{NN} and K_{LL} have been measured in $\vec{p}\vec{p} \rightarrow \vec{n}X$ at 0° and 800 MeV for neutron momenta between 700 and 1200 MeV/c. Peak values of K_{NN} and K_{LL} are $-.3 \pm .05$ and $-.5 \pm .1$ respectively.

Text

The spin transfer parameters K_{LL} and K_{NN} for the reaction $\vec{p}\vec{p} \rightarrow \vec{n}p\pi^+$ with $\vec{n}$ at 0° have been measured on the neutron beam line at LAMPF. The 800 MeV proton beam was polarized vertically for the K_{NN} part and almost longitudinally for the K_{LL} part. A small horizontal component existed for the latter. In both cases the beam struck a liquid hydrogen (LH_2) target and then deflected through 60° into a beam dump. The 0° neutrons traversed a $\sim$ 3.7m (12 ft.) steel collimator which terminated with a $\sim$ 5cm (2 in.) diameter aperture. The neutron flux was cleared of charged particles with a sweep magnet. In the K_{LL} case the sweep magnet was also used to compensate for the precession caused by the beam line bending magnets which the neutrons had to traverse. Use was then made of the recently measured[1] analyzing power in the charge exchange scattering, $\vec{n}p \rightarrow p\vec{n}$. An LH_2 radiator, $\sim$ 30 cm thick, scattered the incoming vertically polarized neutrons. The longitudinal case required 90° spin precession prior to the scattering at the LH_2 radiator in order to put the neutron polarization into a vertical orientation. Since the neutrons in this experiment were polarized and the protons (LH_2 radiator) were not, the assumption of charge symmetry invariance ($A(\vec{n}p) = A(\vec{n}\vec{p})$) was invoked in order to use the previously measured analyzing power to get the neutron polarization. The proton beam polarization was measured with beam line polarimeters[2] and was typically about 75%.

The major source of background in these measurements was the inelastic reactions in the LH_2 radiator. This background as well as

that caused by target walls was removed through an analysis procedure that made use of the 5 nsec micro structure of the proton beam. Time of flight measurements with respect to this structure yielded another measurement of the neutron momentum which when compared to the spectrometer momentum measurement provided a means of distinguishing between elastic and inelastic reactions in the LH_2 radiator.

The results for the K_{NN} experiment are shown in Fig. 1, and the K_{LL} results are shown in Fig. 2.

The only calculations[3] of these parameters available to us are in considerable disagreement with our present K_{NN} and K_{LL} results. The model used in reference 3 does not comply with unitarity and it is felt that when unitarity is brought into the picture the calculation should be more in line with our measurements. There exists another approach[4] based on Aaron, Amado and Young's[5] three body final state solution which complies completely with unitarity. We await these results to see whether in fact unitarity is as important in these spin transfer processes as it is felt to be or whether still other exchange mechanisms, not taken into account, play unexpected roles here.

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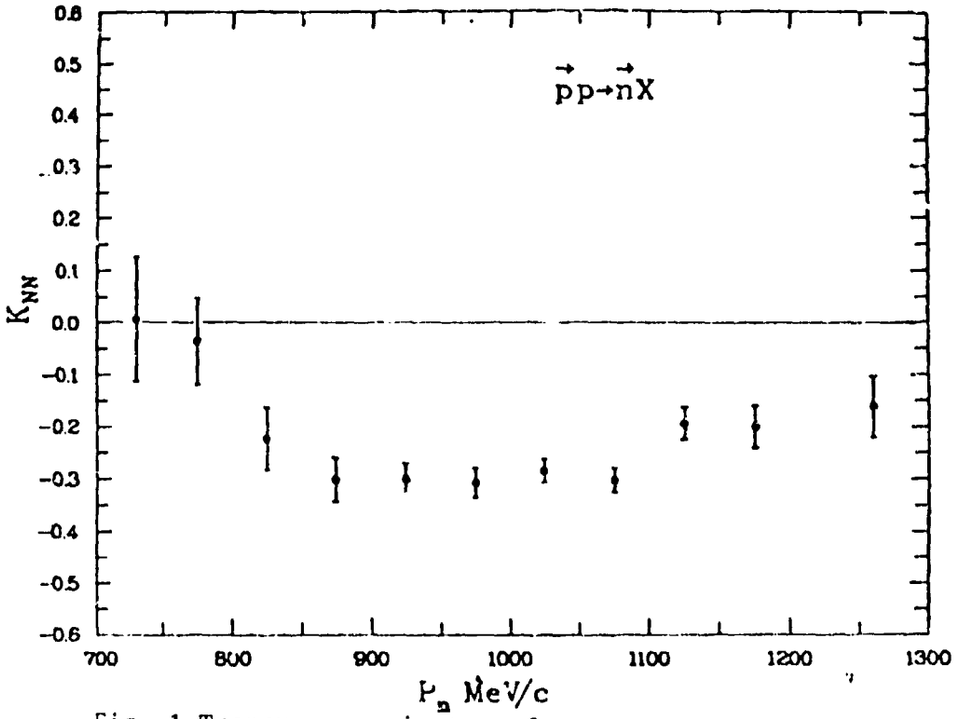

Fig. 1. Transverse spin transfer results.

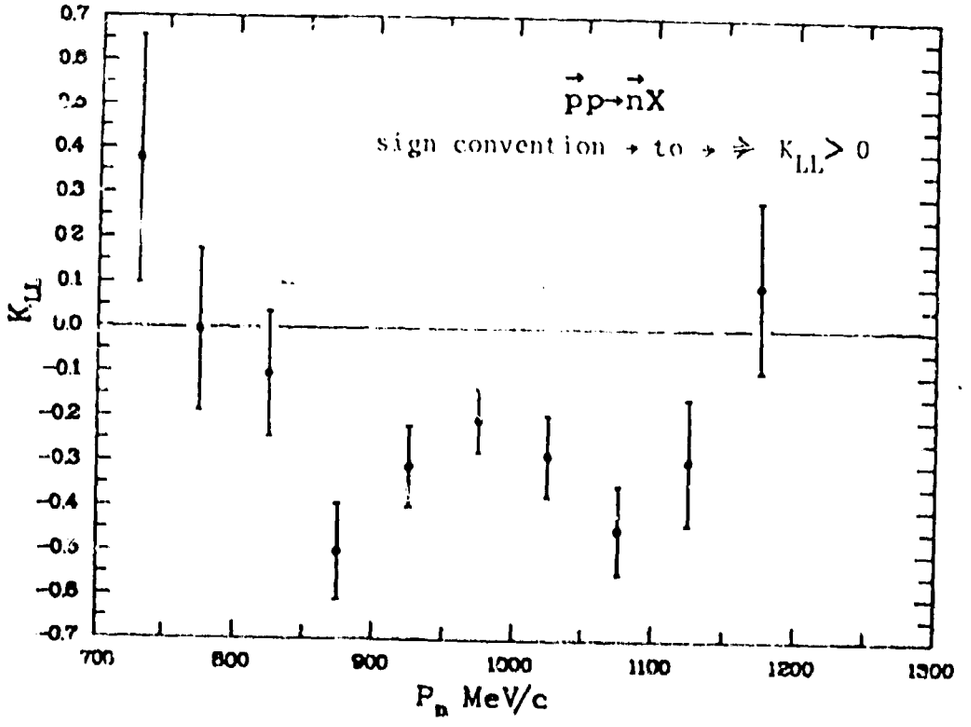

Fig. 2. Longitudinal spin transfer results.