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TITLE: K_{NN}, K_{SS}, K_{SL}, and K_{LL} in $\vec{n}p \rightarrow \vec{p}n$ at 800 MeV in the CEX Region

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Measurement of K_{NN}, K_{SS}, K_{SL}, and K_{LL} in $\vec{n}p \rightarrow \vec{p}n$ at 800 MeV in the CEX Region*

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ABSTRACT

The spin transfer parameters[1] K_{NN}, K_{SS}, K_{SL}, and K_{LL} have been measured for np elastic scattering at 800 MeV between 165° and 180° c.m. The parameters K_{NN} and K_{LL} are in good agreement with the quasi-free reaction $\vec{p}d \rightarrow \vec{n}pp$ at 180°.[2]

DISCUSSION

The np elastic charge exchange (CEX) region is of interest for several reasons. First, the differential cross section has a sharp peak near 180°.[3] This peak persists over a large energy range (300 MeV to greater than 60 GeV). The reaction mechanism responsible for this peak is still only poorly understood.[4] A knowledge of the spin transfer parameters will help determine this mechanism. Measurements in this region are important as part of a larger program of determining np elastic scattering amplitudes. Knowledge of these amplitudes will provide a better understanding of the NN force. They are also needed for interpretation of nucleon nucleus scattering data.[5]

The spin transfer parameters K_{NN}, K_{SS}, K_{SL}, and K_{LL} were measured at LAMPF with an incident neutron energy of 800 MeV. The experimental arrangement is shown in Fig. 1. The neutron beam is produced by the reaction $\vec{p}d \rightarrow \vec{n}pp$, utilizing the high value of K_{LL} in the quasi-elastic region.[2] Two spin precession magnets allow orientation of the neutron beam in any direction. The recoil protons are momentum analyzed by a magnetic spectrometer. Only elastic scatters from the high energy peak are used. These protons are polarization analyzed by a carbon polarimeter.[6] The incident proton beam polarization is measured by a beam line polarimeter (LBP).[7]

The recoil proton polarization values to be determined are the two transverse components perpendicular to and in the scattering

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plane (σ_n and σ_s) and the component along the momentum vector (σ_ℓ). The use of a magnetic spectrometer causes a precession of the proton spin and a mixing of these parameters. The measured polarizations are of the form:

$$\sigma_{n2} = a\,\sigma_n + b\,\sigma_s + c\,\sigma_\ell$$

$$\sigma_{s2} = d\,\sigma_n + e\,\sigma_s + f\,\sigma_\ell$$

σ_{n2} and σ_{s2} are the two orthogonal, transverse components of the proton polarization after passing through the spectrometer. The unambiguous separation of these components requires two spectrometer magnet settings for both the S and L initial states. Unfortunately, there was only enough time to complete one of the initial state L settings. These preliminaray values for K_{LL} were computed assuming K_{LS} equal to zero (parity conservation requires K_{LS} to be zero at 180^o c. m.).

Preliminary results are shown in Figs. 2-5, along with phase shift predictions by Arndt.[8] The quasi-free results from Ref. 2 are also indicated.

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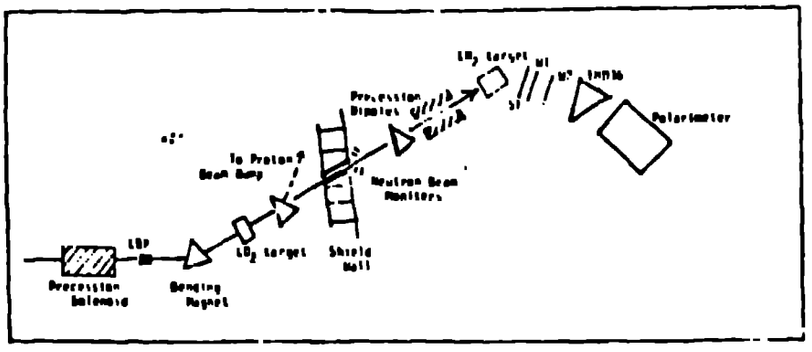

Fig. 1. Experimental arrangement, LAMPF area B.

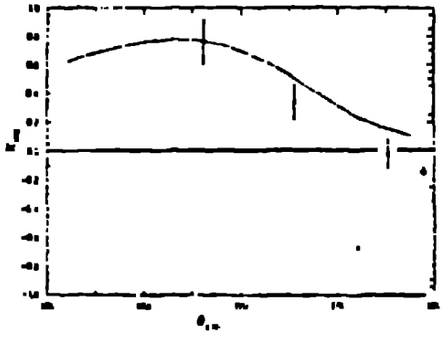

Fig. 2. K_{NN} (▲) indicates quasi-free data of Ref. 2

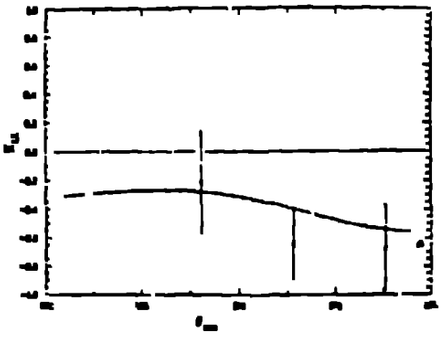

Fig. 3. K_{LL} (▲) indicates quasi-free data of Ref. 2 (–) to (–)= $K_{LL} > 0$

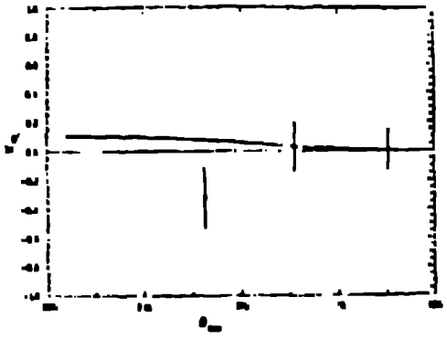

Fig. 4. K_{SL} (↑) to (→)= $K_{SL} > 0$

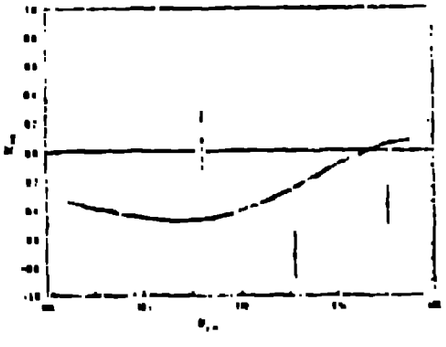

Fig. 5. K_{SS}

Spin transfer parameters for $\vec{n}p \to \vec{p}n$ elastic scattering at 800 MeV between 160^0 and 180^0 cm. Phase shift solutions from Arndt.