

TITLE: The Measurement of K_{HN} and K_{LL} in $\vec{p}p \rightarrow \vec{n}X$ at 800 MeV

AUTHOR(S): T. S. Bhatia, G. Glass, J. C. Hiebert, L. C. Northcliffe,
W. B. Tippens, P. J. Riley, C. L. Hollas, C. P. Newsom,
R. D. Ransome, G. Pepin, B. E. Bonner, J. E. Simmons

SUBMITTED TO: Fifth International Symposium on Polarization Phenomena
in Nuclear Physics, Santa Fe, NM, August 11-15, 1980

MASTER

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof nor any of their employees makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information appearing hereon, or whether the information herein was obtained by the results of information reported herein. Reference herein to any specific commercial product or process or to any trade name, trademark, manufacturer, or otherwise, does not constitute an endorsement, recommendation, or approval by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

University of California

By acceptance of this article, the publisher recognizes that the U.S. Government retains a nonexclusive, royalty free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes.

The Los Alamos Scientific Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy.



LOS ALAMOS SCIENTIFIC LABORATORY

Post Office Box 1663 Los Alamos, New Mexico 87545

An Affirmative Action/Equal Opportunity Employer

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

T. S. Bhatia, G. Glass, J. C. Hiebert
L. C. Northcliffe, W. B. Tippens
Texas A&M University, College Station, TX 77843

C. L. Hollas, C. R. Newsom, R. D. Ransome, P. J. Riley
University of Texas at Austin, Austin, TX 78712

G. P. Pepin
Rice University, Houston, TX 77001

B. E. Bonner, J. E. Simmons
Los Alamos Scientific Laboratory, Los Alamos, NM 87545

ABSTRACT

The spin transfer parameters, K_{NN} and K_{LL} have been measured in $\vec{p}p \rightarrow \vec{n}X$ 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 $\vec{p}p \rightarrow \vec{n}p\pi^+$ 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 ~ 3.7 m (12 ft.) steel collimator which terminated with a ~ 5 cm (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 analyzing power in the charge exchange scattering, $n\vec{p}-pn$. An LH_2 radiator, ~ 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 ($A(n\vec{p}) = A(p\vec{n})$) 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 polarimeters² 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

618 1000

630 3000

551 6000

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 LH₂ 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 calculations³ 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 approach⁴ based on Aaron, Amado and Young's⁵ 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.

We would like to thank Professor G. C. Phillips for the use of the Rice/Houston equipment for the K_{LL} measurement. We also appreciate the valuable support provided by LAMPF personnel.

* Work supported by the U.S. Department of Energy.

1. C. R. Newsom, et al., 8th ICOHEPANS, Vancouver, B.C., 1979.
2. M. W. McNaughton LA-8367-MS (unpublished) 1980.
3. B. J. Ver West Phys. Lett. B 83 p 161, 1979.
4. W. M. Kloet and R. R. Silber, Nuc. Phys. A338 281, 1930.
5. R. Aaron, R. D. Amado, J. E. Young, Phys. Rev. 174 2022, 1968.

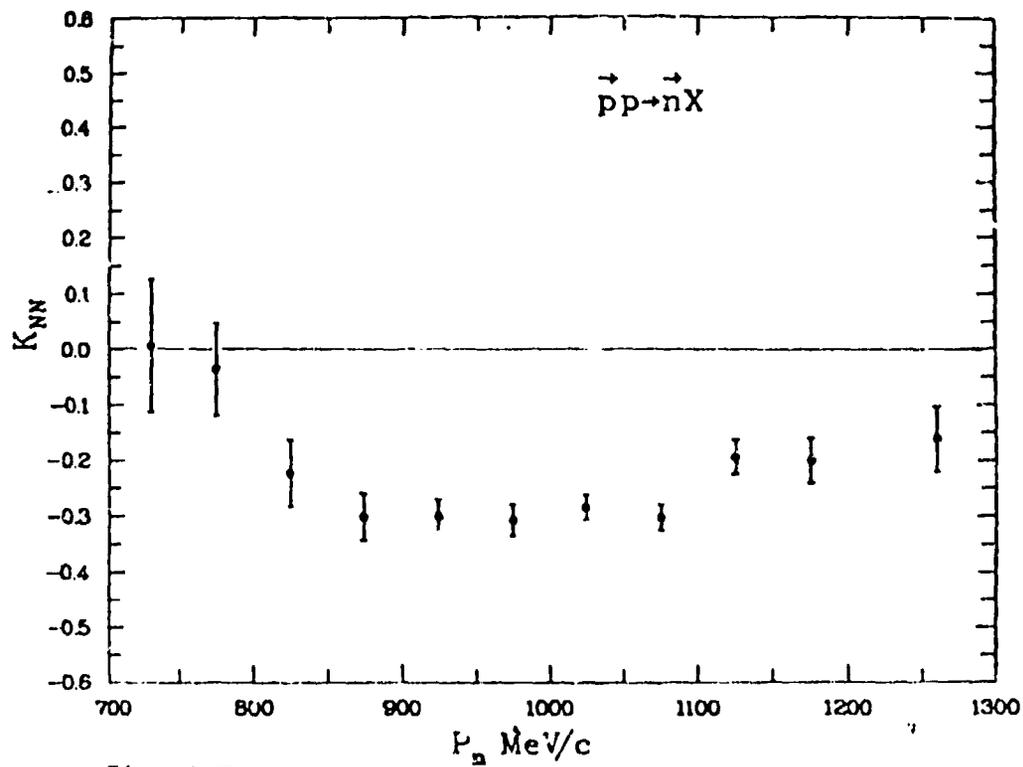


Fig. 1. Transverse spin transfer results.

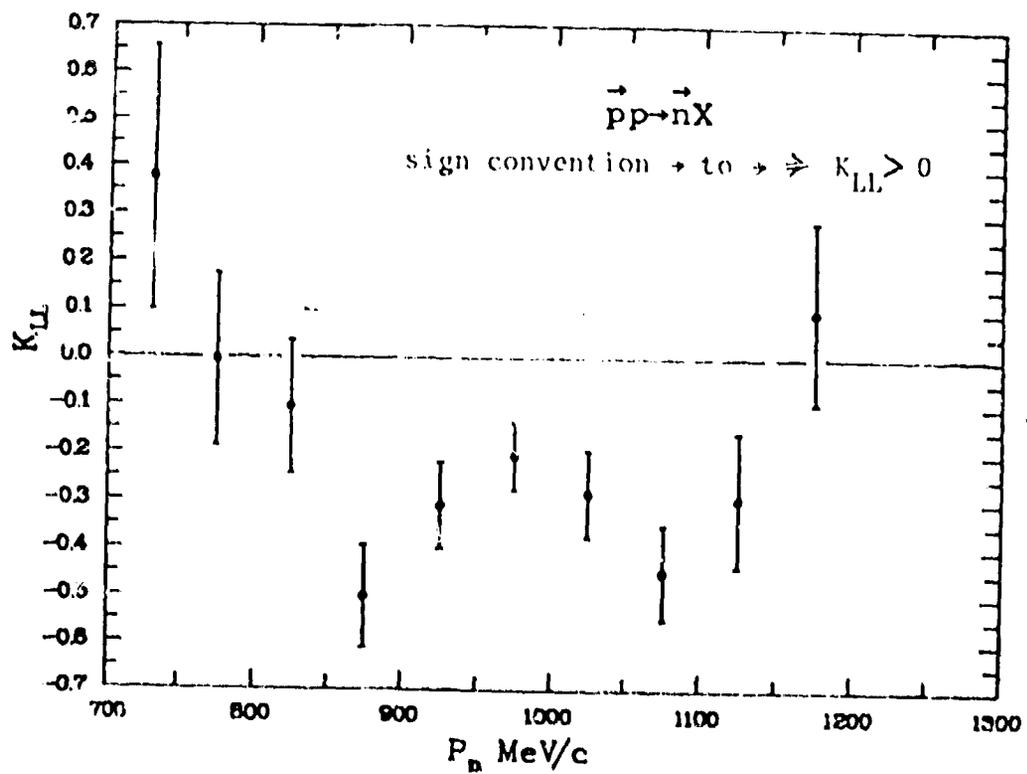


Fig. 2. Longitudinal spin transfer results.