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A PRECISION MEASUREMENT OF THE ANALYZING POWER FOR THE P-P SCATTERING AT 25.68 MeV. +)

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The spin dependent parts of the N-N interaction can be extracted unambiguously only from high precision polarization measurements in the two-nucleon-system. Analyzing power data with an accuracy of $\Delta A \leq 10^{-4}$ have been measured at 5.05 MeV and 9.85 MeV in Madison[1], at 12 MeV in Zürich[2] and at 50.04 MeV in PSI, Villigen[3]. Thus the isovector NN-interaction is not well known in the energy range between 12 and 50 MeV.

In this contribution we report on a new analyzing power measurement at 25.68 MeV, which was performed at the PSI, Villigen, with the polarized proton beam of the atomic beam source of the Philips cyclotron and with a windowless high density H_2 gas-jet target[4] which was developed in Erlangen. The protons scattered in the forward direction were measured in a cinematic coincidence with the corresponding recoil protons. As detectors scintillators were used, which were symmetrically arranged with respect to the beam axis, thus allowing a simultaneous measurement at 8 scattering angles. The beam current was about 1 µA and the beam polarization of 0.88 was monitored on line in a ^{4}He-polarimeter behind the gas target. The absolute normalization of the polarimeter reaction was obtained from an extra double scattering experiment using polarized and unpolarized incident protons[5], which yields an overall normalization error of about 0.9%.

In this way the analyzing power of p-p-scattering at 25.68 MeV was determined at 24 angles in an angular range of $5^o \leq \theta_{Lab} \leq 42.5^o$ with an accuracy of up to $1 \cdot 10^{-4}$. The data are analyzed with a phase shift program written by Watari, which was modified to include the effects of vacuum polarization, and electromagnetic (e.m.) spin-orbit- and tensor-potentials according to Knutson et al.[6]. The influence of the latter two effects is demonstrated in fig. 1a, where the data are compared with a prediction of the Paris potential[7] with and without these spin dependent corrections to the Coulomb potential. This clearly shows that for the analysis of precision analyzing power data in this energy range at least the electromagnet spin-orbit potential has to be taken into account. A comparison of the data with Arndt's most recent 0-1.3 GeV multi-energy analysis (fig. 1b) shows a very good agreement, which is close to our best fit. Furthermore we report on preliminary results of a similar experiment at 39.6 MeV and on the p-wave scattering lengths and effective range parameters deduced from this experiment and from the most precise analyzing power measurements in this energy regime[1-3].

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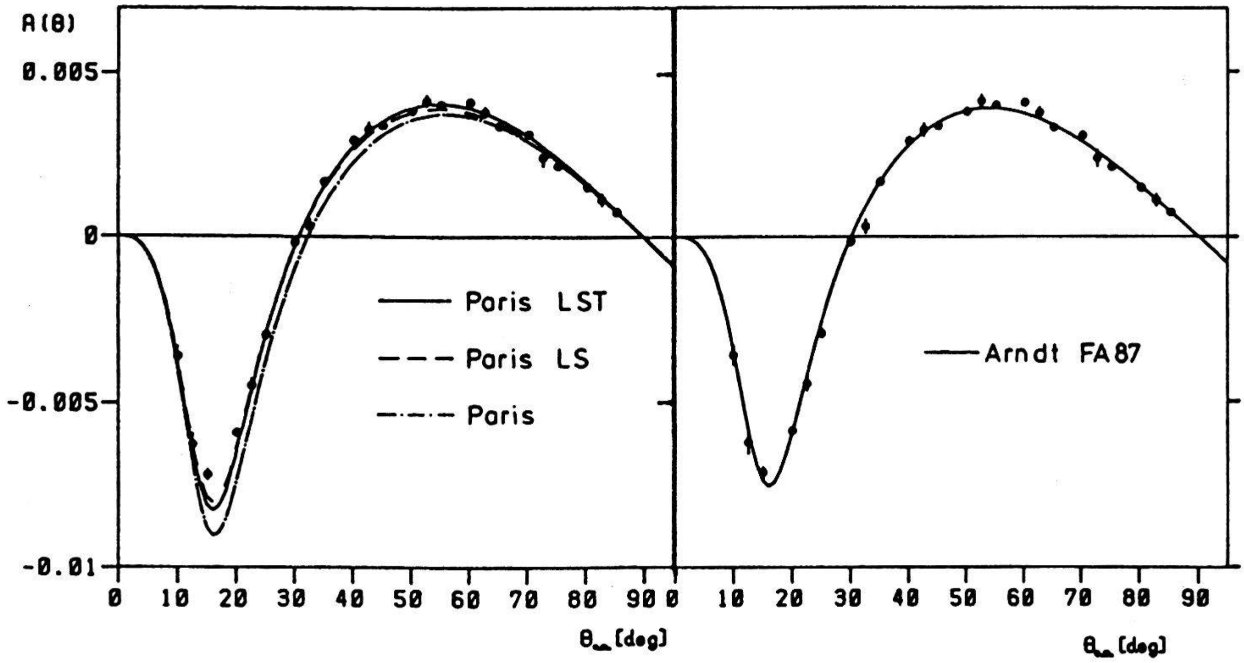

Fig. 1: Analyzing power of p-p scattering at 2.568 MeV
a.) Paris potential prediction (-.- without e.m. LS and tensor potential; - - with e.m. LS potential; — with e.m. LS and tensor potential)
b.) Arndt's multienergy analysis FA 87[7]

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