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3.1 Analyzing Power of Proton-Proton Scattering at 12 MeV *)

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The spin dependent parts of the fundamental nucleon-nucleon interaction can be extracted unambiguously only from high precision polarization measurements in the two-nucleon system. In the low energy p-p scattering the polarization effects are very small, since here the reaction is clearly dominated by Coulomb and S-wave scattering. Therefore in the energy range E_p = 5-16 MeV only few polarization measurements with sufficient accuracy [1-4] are available to determine the long range part of the T = 1 NN interaction.

In this contribution a new measurement of the analyzing power of the p-p scattering at E_p = 12 MeV is discussed. The measurement was performed at the ETH-Zürich, where polarized protons of an atomic beam source were scattered from the supersonic H_2 gas jet of the Erlangen windowless high density gas target[5]. This jet target is especially suitable for this experiment, since the target zone is well-defined (about 4 x 5 mm²) and since there is no scattering, energy loss and -straggling at the entrance and exit foils of the usual gas cells. The incident beam was defined with a set of different collimators located at distances of 0.3 m to 0.6 m from the target center. The beam polarization (70-75%) was continuously monitored in a ^{4}He polarimeter mounted behind the main scattering chamber. For the elimination of systematic errors the spin of the incoming protons was reversed quickly and the scattered protons were detected symmetrically with respect to the beam line with four scintillation counters ($\theta_{Lab} \lesssim 22.5°$) and three surface barrier detectors ($\theta_{Lab} \gtrsim 27.5°$) on each side simultaneously. For a drastic reduction of the background the four extreme forward angles were measured in coincidence with the backscattered protons. The detector blocks can be shifted by 2.5° each and so a whole angular distribution ($5 \lesssim \theta_{Lab} \lesssim 45°$) can be obtained in two separate runs. With this method the analyzing power was measured with an accuracy of about $\Delta A = (8\text{-}10) \cdot 10^{-5}$, but the statistical uncertainty will be reduced in a further beam time. The preliminary data are shown in fig. 1, where the full line corresponds to a best fit phase shift analysis, the dashed line to a prediction of the Paris potential [6] and the dashed-dotted line to a prediction of the Bonn-potential[7].

For a completion of the data set at 12MeV and for a further reduction of the errors in the phase shift analysis the differential cross section and the depolarization[8] of p-p scattering are measured at the moment in Erlangen. By taking into account more polarization data in the low energy region, the scattering length and the effective range for the p-waves will be determined.

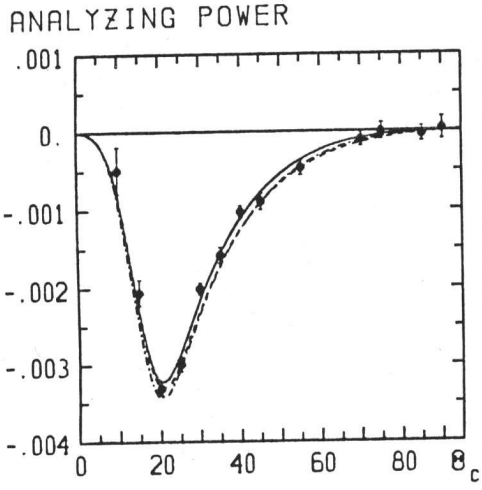

Fig. 1: Analyzing power of p-p scattering at E_p = 12 MeV

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