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Analyzing Powers of the Elastic ñ-<sup>3</sup>He Scattering from 1-2 MeV and from 16-50 MeV

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Analyzing powers of the elastic  $\vec{n}$ -<sup>3</sup>He scattering have been measured from 1-2 MeV at the Van de Graaff accelerator and from 16-50 MeV at the cyclotron of the Kernforschungszentrum. In both experiments a liquid <sup>3</sup>He scintillating sample1) was employed as scattering sample. This allows for practically background-free data by recording for each scattering event the time-of-flight between the charged beam pick-up and the <sup>3</sup>He scatterer, the time-of-flight between the scatterer and the detector, and the pulse heights both in the scatterer and in the detector. Corrections for multiple scattering and finite geometry effects were applied employing a Monte-Carlo program. Van de Graaff experiment

This experiment was performed with polarized neutron beams of 1.0, 1.5 and 2.0 MeV obtained by the  ${}^{3}\text{H}(\text{p,n}){}^{3}\text{He}$  reaction. The scattered neutrons were detected by twelve scintillators (NE 102 A, NE 213 and stilbene), pairwise positioned at left and right angles from 50° - 160° c.m.. The spin direction of the neutrons was inverted by a

superconducting solenoid about every 10 min.. The results at two energies are shown in Fig.1. They are compared with existing data at nearby energies. A striking improvement in accuracy has been achieved. The full



Fig.1. Measured  $\vec{n}$ -<sup>3</sup>He analyzing powers at 1.0 and 1.5 MeV compared with other data and with R-matrix and phase-shift calculations.

curves are results of a new phase-shift analysis taking into account differential cross-sections and analyzing powers up to 3.7 MeV. The dashed curves are results of a recent R-matrix calculation in which our data had not been included yet.

## Cyclotron experiment

In our polarized neutron beam facility  $POLKA^{2}$  at the cyclotron polarized neutrons are produced by bombarding a liquid deuterium target by polarized deuterons of 52 MeV. A continuous spectrum of neutrons is emitted, of which the part between 16 and 50 MeV has sufficient intensity and polarization to be employed for experiments. The scattered neutrons were detected by 20 scintillators (NE 213), 200 mm high x 140 mm diameter at a distance of 1 m.

The data were analyzed in 11 energy bins between 16 and 50 MeV. The results at two energies are shown in Fig.2. There is good agreement with existing data up to 22 MeV.



Fig.2. Experimental  $\vec{n}$ -<sup>3</sup>He analyzing powers at 20 and 40 MeV. The curves are the results of phase-shift calculations.

Above this energy no data existed yet for this observable. The curves are results of phase-shift analyses, in which new cross-section data measured by our group were included. Due to the large number of free parameters, no unique solution could be obtained. The main emphasis was laid on reproducing the data by a set of phases, varying smoothly with energy.

## References

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