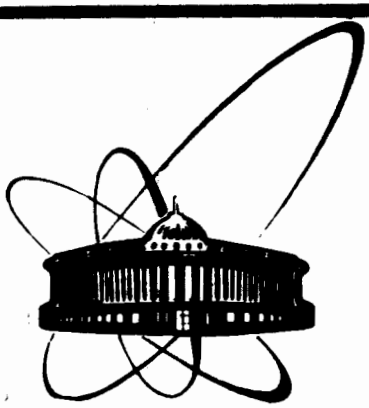

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MEASUREMENT OF VECTOR ANALYZING POWER OF REACTIONS d↑C - pX AND d↑C - dX AT 800 MeV/Nucleon

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This paper reports on vector analysing power of polarized deuteron induced reactions,

$$d\uparrow C - p X , \quad (1)$$

$$d\uparrow C - d X , \quad (2)$$

at 800 MeV/nucleon. Final state protons or deuterons of energies in the range 40 - 460 MeV have been registered at two angles, 75° and 102° respective to the beam.

Experimental studies of analysing power are usualy motivated by the hope of better understanding of the mechanism of particle scattering in a region forbidden by two-free particle kinematics and hadron nucleus interactions. A similar experiment has been performed with a proton polarized beam /1/.

Theoretical predictions based on direct proton knock-out model have been compared with the experimental data /2/.

In this study a vector polarized deuteron beam has been supplied by JINR, Dubna synchrophasotron /3/ at the energy of 800 MeV/nucleon and an intensity of up to .5 x 10^9 deuterons per cycle. A mode of beam polarization has been altered every cycle with a period of three cycles and typical magnitude of polarization +0.33, -0.17 and 0.0, respectively. An internal target of thin (3 micrometers) polyethylene foil has been used. Multiple beam - target traversing in a cycle have ensured a comparatively high luminosity.

A beam polarization has been estimated by measuring $d\uparrow p$ elastic scattering asymmetry. For this purpose recoil protons with kinetic energy of about 14 MeV and corresponding four-transfer momentum $-t = 0.026$ $(GeV/c)^2$ have been registered by two telescopes of semiconductor detectors, seen from the target at angles of +82.5° and -82.5° respective to the beam.

Each telescope consists of three detectors with thickness of 200, 4000 and 1000 microns, respectively. Two detectors closest to the target measured particle energy used for its identification by the dE - E method. The last detector has been connected in anticoincidence with others in order to reduce the background. The analyzing power of the elastic scattering at the above quoted t - value is $A_y = -0.240 \pm 0.015$ /4/.

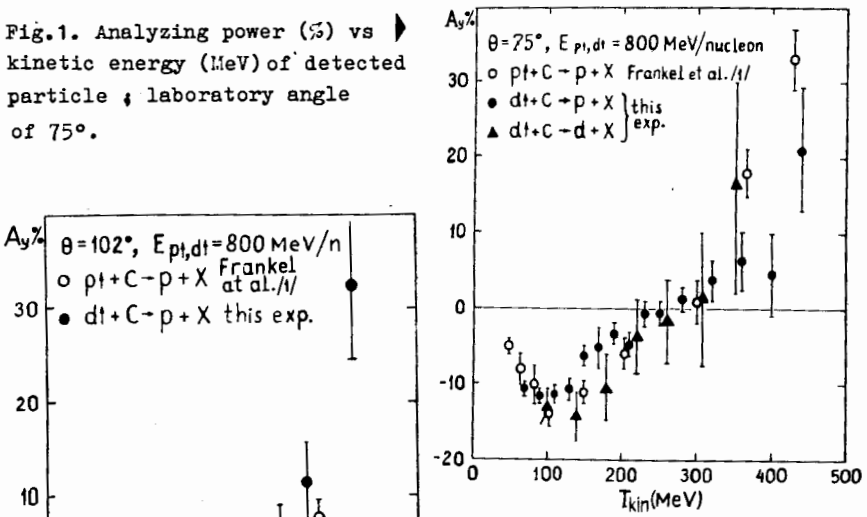
A vector analyzing power of reactions (1) and (2) has been studied by means of three identical telescopes, each covering a space angle of 2.5 msr. Each of them consists of two plastic scintillators (7 mm thick) and two NaI(Tl) crystals (80 and 150 mm thick, respectively). One telescope has been seen from the target at 75° from beam direction. In front of it there has been a two plane hodoscope with each plane built of 8 plastic scintillator strips. The hodoscope contributes to better separation of elastically scattered protons of energy about 57 MeV and analysing power 0.36 ± 0.02 /4/. The measured elastic scattering asymmetry with this telescope has been also used for beam polarization control.

Two other telescopes cover the range from 99° to 105°. Their results have been merged and they are afterfore reffered to as 102° telescope. In order to extend the upper limit of measured proton energy up to 460 MeV absorbents of organic glass (16 g/cm^2) or/and aluminum (41 g/cm^2) have been inserted between plastic scintillators.

Target luminosity monitoring has been achieved using total counts of both symmetric silicon telescopes.

The analyzing power of reactions (1) and (2) from this study is shown in Fig.1 as a function of proton (deuteron) kinetic energy. Findings for p↓ C - p X reaction at the same angle (75°) and beam energy (800 MeV/nucleon) from ref. /1/ are shown as well.

Fig.1. Analyzing power (%) vs kinetic energy (MeV) of detected particle ; laboratory angle of 75°.



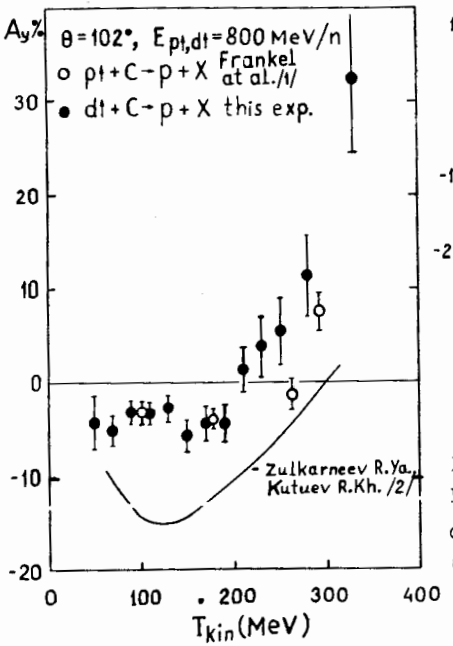


FIG.2. Analyzing power (%) vs kinetic energy (MeV) of detected proton; laboratory angle of 102°.

Regardless of different beam and registered particles the experimental data are in a very good agreement within error limits. Although statistics is poor at higher proton energies the common trend of the data is obvious: the analysing power changes its sign around 300 MeV and after that increases constantly. The reaction (2) data are slightly shifted (50 MeV) towards higher energies.

The analyzing power of the same reaction at 102° is shown in Fig.2 together with prediction of nucleon knock-out model /2/.

Both samples of experimental data are again in a good agreement but disagree with the model prediction in magnitude and in general trend. The data show a very low negative analyzing power (4%) up to 200 MeV followed by a very steep increase.

We are not ready for a complete understanding of the experimental results or theoretical predictions. But the above findings suggest a naive approach to a qualitative understanding of analyzing power energy dependence. The registered low energy protons are predominantly the recoil ones, originated from a quasi-free scattering of beam particles on nucleus protons. At higher energies beam particles are registered after coherent scattering on nucleon clusters or multiple rescattering at large angles. The latter mechanism is favored by kinematics when registered particle energy increases and thus it accounts for analyzing power increase and its sign changes.

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Измерение векторной анализирующей способности реакций d↑C-pX и d↑C-dX при энергии 800 МэВ/нуклон

В работе сообщается об измерении векторной анализирующей способности реакций d↑C-pX и d↑C-dX при энергии векторно-поляризованных дейтронов 800 МэВ/нуклон. Испускаемые протоны и дейтроны регистрировались под углами 75° и 102° /лаб.сист./ в диапазоне энергий 40-460 МэВ. Полученные данные находятся в хорошем согласии с экспериментальными данными для реакции p↑C-pX, но противоречат предсказаниям модели прямого выбивания нуклонов.

Работа выполнена в Лаборатории высоких энергий ОИЯИ.

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Beznogikh G.G. et al. E2-88-609

Measurement of Vector Analyzing Power of Reactions d↑C-pX and d↑C-dX at 800 MeV/Nucleon

This paper reports on measurements of the vector analyzing power of the reactions d↑C-pX and d↑C-dX using 800 MeV/nucleon vector polarized deuterons. Emitted protons and deuterons of energies in the range 40-460 MeV have been detected at 75° and 102° (lab). The data are in a good agreement with the experimental data for p↑C-pX reaction but disagree with nucleon knock-out model predictions.

The investigation has been performed at the Laboratory of High Energies, JINR.

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