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Strong interaction invariance with respect to time inversion results in the well-known "polarization-asymmetry" ($\mathcal{P}=\mathcal{A}$) relation [1,2] which has been checked up only in proton-proton collisions [3-7]. However, a possible contribution of T-odd terms to the pp-interaction amplitude according to the above investigations is comparatively small and from this point of view large angle neutron-ptoton scattering experiments at 450-700 MeV [8,9] are more promising.

Thus, $\mathcal{P}(\theta)$ polarization in 635 MeV pn-scattering in the angular range of (34 124) c.m.s. has been measured. The results have been compared with the values of the $\mathcal{A}$ parameter obtained at this energy in [10].

The polarization was determined in the double scattering experiment of the primarily unpolarized proton beam. Protons were scattered at a neutron-rich target (CD_2-C). The polarization of protons scattered at this target was analysed by the repeated scattering by carbon at the angle $\theta_2 = 8^\circ$ lab.s. Recoil protons were registered by a special neutron detector. The experimental set-up and the experimental procedure have been described in detail in [11]. The measurement of left-right asymmetry of scattering by carbon, e_{pn}, made it possible to obtain the

$\mathcal{P}_{pn}$ polarization parameter in pn-scattering by using the following formula:

$$e_{pn} = \mathcal{P}_{pn} \cdot A_c , \qquad (1)$$

where A_c is the analysing power of carbon. The analysing power of the analyser was obtained together with measuring the e_{pn} asymmetry. With this purpose a special coincidence circuit separated the events of quasi-elastic pp-collisions at a deuterium polarizing target. The measurement of the left-right asymmetry, e_{pp} , for quasi-elastically scattered protons allowed the determination of A_c from the following expression

$$e_{pp} = \mathcal{P}_{pp} \cdot A_c , \qquad (2)$$

where $\mathcal{P}_{pp}$ is polarization in quasi-elastic pp-scattering by deuterium. The value of A_c was obtained under the assumption that $\mathcal{P}_{pp} = \mathcal{A}_{pp}$, where $\mathcal{A}_{pp}$ is the asymmetry parameter for quasi-elastic pp-scattering by deuterium found earlier in /10/ at 635 MeV. Our analysis and special experiments have shown that the systematic error caused by a method of determining the analysing power is several times smaller than the statistical error in the case of A_c determination and it does not exceed (0.02-0.05) A_c .

Our method and special apparatus had been tested previously in the runs described in /11/ .

The values of the measured quantities $\mathcal{P}(\theta)$ are presented in Table 1 without taking into account false asymmetries which were neglected. The errors given in Table 1 are total statistical ones. The total absolute value of

Table 1

θ_1, degree, c.m.s.	$\mathcal{P} \pm \Delta\mathcal{P}$ present investig.	$\mathcal{A} \pm \Delta\mathcal{A}$ ref. /10/	$\mathcal{P} - \mathcal{A}$	$\frac{Re\,t}{\sqrt{I_{pn}}}$, %*
34.5	0.330±0.040	0.346±0.046	-0.02±0.06	3.6±11.0
49.0	0.189±0.028	0.179±0.030	0.01±0.04	2.0±8.0
61.5	0.065±0.036	0.078±0.025	0.01±0.04	0.7±2.8
72.0	0.000±0.030	0.004±0.030	0.00±0.04	-0.2±2.2
108.2	-0.256±0.036	-0.356±0.040	0.10±0.05	-5.5±2.8
119.5	-0.237±0.135	-0.324±0.040	0.09±0.14	-2.8±4.5
124.0	-0.412±0.059	-0.330±0.030	-0.09±0.07	2.6±1.9

* In the calculations it has been suggested that $Re\,t \cong Im\,t$.

the possible systematic error of our $\mathcal{P}_{pn}$ determination according to our evaluations and those of ref.[9] is 0.01÷0.02.

On the basis of the obtained values of $\mathcal{P}-\mathcal{A}$ the contributions of the T-odd term, t , i.e., the elastic 635 MeV pn-scattering t-odd matrix [1,2] to the total amplitude of the process for each scattering angle were evaluated (see Table 1).

The averaged results for all scattering angles are as follows:

$$\frac{\mathrm{Re}\, t_{pn}}{\sqrt{I_{pn}}} = \frac{\mathrm{Im}\, t_{pn}}{\sqrt{I_{pn}}} = (0.0 \pm 1.4)\%, \qquad (3)$$

where I_{pn} is the differential cross section of pn-scattering. Our evalation (3) is in agreement with similar results obtained earlier by measuring the difference $\mathcal{P}-\mathcal{A}$ in elastic 140-640 MeV pp-scattering [3-7].

For the T-odd scattering phase λ_1 [2,8] the following value has been obtained

$$\lambda_1 = 0.01 \pm 0.02. \qquad (4)$$

The values of the phase shifts of the B1(III) set of the phase shift analysis[12] for 600-630 MeV scattering were used.

As is seen from Table 2, the accuracy of our determination of the λ_1 phase is larger than that for the λ_2 phase in 635 MeV pp-scattering[7] and competes with (even may exceed) the accuracy of determining the value of λ_2 at other energies.

Table 2

Energy (MeV)	142[3]	180[4]	220[5]	430[6]	635
Sin λ_1 Present investig.	-	-	-		0.01 ± 0.02
Sin λ_2	-0.05 ± 0.033	0.022 ± 0.038	-0.100 ± 0.060	0.1	-0.11 ± 0.10

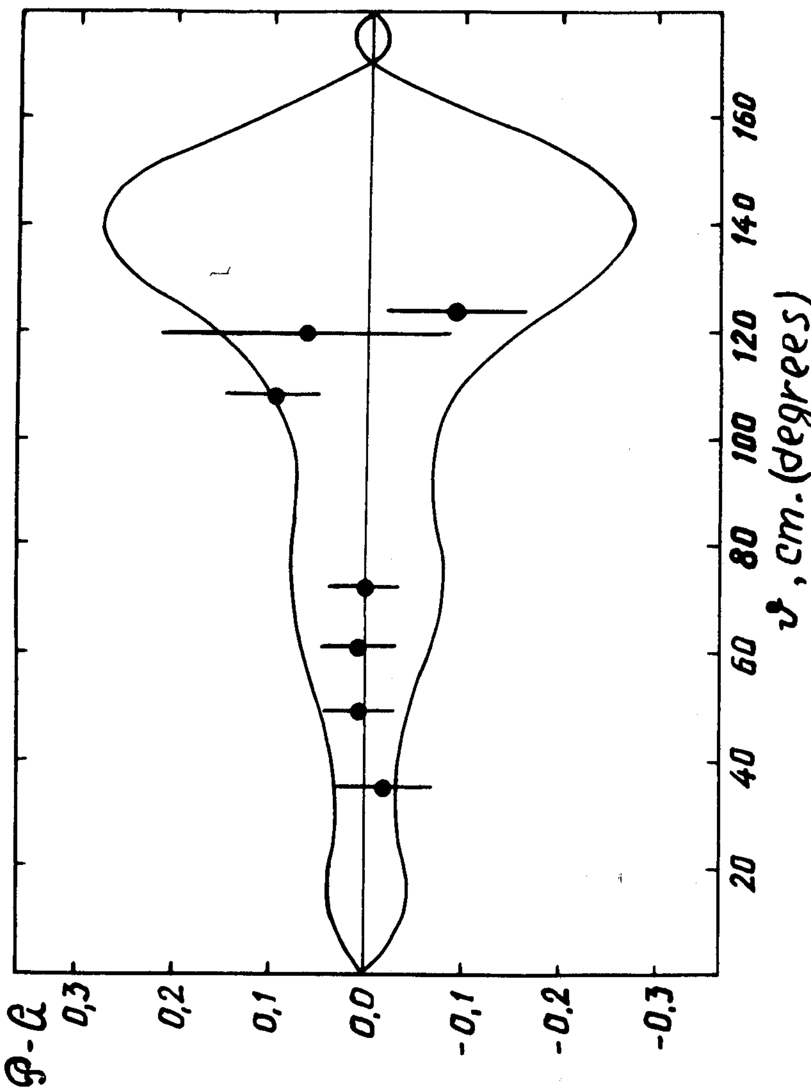

Fig. 1. The angular dependence of the $\mathcal{P}-\mathcal{A}$ difference. Dots are experimental data of the present investigation. Solid lines are theoretical predictions [8,9].

Thus, our measurements make it possible to state that should the T-invariance violation appear in 635 MeV pn-scattering, the value of the T-odd scattering phase must not exceed (1-3)% of the maximal value of the invariant phase $\lambda_1 = \pi/2$.

Our value of the $\mathcal{P}-\mathcal{A}$ difference can be compared with the results predicted theoretically for it. The calculations have been performed by Bryan et al.[8,9] by using the potential models of NN-interactions based on the Sudarshan's hypothesis[13]. One of the results of such calculations for the 600 MeV energy[9] is shown in Fig. 1. As is seen from the Figure, the theoretically predicted values of $\mathcal{P}-\mathcal{A}$ differ considerably from zero and disagree with our experimental results. A similar conclusion has been drawn by Bryan[9] after analysing the unpublished results of Kerth et al.[14] who have measured the parameters of triple 500 and 600 MeV np-scattering.

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