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Proton Polarization in the Reaction $\gamma d - pn$ in
the Photon Energy Range from 0.7 to 1.0 GeV
at $\theta_p = 90^\circ$ c.m.s.

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The measurements of proton polarization from the reaction $\gamma d - pn$ performed at Tokyo [1] and then at Kharkov [2] at photon energies between 0.35 and 0.65 GeV have revealed the region of anomalous polarization values. This fact may be attributed to the presence of two-nucleon resonances in the intermediate state of the reaction $\gamma d - pn$ and a strong interference between them [1] (fig.1, curves 1,2). However, this hypothesis needs to be carefully verified. In this respect it would be of interest to extend measurements to higher photon energies in order to determine the bounds of the anomalous polarization values and the resonance interference effects associated with them.

Here we report the results of proton polarization measurements in the reaction $\gamma d - pn$ in the photon energy range from 0.7 to 1.0 GeV at $\theta_p = 90^\circ$ c.m.s. The experiment was performed using the electron bremsstrahlung beam of the Kharkov electron linac. The photon beam was shaped on a liquid deuterium target, 20 cm long and 5 cm diameter. The protons from the reaction were momentum analysed by a magnetic spectrometer and were detected by a telescope of magnetostrictive wire spark chambers with a carbon scatterer. The proton polarization value was calculated by the method of maximum likelihood using the inclusive analysing power of carbon from paper [3].

The spurious asymmetry effect of the detector was determined from the measurements of the recoil proton polarization in the process of elastic scattering of 0.8 GeV electrons by hydrogen and was found to be about $+0.019 \pm 0.03$.

The results of our present measurements together with the data from refs [1], [2] are shown in fig. 1. The measurement errors are statistical only. It is seen from the figure that the region of high polarization values extends up to 1 GeV. Besides, the experimental curve shows up some structure in the energy dependence of the polarization.

The results obtained from the deuteron photodisintegration reaction at $E_\gamma = 0.45 - 1$ GeV give evidence for the interference between the imaginary parts of the amplitudes, the nature of which is not clear at present.

References

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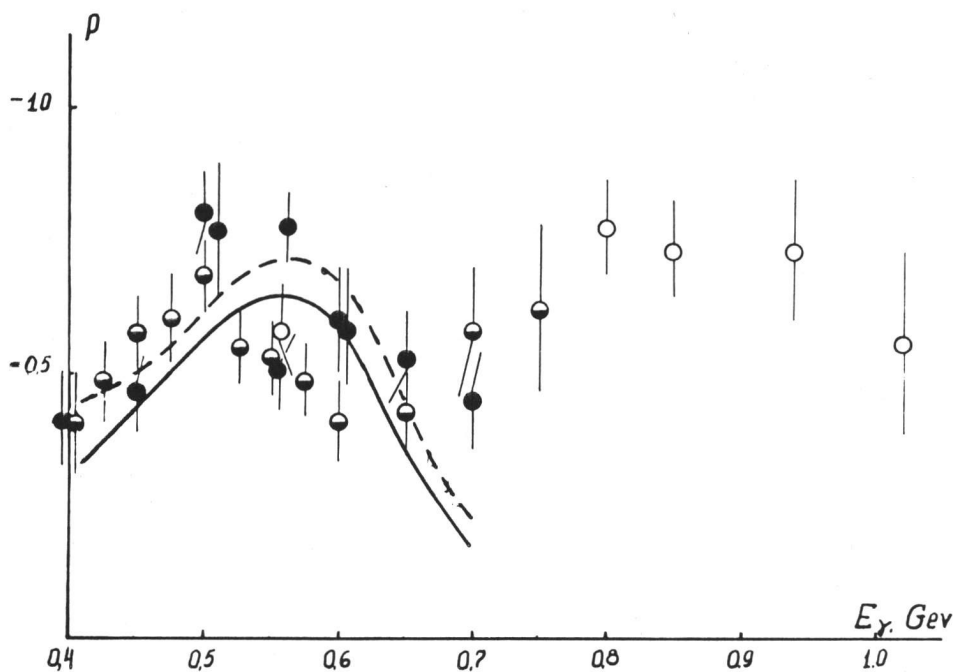


Fig.1. Proton polarization from the reaction $\gamma d - pn$ versus the photon energy at $\theta_p = 90^\circ$ c.m.s.

• : data from ref. [1];

○ : data from ref. [2];

◐ : our present results.

The solid and dashed curves show the resonances $1(3^-) + 0(3^+)$ and $1(3^-) + 0(1^+)$, respectively.