$$\gamma + p \to p + \rho^0, \quad \gamma + p \to p + \omega, \quad \gamma + p \to p + \varphi$$

in the angle and energy region where peripheral mechanisms corresponding to vector-meson exchange take place. Exchange of pseudoscalar mesons, which does not violate C-invariance, is a competing process. With the aid of linearly-polarized γ quanta it is possible to separate the mechanism of interest to us.

4. In conclusion let us consider the process $\gamma + p \to p + f^0$ at small angles of f^0 production. If C-parity is not conserved, then peripheral mechanisms take place with $\pi^0(\eta)$ meson exchange. In this case the form of the cross section is (we retain the contribution of the π^0 meson only)

$$\frac{d\sigma}{d\Omega} = \frac{g^2}{4\pi}\frac{5}{2}\frac{m\Gamma(f \to \pi^0\gamma)(-\Delta^2)}{W^2(1 - m_\pi^2/m^2)(\Delta^2 - m_\pi^2)^2}\left(\frac{\Delta^2/m^2 - 1}{m_\pi^2/m^2 - 1}\right)^4, \qquad (2)$$

where g is the (πN) interaction constant, $\Gamma(f \to \pi^0\gamma)$ the width of the decay $f \to \pi^0 + \gamma$, m the mass of the f meson, W the total energy, and Δ^2 the square of the momentum transfer.

We note that a direct investigation of the decay $f \to \pi^0 + \gamma$ is made difficult by the large width of the f meson, which decays as a result of the strong interactions.

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CROSS SECTION FOR THE PRODUCTION OF CHARGED PIONS IN (n-p) COLLISIONS AT A NEUTRON EFFECTIVE ENERGY 585 keV

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The cross section for the production of charged pions in the reactions

$$\begin{aligned} &n + p \to \pi^+ + n + n, \\ &n + p \to \pi^- + p + p \end{aligned} \qquad (1)$$

plays an important role in the phenomenological analysis of pion production in nucleon-nucleon collisions.

The cross sections of (1) were measured in [1,2] for 600 MeV neutrons. To obtain more accurate values, we have made new measurements with the aid of a scintillation telescope and a liquid-hydrogen target in the form of a Dewar of special construction.

Figure 1 shows the diagram of the experiment. A neutron beam from the JINR synchrocyclotron was incident on the liquid-hydrogen target. The pions of both polarities produced

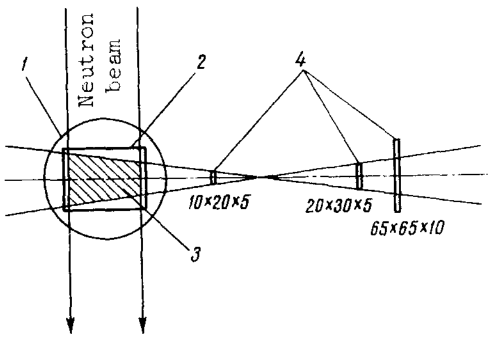

Fig. 1. Diagram of the experiment. 1 - Dewar, 2 - appendix, 3 - effective volume of hydrogen, 4 - telescope crystals.

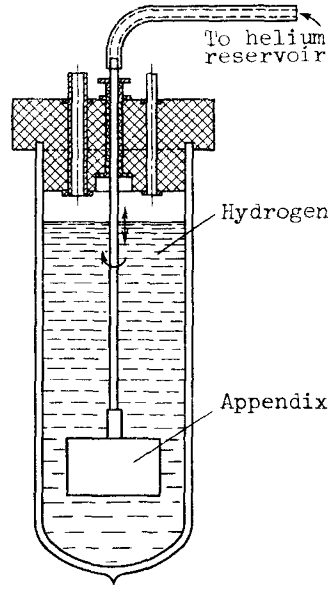

Fig. 2. Diagram of liquid-hydrogen target.

in the (n-p) collisions were detected with a scintillation telescope placed at 90° to the neutron beam. The choice of the 90° l.s. angle, corresponding to one of the "isotropic" angles in the c.m.s., makes it possible to determine the total cross section from the differential cross section at this angle; it furthermore makes it possible to eliminate the background of the elastically scattered protons. The absolute normalization of the cross section was against the known cross section of elastic (n-p) scattering [3], by comparing the pion yield with the proton yield at 60°. For the chosen registration threshold, the effective neutron energy was 585 MeV.

The difficulty of these measurements lay in the relative smallness of the pion yield and accordingly in the large corrections necessitated by the various backgrounds.

Among the background sources were the walls of the hydrogen chamber, which comprised a cylindrical Dewar. This background amounted to 15 - 20% of the counting rate from the hydrogen-filled target, in spite of the fact that the experimental geometry was chosen such that the target walls did not enter into the "effective" volume of the target. To this end, an appendix of light material was placed in the target Dewar. A diagram of the target is shown in Fig. 2. The appendix was a hollow rectangular box made of mylar 15 μ thick. The dimensions of the appendix were chosen such that it completely overlapped the "effective" volume of the liquid hydrogen. The construction of the upper cover of the Dewar, through which passes a metallic tube connecting with the appendix, allows the latter to be moved vertically and to be rotated relative to the beam axis at the angle required to measure the effect. To prevent condensation of air, the inner volume of the appendiz, which was at liquid-hydrogen temperature, was connected with a reservoir with helium gas at a pressure slightly above atomspheric. The excess pressure (which in our system did not exceed several atmospheres) was chosen such that after part of the helium passed from the reservoir into the hydrogen-cooled appendix the pressure in the entire system was close to atmospheric. The helium gas in the appendix had in this case the same density as at 20°K.

The procedure for the principal measurements consisted of successive determination of the counting rate from the target filled with liquid hydrogen, at two positions of the appendix. These two positions corresponded to measurement of the effect from the hydrogen when the appendix is removed from the effective volume, and measurement of the background when the appendix replaces the effective volume of the hydrogen.

The backgrounds from the appendix walls and from the helium were determined in supplementary tests.

In determining the cross section, several computational corrections were introduced, principal among which were the corrections for the electron admixture, for pions with energy below the registration threshold, and for the difference between the "effective" volumes of the hydrogen at 90° and 60°.

As a result of the measurements and of all the corrections, we obtained the differential cross section for the summary production of $\pi^{\pm}$ mesons at 90° in the l.s.

$$\left(\frac{d\sigma}{d\Omega}\right)^{\pi^+}_{90^\circ} + \left(\frac{d\sigma}{d\Omega}\right)^{\pi^-}_{90^\circ} = (1.34 \pm 0.16) \times 10^{-28}\ \mathrm{cm}^2/\mathrm{sr}. \quad (2)$$

The corresponding value of the total cross section is

$$\sigma^{\pi^+}_{np} + \sigma^{\pi^-}_{np} = (2.70 \pm 0.35) \times 10^{-27}\ \mathrm{cm}^2/\mathrm{sr}. \quad (3)$$

The errors indicated in the cross section constitute essentially those arising in the absolute normalization of the cross section and the uncertainty in the values of the calculated corrections.

The cross section obtained is in agreement with the measurements of [1,2].

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OPTOCALORIC EFFECT (AMPLIFICATION OF THE ATOMIC INTERACTION AND COOLING OF THE MEDIUM) IN A LASER BEAM

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It is customarily assumed that the laser beam heats the medium and causes disordering of