each of the bands, the generation is maximal at the same transitions as in the case of a resonator with a dispersive element such as a prism or a diffraction grating.

We note that the measurements were made with the BCl_3 flowing through the cell. To obtain the same effects without flow, larger pressures are needed.

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INVESTIGATION OF THE MECHANISM OF THE REACTION $C^{12}(\pi^-, \pi^-p)B^{11}$ AT 1.04 GeV/c MOMENTUM

A. O. Agan'yants, Yu. D. Bayukov, L. S. Vorob'ev, V. N. Deza, S. V. Donskov, N. A. Ivanova, V. M. Kolybasov, G. A. Leksin, V. L. Stolin, V. B. Fedorov, and V. D. Khovanskii
Institute of Theoretical and Experimental Physics, USSR Academy of Sciences
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The purpose of the present investigation was to study the mechanism of the reaction $C^{12}(\pi^-, \pi^-p)B^{11}$ (1) by performing the measurements necessary for the identification of the pole mechanism, and to compare the experimental results with the predictions of the theory of direct nuclear reactions [1].

The program of such measurements was discussed earlier in [1, 2] and comprises the following: 1) Measurement of the distribution with respect to the Treiman-Yang angle. 2) Measurement of the dependence of the differential cross section on the momentum of the residual nucleus in the laboratory frame. 3) Measurement of the dependence of the differential cross section as a function of the kinematic invariants of the corresponding elastic reaction. 4) Investigation of the angular distribution of the recoil nuclei. 5) Determination of the absolute value of the differential cross section. 6) Investigation of the dependence of $|M|^2$ on the initial energy at fixed values of the remaining variables. 7) Study of the polarization effects in experiments with polarized targets. 8) Verification of the isotopic relation. Our experimental setup has made it possible, for the first time, to realize the first five items for the knock-out reactions.

The measurements were performed with a beam of negative 1.04-GeV/c pions from the ITEF

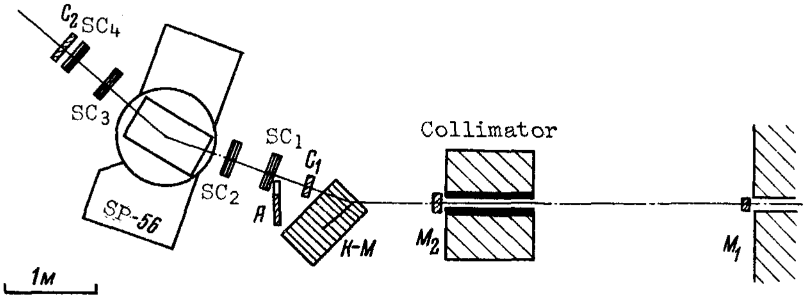

Fig. 1. Diagram of experimental setup

7-GeV proton synchrotron. The experimental setup is shown in Fig. 1. The beam of primary π^- mesons [$\Delta p_{\parallel}/p_{\parallel}$ = ±2.5%, $\Delta p_{\perp}/p_{\perp}$ = ±1%] crossed the first 13 polyethylene electrodes of the target spark chamber, set at an angle of 45° to the beam direction. The target spark chamber, which had 44 discharge gaps, was used simultaneously to record the emitted proton and to measure its momentum from the flight path accurate to $\Delta p_p/p_p$ = ±2%. The scattered π^- meson was recorded with a magnetic spectrometer with four optical spark chambers. The spectrometer resoluation was $\Delta p/p \simeq \pm 0.7\%$.

The momentum triggering the setup was shaped in accordance with the following logic: M_1, M_2, C_1, C_2, $\bar{A}$. The counter A excluded the direct passage of the beam and production of charged particle in a cone of approximately 25° relative to the direction of the initial beam, with the exception of the π^- mesons scattered in a horizontal plane in the 18 - 22° angle interval in the laboratory frame.

The presence of hydrogen in the chamber made it possible to measure the differential cross section of elastic $\pi^- p$ scattering, which enters as a vertex in the proposed pole diagram, and to calibrate the setup.

A total of 40000 photographs was obtained. Approximately 2500 were identified as elastic scattering of negative pions by free hydrogen, and approximately 800 as events of the reaction (1).

The differential cross section of elastic $\pi^- p$ scattering at 20.5° in the lab, determined from these data, turned out to be $d\sigma/d\Omega_{lab}$ = 11.0 ± 0.4 mb/sr, which agrees well with the ± 0.4 mb/sr, which agrees well with the value 10.0 ± 0.7 obtained in [3].

Figure 2a shows the excitation spectrum of the residual nucleus B^{11} for the cases of the reaction (1) (cases with E_{exc} > 100 MeV are not included). The solid curve is the best fit to experimental distribution of the number of events of elastic $\pi^- p$ scattering with respect to the excitation energy formally calculated for them. It reflects the spread of the primary beam and the resolution of the setup. The normalization is to the total number of events. It is seen from the comparison that the excitation spectrum does not contradict the assumption that the B^{11} is produced essentially in low-excited states.

Figure 2b shows the distribution of the number of events with respect to the momentum of the re-

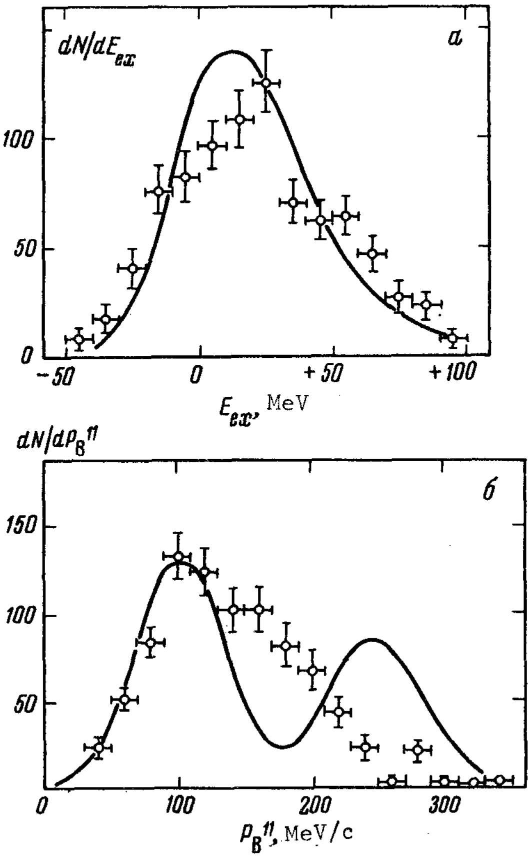

Fig. 2. Distributions: a - with respect to the excitation energy of the residual nucleus, b - with respect to the momentum of the residual nucleus.

sidual nucleus. The modulus of this momentum was determined with accuracy $|\Delta\vec{p}_{B11}| = \pm 20$ MeV/c. This figure takes into account the spread of the initial beam, the resolution of the setup, and the real angular distribution of the recoil nuclei. The solid curve is the result of a calculation in accordance with the pole diagram with a Butler form factor. The calculation includes also the appropriate corrections. The radius of the carbon nucleus was taken equal to 4 F. The normalization was relative to the "soft" part of the spectrum ($|\vec{p}_{B11}| < 135$ MeV/c), where experiment and theory are in qualitative agreement. We shall call this part region I. A sharp disparity was observed in the remaining part of the spectrum ($|\vec{p}_{B11}|$ 135 MeV - region II).

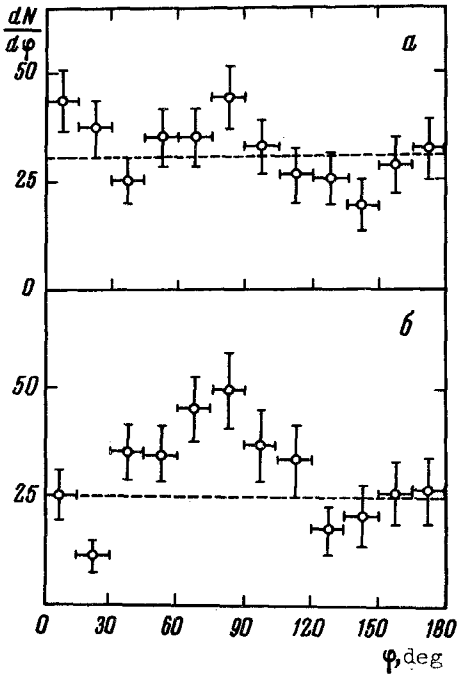

Fig. 3. Distribution with respect to the Treiman-Yang angle.

On this basis, it seems advisable to apply the Treiman-Yang criterion to regions I and II separately. Figures 3a and 3b show the distributions with respect to the Treiman-Yang angle ϕ for regions I and II, respectively. The accuracy with which the angle ϕ is measured is determined essentially by the errors in the transverse component of the recoil-nucleus momentum and amounts, at our resolution, to $\Delta\phi = \pm 7°$. The experimental results are compared with the isotropic distribution, which follows from the pole mechanism of the reaction. The dashed lines are the mean-weiged values of all points. We see that whereas in region I the data correspond to an isotropic distribution ($\chi^2 = 15$, reliability 0.17), in region II this is not the case ($\chi^2 = 41$, reliability $< 10^{-4}$).

We calculated for region I the effective number of protons in the carbon nucleus, defined as

$$N_{eff} = \frac{d\sigma}{d\Omega_{\pi\,inel}} \bigg/ \frac{d\sigma}{d\Omega_{\pi\,el}} .$$

It is listed in the table and compared with the value of N_{eff} obtained from data on the reduced widths for other reactions [4] in the same region of residual-nucleus momenta at $R_{C^{12}} = 4$ F. All the results are in safisfactory agreement. The reduced width recalculated

Reaction	Energy, MeV	$N_{eff}(P_B < 135$ MeV/c$)$	Error, %
$B^{11}(d, n)C^{12}$	9	0.14	15
$C^{12}(p, d)C^{11}$	155	0.32	15
$C^{12}(p, 2p)C^{11}$	155	0.41	15
$C^{12}(\pi^-, \pi^-n)C^{11}$	400 – 600	0.36	15
$C^{12}(\pi^-, \pi^-n)C^{11}$	500 – 1900	0.36	15
$C^{12}(p, pn)C^{11}$	500 – 1900	0.36	15
$C^{12}(\pi^-, \pi^-p)B^{11}$	910	0.32	10

from our value $N_{eff} = 0.32 \pm 0.03$ amounts to $\theta^2 = 0.59 \pm 0.06$.

We obtained the following data: the dependence of the differential cross section on the invariant mass of the $\pi^- p$ system, the spectrum of the π^- mesons scattered at a fixed angle, the distribution with respect to the angle between the π^--meson and proton paths, and the angular distribution of the recoil nuclei. They agree qualitatively with the theoretical calculations both in region I and in region II.

It can thus be assumed that the pole mechanism dominates in the region of momenta $\lesssim$ 100 MeV/c transferred to the nucleus.

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SEARCHES FOR THE GRAVITATIONAL MOMENT OF THE PROTON

G. E. Velyukhov
A. F. Ioffe Physico-technical Institute, USSR Academy of Sciences
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1. If it is assumed that violation of C and P invariance, each separately, occurs in weak interaction because the latter is weak, then we can attempt to extend the loss of left-right symmetry to interactions of the microworld with a gravitational field. The Hamiltonian of a proton located in a gravitational field will then include a pseudoscalar term $\Delta U = (\vec{\xi}\cdot\vec{G})$, where $\vec{G}$ is the intensity of this field (polar vector, and we shall call $\vec{\xi}$ the gravitational moment of the proton (axial vector). Its dimension is erg/Gal in the cgs system.

The distinguished direction for the proton is that of the spin, and consequently $\vec{\xi} = \xi_0\vec{\sigma}$ (ξ_0 - projection of $\vec{\xi}$ on the Z axis, $\vec{\sigma}$ - Pauli matrix).

It is easy to show that a proton with ξ_0 in a field G will precess with a frequency $\omega' = \pm\xi_0 G/(h/2)$, forming a right-hand (Fig. 1a) and a left-hand system of coordinates (Fig. 1b). A consistent analysis shows that the frequencies of the nuclear magnetic resonance (NMR) remain unchanged when $H_0 \downarrow\downarrow G$ and $H_0 \uparrow\downarrow G$, but when $H_0 \perp G$ the position of the NMR relative to the first two cases shifts either towards higher or lower frequencies. This makes it possible to determine the value of ξ_0 and its sign for the corresponding coordinate system: