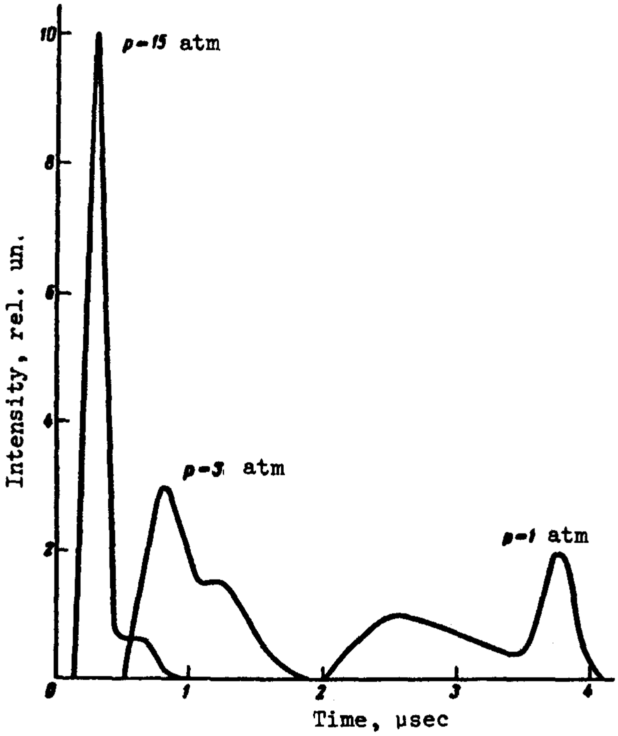

Fig. 2. Shape of generation pulse at different pressures. The pulses were obtained at the following ratios of the energy input to the discharge W to the threshold energy W_{thr}: $W/W_{thr} \approx 1.5$ for p = 1 atm, ≈ 1.1 for 3 atm, and ≈ 1.02 for 15 atm. Mixture composition $CO_2:N_2$ = 1.2.

increases, and, as a result of the increase of the frequency of the collisions between the excited N_2 molecules and the CO_2 molecules, a decrease takes place in the duration of the generation pulse and in the delay of the generation pulse relative to the ionization pulse (see Fig. 2).

[1] N.G. Basov, E.N. Belenov, V.A. Danilychev, and A.F. Suchkov, Kvantovaya elektronika (Quantum Electronics), No. 3, 121 (1971).
[2] A.B. Eletskii and B.M. Smirnov, Dokl. Akad. Nauk SSSR 190, 809 (1970) [Sov. Phys.-Dokl. 15, 109 (1970)].
[3] B.M. Koval'chuk, G.A. Mesyats, and Yu.F. Potalitsyn, Zhurnal prikladnoi mekhaniki i tekhnichesko fiziki (Journal of Applied Mechanics and Technical Physics), No. 6, 120 (1971).

DETERMINATION OF THE AXIAL FORM FACTOR OF THE NUCLEON FROM THE CROSS SECTION FOR ELECTROPRODUCTION OF PIONS AT THRESHOLD

Yu.I. Titov and N.F. Severin
Physico-technical Institute, Ukrainian Academy of Sciences
Submitted 23 June 1971; resubmitted 30 August 1971
ZhETF Pis. Red. 14, No. 7, 426 - 428 (5 October 1971)

The methods of current algebra in conjunction with the hypothesis of partial conservation of the axial current (PCAC) show that the cross section for the electroproduction of pions at the threshold is sensitive to the axial-vector form factor F_A of the nucleon [1]. An analysis of the first experimental data [2] has shown that the cross section at the threshold can be satisfactorily described at the values of F_A obtained in neutrino experiments. In the present paper we use the previously obtained data [2, 3] and some new ones to determine F_A in the interval of the 4-momentum transfer squared k^2 from 2.5 to 10.4 F^{-2}. In the determination of F_A, we use the same theory as in [2]. New data at $k^2 = 5.2\ F^{-2}$ and $k^2 = 10.4\ F^{-2}$ were obtained with the aid of a procedure described in [3], however, to identify the electrons we used a telescope made up of threshold gas Cerenkov and scintillation counters. Figure 1

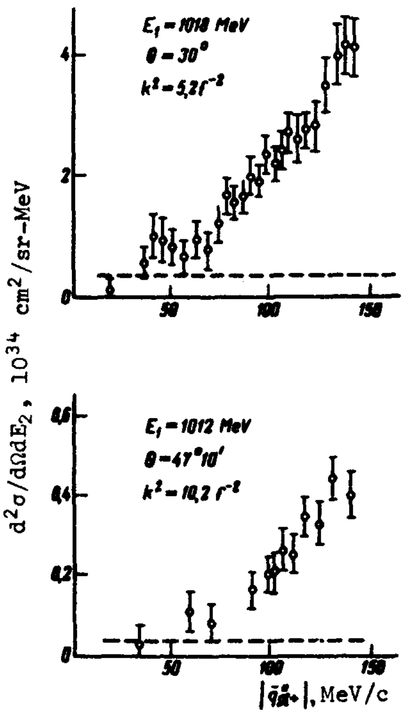

Fig. 1

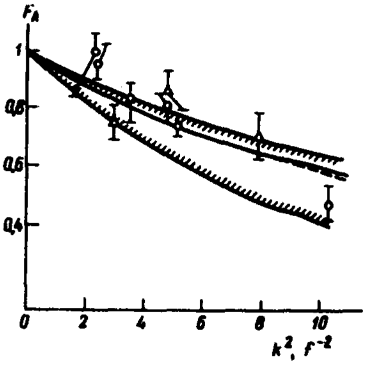

Fig. 2

shows the cross sections for the electroproduction of pions at threshold as a function of the 3-momentum of the pion in the c.m.s. and, as earlier in [3], the measured cross section was subjected to a radiative correction; the dashed curve shows the systematic error.

The result of the determination of F_A are shown by the closed circles in Fig. 2. The same figure shows the preliminary results obtained at NINA (England) [4]. The corridor with the shading corresponds to the uncertainty of F_A obtained in the neutrino experiment [5]. Good agreement is seen for the values of F_A obtained by different methods.

The availability of experimental data up to $k^2 = 10.4\ F^{-2}$ makes it possible to obtain a satisfactory analytic fit to F_A. The axial-vector form factor was specified in the form

$$F_A = 1/(1 + k^2/M_A^2)^n, \tag{1}$$

where M_A is the varied value of the axial-vector mass.

Two fittings were performed, in which the exponent was assumed to be equal to one or to two. The results are listed in the table.

n	M_A, GeV	χ^2/m	m	M_A^*, GeV
1	0.76 ± 0.05	1.64	5	0.77 ± 0.040
2	1.12 ± 0.06	1.35	5	1.13 ± 0.055
1	0.70 ± 0.15	Neutrino experiment [5]		
2	1.05 ± 0.20			

M_A was obtained using only our data; the value of χ^2 divided by the number of degrees of freedom m is given for this case. M_A^* was obtained using both our data and the results of [4], a fact that barely changed the results of the fitting. The curves corresponding to fitting at n = 2 and n = 1 are shown in Fig. 2 by solid and dashed lines, and differ insignificantly from one another. To choose the concrete value of n, measurements at large k^2 are necessary.

The authors are grateful to N.G. Afanas'ev, A.P. Klyucharev, Yu.V. Kulish, and M.P. Rekalo for interest in the work and to Yu.P. Antuf'ev, for graciously supplying the fast-logic electronic circuitry.

[1] A.I. Vainshtein and V.I. Zakharov, Usp. Fiz. Nauk 100, 225 (1970) [Sov. Phys.-Usp. 13, 73 (1970)].
[2] Yu.I. Titov, N.F. Severin, N.G. Afanas'ev, R.V. Akhmerov, S.A. Byvalin, Yu.V. Kulish, A.S. Omelaenko, E.V. Stepula, and E.M. Smelov, ZhETF Pis. Red. 12, 186 (1970) [JETP Lett. 12, 129 (1970)].
[3] Yu.I. Titov, N.F. Severin, N.G. Afanas'ev, et al., Yad. Fiz. 13, 541 (1971) [Sov. J. Nucl. Phys. 13, 304 (1971)].
[4] N.V.P.R. Nuthakki, O.T. Tumer, B. Dickinson, et al., Paper delivered at 15th International Conference on High Energy Physics, Kiev, 26 August - 4 September 1970.
[5] R.Z. Kustom, D.E. Lungquist, T.B. Novey, et al., Phys. Rev. Lett. 22, 1014 (1969).

NEW EFFECTS IN THE ABSORPTION OF ULTRASOUND IN THE INTERMEDIATE STATE OF A VERY PURE SUPERCONDUCTOR

A.G. Shepelev, O.P. Ledenev, and G.D. Filimonov
Physico-technical Institute, Ukrainian Academy of Sciences
Submitted 31 August 1971
ZhETF Pis. Red. 14, No. 7, 428 - 433 (5 October 1971)

The oscillatory absorption of ultrasound (US) in the intermediate state (IS) of a superconductor of the first kind [2] (upon change in thickness of the normal layers a with change of magnetic field H), which was theoretically predicted by Andreev [1], cannot be observed without overcoming the difficulties involved in the production [3] of a periodic structure of the IS in the interior of the metal and satisfying a number of strong inequalities relating the electron mean free path ℓ, a, and D_{ext} [1)], namely $\ell \gg D_{ext} \gg a$. The criterion for satisfying the most stringent condition $\ell \gg D_{ext}$ (the field H exerts a definite influence on the dynamics of the electrons in the normal layers) is the process of ordinary magnetoacoustic oscillations in the normal state of the metal at $T > T_c$ and $H < H_c$. The only superconductor in which one can certainly hope to observe the predicted phenomenon is pure gallium, in which magnetoacoustic oscillations were observed in the normal state [4] in fields starting with several Oersted.

1. We present below some results obtained in an investigation, by a pulsed method [5] of the absorption of longitudinal ultrasound of frequency

1) A.F. Andreev advised us that in the formulas of [1] R_{ext} should be taken to mean the extremal diameter D_{ext} of the electron orbit in the magnetic field.