b) by comparing our result with the value obtained by the Columbia group [12] by a measurement where the nuclear capture of the μ^- by a proton was observed in a mesomolecular system, it is possible to conclude the necessity of a (V-A) type of interaction governing the process (1), with no essential dependence on the values assumed for the axial and vector coupling constants g_A and g_V.

c) assuming for (g_A/g_V) and for g_V the values given by Wu [13] and Kabir [8], our result (3) leads to the following determination of the induced pseudoscalar coupling constant g_p:

$$g_p = -(8.7 \pm 3.7)\, g_A.$$

A very similar result is obtained analysing the experiment performed at the Columbia University [12, 8].

We would like to thank Messrs. R. Schillsott, G. Sicher and B. Smith for their technical assistance, and Mr. G. Lidö for helping us during the measurements. We are particularly indebted to Professors P. Bassi, B. Ferretti, G. Puppi and P. Preiswerk for their suggestions, encouragement and support.

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INVESTIGATION OF THE ρ-MESON RESONANCE WITH ELECTRON-POSITRON COLLIDING BEAMS

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Received 1 September 1967

Preliminary results on the determination of the position and shape of the ρ-meson resonance with electron-positron colliding beams are presented.

When experiments with electron-positron colliding beams were planned [1, 2] investigation of the process

$$e^- + e^+ \to \pi^- + \pi^+$$

$$e^- + e^+ \to K^- + K^+$$

was considered as one of the first problems to be treated. At the energies up to 2×700 MeV covered by the electron-positron storage ring VEPP-2 at Novosibrisk the most interesting are the region of the ρ-meson resonance (2×380 MeV) for the former reaction and the region of φ-meson resonance (2×510 MeV) for the second.

This letter presents preliminary results on the determination of position and shape of ρ-meson resonance.

In comparasion with earlier experiments on the observation of pion pair production [3] working conditions on the VEPP-2 machine were considerable improved. At present each run lasts about two hours. A third of this time is spent on electron and positron storting. The initial positron current in an ordinary run is 20 mA, electron current - 50 mA. Beam life-time is more than 3000 sec. The adjustment of optium conditions of beam collision, and the continuous control over the preservation of these conditions, is carried out with the help of a scintillation counter system recording small-angle e^--e^+ scattering [4].

The spark chamber array consists of two identical parts (upper and lower) subtending the solid angle 2×0.6 steradians near the vertical axis. Fig. 1 shows the layout of spark chambers. Next to the interaction region are thin-plate spark chambers which determinate the angles of outcoming particles and the coordinates of the interaction point. The nature of the particles is identified by their interaction with the material of the plates in the "shower" and "range" spark chambers. The "shower" chamber has eleven copper plates 6 mm thick, the "range" chamber has 21 plates made of stainless steel 8 mm thick. A rather complicated mirror system makes it possible to have a single camera.

The whole array of spark chambers is triggered on four scintillation counters (with dimensions $40 \times 40 \times 1$ cm^3) put into coincidence with resolution time $2\tau = 20$ nsec. An anticoincidence counter with dimensions $160 \times 160 \times 5$ cm^3 viewed by the single photomultiplier FEU-65 is used for cosmic ray vetoing. Between the counter and the chambers a lead absorber 20 cm thick is placed preventing the particles under investigation from penetrating into the anticoincidence counter. The anticoincidence counter reduces the cosmic particle trigger rate more than 100 times. Additional reduction by the factor 5 was obtained by counters gating at r.f. frequency.

In these conditions the trigger rate is 10 counts per hour due to cosmic rays and about one count per 1 mA of electron or positron current lost.

Experiments were carried out at seven energy values from 2×290 MeV up to 2×510 MeV. About 650 runs were made in five months with a total data taking time of 742 hours. From 44 000 photographs 303 events were selected corresponding to collinear tracks originated in the interaction region. Identification of secondary particles types resulted in separation of all events into three groups: 186 events of elastic e^--e^+ scattering, 109 pion pair production events

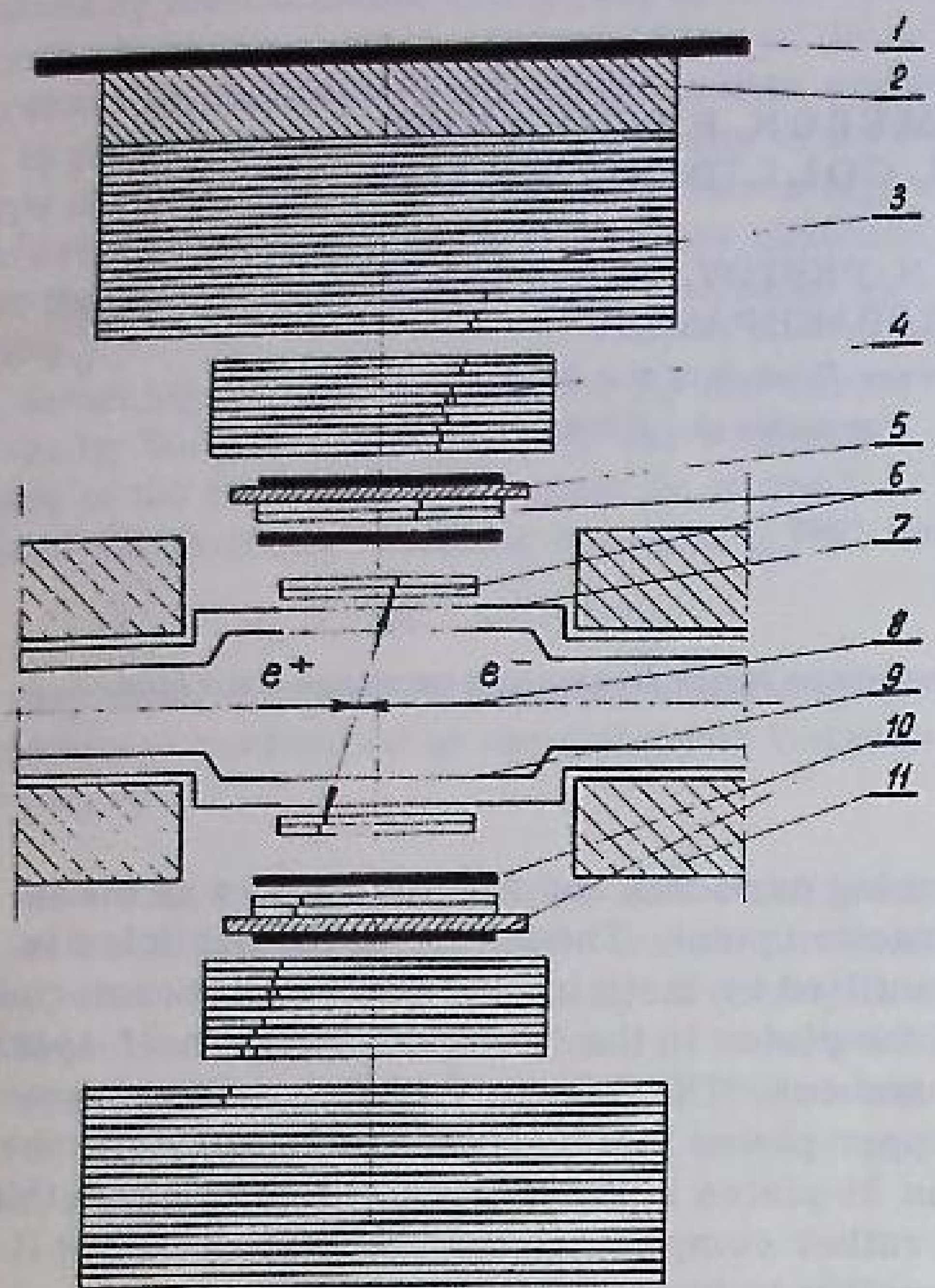

Fig. 1. Spark chambers system:
1) Anticoincidence scintillation counter
2) Lead absorber 20 cm thick
3) "Range" spark chamber
4) "Shower" spark chamber
5) Duraluminium absorber 2 cm thick
6) Thin-plate spark chambers
7) Window of outer vacuum chamber
8) Interaction region
9) Inner vacuum chamber
10) Storage ring magnet
11) Scintillation counters

and 8 muon pair production events. Control runs proved that a single-beam background is negligibly small. Runs with no beams made it possible to detect a small number of cosmic rays background events (several times less than the effect almost at each energy value) imitating pion pair production.

The ratio of cross sections for pion production and e^--e^+ elastic scattering measured by the same detector may be written as

$$\frac{\sigma_\pi}{\sigma_e} = \frac{\beta_\pi^3}{a} F^2 (E)$$

where β_π-velocity of the pions in units of light velocity, a- constant determined by the experiment geometry and F- modulus of the form factor for pion pair production [1]. In the case of QED with no other forces F=1. If the particles are produced at the angle 90° with respect to the beam axis then a=18. Integration over the solid angle gives a=20.4.

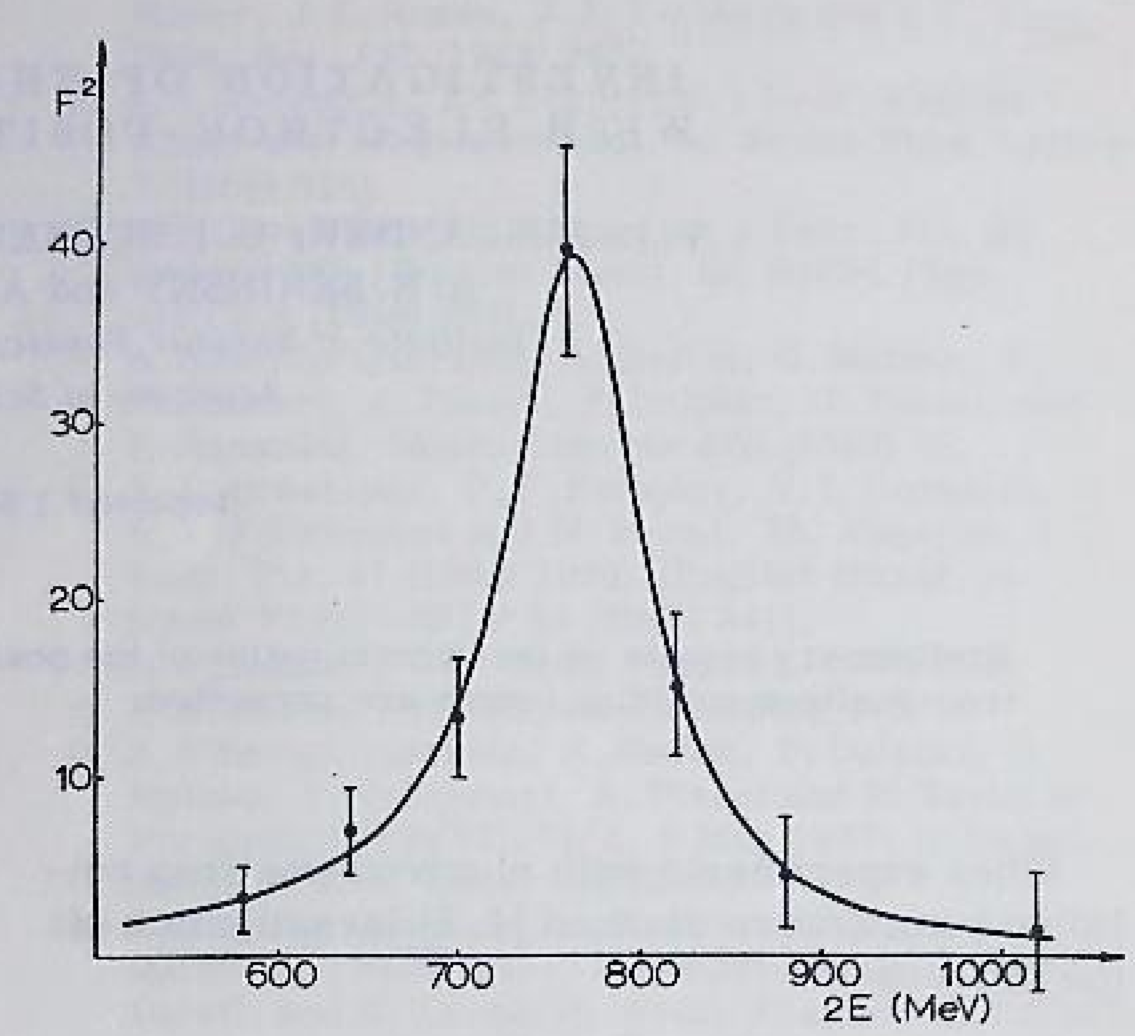

Fig. 2. Experimental values of F^2 (E) approximated by the Breit-Wigner formula.

Experimentally obtained values of the function F^2 (E) shown in fig. 2 clearly demonstrate its resonant character.

Approximation of the experimental results by the Breit-Wigner formula

$$F^2 (E) = \frac{k\, m_\rho^4}{(4E^2 - m_\rho^2)^2 + m_\rho^2 \Gamma_\rho^2}$$

after maximum-likelihood routine gives the following best fits for the parameters

$$k = 0.59 \pm 0.15$$

$$m_\rho = 764 \pm 11 \text{ MeV}$$

$$\Gamma_\rho = 93 \pm 15 \text{ MeV}.$$

The indicated errors correspond to one standard deviation. Statistical errors and the precision of primary energy determination (1%) are taken into account. The value of criterion $P(\chi^2)$ turned out to be equal to 98%. Precise analysis of the data treatment process allows us to allocate this lucky occasion to the benevolence of Pure Chance. It is evident that within the obtained statistical accuracy the process may be treated by not taking into account its nonresonant channel.

The total cross section of electron-positron annihilation into pion pairs at the maximum corresponding to the formation of an intermediate ρ-meson is

$$\sigma_\rho = 1.2 \pm 0.2\ \mu\text{b}.$$

At present on the VEPP-2 machine experiments have begun on the observation of kaon pair production at the energy of the φ-meson resonance. Experiments are planned to end this October in order to spend several months on some improvements which would result in an increase of the data taking rate of an order of magnitude.

The authors are indebted to many colleagues who participated in data recording and data treatment.

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SEARCH FOR THE DECAY MODE $\eta^0 \rightarrow \pi^0 e^+ e^-$

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Received 14 August 1967

In an effective sample of 6 300 η^0 (549) mesons, no positively identified example of the $\pi^0 e^+ e^-$ decay mode has been found. With 90% confidence the branching ratio for this mode is less than 3.7×10^{-4} of all η^0 decays.

The magnitude of the branching ratio for $\eta^0 \rightarrow \pi^0 e^+ e^-$ decay is directly connected with charge conjugation invariance in the electromagnetic interactions of hadrons. Several authors [1] have discussed the consequences of C violation on this decay mode. If C is conserved, the decay can proceed only through two virtual gammas and the branching ratio is estimated to be $\approx 0.4 \times 10^{-8}$ [2] assuming a branching ratio of 0.2 [3] for the $\pi^0\gamma\gamma$ mode. Observation of a branching ratio much in excess of this would be evidence for C violation. Previous determinations have revealed no such evidence, the current upper limit to the branching ratio being 0.9×10^{-3} [4].

Experimental conditions: An exposure of the University College London/Rutherford Laboratory Heavy Liquid Bubble Chamber to a 930 MeV/c π^+ beam at the Nimrod proton synchroton has yielded 2.23×10^6 π^+-nucleon interactions in the heavy freon CF_3Br. The mean momentum of the pions at interaction was approximately 830 MeV/c. The useful volume of the chamber has dimensions $1.4 \times 0.5 \times 0.45$ metres^3 and is situ-

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