mesons: $a_- = 0.54 \pm 0.024$, $b_- = 0.34 \pm 0.058$, $c_- = 0.90 \pm 0.098$.

b) Gamma emission from π^0 meson decay; $a_\gamma = 1.87 \pm 0.24$, $b_\gamma = 2.89 \pm 0.44$, $c_\gamma = 2.32 \pm 0.59$.

The angular distribution of the π^0 mesons can be easily obtained from a_γ, b_γ, and c_γ. One obtains $a_0 = 0.68 \pm 0.20$, $b_0 = 1.80 \pm 0.27$, $c_0 = 1.90 \pm 0.50$.

The total elastic cross-section as determined by the above angular representation is $(10.7 \pm 0.6) \times 10^{-27}$ cm^2; the total exchange cross-section is $(16.6 \pm 1.4) \times 10^{-27}$ cm^2. The total cross-section for π^- meson interaction with hydrogen is $(28.8 \pm 1.8) \times 10^{-27}$ cm^2 where we have included the production of mesons by mesons[1] to the elastic and exchange contributions. For comparison one may cite the meson attenuation measurements in hydrogen[2] which gave a total cross-section of $(25.7 \pm 1.0) \times 10^{-27}$ cm^2.

[1] V. G. Zinov and C. M. Korenchenko, J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 301 (1958), Soviet Phys. JETP **7** (in press).

[2] Ignatenko, Mukhin, Ozerov, and Pontecorvo, Dokl. Akad. Nauk SSSR **103**, 45 (1955).

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SCATTERING OF 307 MEV NEGATIVE π MESONS BY HYDROGEN WITH CHARGE EXCHANGE

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We have measured the angular distribution of γ rays emitted in the decay of π^0 mesons which were formed by exchange scattering of π^- mesons by hydrogen ($\pi^- + p \rightarrow \pi^0 + n$). The π^- meson beam was obtained by the use of the synchrocyclotron of the Joint Institute for Nuclear Research. The energy of the π^- mesons was measured at 307 ± 9 Mev as obtained from range measurements in copper. Scintillation counters were used to obtain the data. Liquid hydrogen which was contained in a foamed polystyrene container was used as the target.

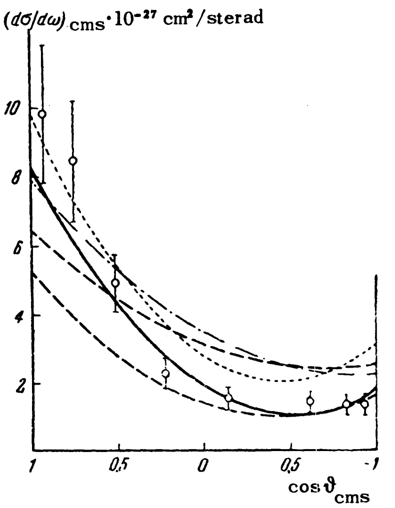
ϑ°_{cms}	$\frac{d\sigma}{d\omega}$, 10^{-27} cm^2/sterad
20.5	9.80±2.02
40.5	8.46±1.74
59.2	4.05±0.83
76.8	2.24±0.46
98.0	1.50±0.31
128.1	1.40±0.31
146.4	1.32±0.30
159.4	1.32±0.29

The measured differential cross-section for gamma ray emission in the center of mass system is presented in the table. These cross-sections include all necessary corrections.

A least squares fit of the function $d\sigma/d\omega = a + b\cos\vartheta + c\cos^2\vartheta$ (ϑ measured in center of mass system) to the data results in the following values for the coefficients (in units of 10^{-27} cm^2/sterad): $a_\gamma = 1.87 \pm 0.24$, $b_\gamma = 3.30 \pm 0.53$, $c_\gamma = 3.14 \pm 0.71$. From these coefficients one can easily obtain the angular distribution of π^0 mesons and one finds $a_0 = 0.57 \pm 0.23$, $b_0 = 2.10 \pm 0.34$, $c_0 = 2.67 \pm 0.60$.

The total cross-section for charge exchange scattering as determined by the above angular distribution is $(18.4 \pm 1.6) \times 10^{-27}$ cm^2. Adding this cross-section to the elastic scattering cross-section[1] and including meson production by mesons[2] one obtains a total interaction cross-section for π^- meson in hydrogen of $(30.2 \pm 1.8) \times 10^{-27}$ cm^2. Meson attentuation measurements in hydrogen[3] yield a total interaction cross-section of $(3.16 \pm 1.6) \times 10^{-27}$ cm^2 (interpolated to 307 Mev).

In the accompanying figure the four dashed curves represent calculations based on four sets of phase shifts. These were obtained[1] from a preliminary phase analysis of elastic scattering of π^- mesons by hydrogen where one assumed that only the S and P states participate in the scattering. The measurements of the present work are indicated in the figure.



The solid curve represents $d\sigma/d\omega = 1.87 + 3.30\cos\vartheta + 3.14\cos^2\vartheta$. It is apparent that none of the computed γ distribution curves agree with the measured distribution, as was pointed out earlier.[1]

[1] V. G. Zinov and C. M. Korenchenko, J. Exptl. Theoret. Phys. (U.S.S.R.) **33**, 335 (1957), Soviet Phys. JETP **6**, 260 (1958).

[2] V. G. Zinov and C. M. Korenchenko, J. Exptl. Theoret. Phys. (U.S.S.R.) **34**, 301 (1958), Soviet Phys. JETP **7** (in press).

[3] Ignatenko, Mukhin, Ozerov, and Pontecorvo, Dokl. Akad. Nauk SSSR **103**, 45 (1955).

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EFFECT OF QUANTUM FLUCTUATIONS IN THE ELECTRON RADIATION OF THE SYNCHROTRON OSCILLATIONS

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THE problem of quantum fluctuations in the radiation of electrons in the synchrotron has been considered in a series of articles (see, for example, Refs. 1 — 4).

In this note we generalize the well known results of Sands,[3] namely, we take into account the damping of synchrotron oscillations caused by the increase in electron energy, and give several practical results.

Putting the damping coefficient

$$\rho = \frac{\dot{E}}{E} + \frac{3-4n}{1-n}\frac{2ce^2}{3R^2}\frac{\gamma^3}{1+\lambda}, \tag{1}$$

where $\gamma = E/mc^2$, $\lambda = N\ell/2\pi R$, ℓ is the length of the straight section of the race track, N is the number of sections, into the phase equation of the synchrotron it is possible to obtain a formula for the stationary value of the mean square amplitude for synchrotron oscillations

$$\langle A_\varphi^2\rangle = \frac{55\sqrt{3}}{32}\frac{\hbar c q \cot\varphi}{e^2(1+\lambda)^2(3-4n)\gamma}F_1F_2. \tag{2}$$

This expression differs from the result of Sands[3] by the presence of the factor F_1F_2, where

$$F_1 = \left(1+\alpha\frac{1-n}{3-4n}\frac{\dot{E}}{P}\right)^{-1};\quad F_2 = \left(1+\frac{\dot{E}}{P}\right)^{-1};\quad P = \frac{2ce^2}{3R^2}\frac{\gamma^4}{1+\lambda},$$

and α is a coefficient of order unity. At energies of several hundred Mev the factor F_1F_2 is important and, essentially, determines the energy dependence of $\langle A_\varphi^2\rangle$. Analysis of Eq. (2) shows that there is no danger of particle loss connected with a maximum of $\langle A_\varphi^2\rangle$ which, under the assumption $\cot\varphi = \text{const}$, occurs for $P = 7E\alpha(1-n)/(3-4n) \approx 1$. The condition $\cot\varphi = \text{const}$ is, in fact, superfluous. Employing another law of increase for the accelerating voltage, it is easy to avoid this maximum.

At high energies where $F_1F_2 \to 1$, using results obtained by Sands,[3] one can find the excess of the amplitude of the accelerating voltage over the value of the amplitude, necessary to accelerate the elec-