the region of the water-ice transition (Fig. 1). The solid curve corresponds to cooling (the supercooled state was maintained to -8°C), and the dashed curve corresponds to the usual heating regime.

The heat was drawn from the thermal screen by a three-stage semiconducting thermopile, on the cold junction of which it was possible to obtain a temperature of -80°C. The specific heat of the sample can be determined from the formula $c = W[(dR/dT)/\Delta R]\Delta t$, where dR/dT is the temperature coefficient of the resistance thermometer, and Δt is the time necessary for the thermometer resistance to change by an amount ΔR. The relative error in the determination of c is of the order of 0.3%. The obtained latent heat of melting of water, referred to 0°C, is 79.6 cal/g, which is in good agreement with the published data [2].

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THE RESONANCE $Y_0^*(1327) \rightarrow \Lambda + \gamma$

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The purpose of this experiment was to study the production of "strange" resonances whose final decay products contain Λ^0 or K^0 particles and γ quanta.

A propane bubble chamber [1] with working volume 100 x 50 x 40 cm in a magnetic field of 1.7 Tl was exposed in a beam of pions with momentum p = 5.1 GeV/c and $\Delta p/p = \pm 2\%$ [2]. The results presented below are based on the processing of 230000 photographs.

We selected events in which the primary interaction was associated simultaneously with at least one V^0 event and one electron-positron pair.

In accordance with visual criteria and the data of the subsequent reduction, the interactions were divided into two groups, $\pi^- + p$ and $\pi^- + C$.

In π^-p events, the admixture of interactions between pions and quasi-free protons in the carbon nuclei is ∿ 30%. All the selected events were measured in accordance with one system of programs for reconstructing the geometry of the events and identifying the Λ^0, K^0, and γ. An additional identification of the unseparated V^0 particles was based on δ-electrons, ionization, and the free path of the positively charged particle. The histograms presented below, with Λ^0 hyperons, contain ∿ 3% of K^0-meson admixture.

The obtained effective-mass spectrum of the $\Lambda^0\gamma$ combinations for π^-p events has two maxima (Fig. 1). The first corresponds to the creation of a Σ^0 hyperon, and the second, going beyond

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about 4 standard deviations, lies in the mass region 1290 - 1440 MeV, just as in [3]. The second maximum appears also in π^-C events, although its intensity is about half as weak.

The background curve on Fig. 1 was obtained by the Monte Carlo method with allowance for the efficiency of registration of Λ^0 and λ, and for the known cross sections of the reactions (including those with production of $Y_1^*(1385)$, $Y_0^*(1405)$, and $Y_0^*(1520)$, the final products of which are Λ^0 hyperons and γ quanta. The normalization was against the area of the histogram outside the (1290 - 1440) MeV region. The number of events above the background in the second peak was 39.0 ± 10.2.

If we attempt, following [3], to interpret the observed peak as being due to the presence of the resonance

$$Y_0^*(1670) \to \Lambda^0 + \eta, \quad \eta \to 2\gamma,$$

then, for events of the $\Lambda 2\gamma$ type, each $\Lambda\gamma$ combination from (1) would make a contribution to the mass region (1290 - 1440), and the effective masses of the observed particles would satisfy the conditions

$$M_{\gamma\gamma} \approx M_{\eta}, \quad M_{\Lambda 2\gamma} \approx M_{Y_0^*(1670)} .$$

Within the limits of our statistics (85 $\Lambda 2\gamma$ combinations), however, not one of them contributes twice to the (1290 - 1440) MeV region of the $\Lambda\gamma$ mass spectrum on Fig. 1, nor to the region of M_η and $M_{Y_0^*(1670)}$ within the limits of three standard deviations in the $M_{\gamma\gamma}$ and $M_{\Lambda 2\gamma}$ effective masses (Fig. 2). Under our conditions this error amounts on the average to 55 MeV.

Knowing the γ-quantum registration efficiency, we can estimate the expected number $\bar{n}$ of events in the region of the masses M_η and $M_{Y_0^*(1670)}$. Assuming that all the observed combinations above the background in the second peak of the $\Lambda\gamma$ spectrum are due to the decay (1), we obtain $\bar{n}$ = 5.5 ± 1.4. From the Poisson distribution it follows that the probability of zero dropping out at $\bar{n}$ = 5.5 is equal to 0.6%. Thus, within the framework of the available statistics, the existence of the $Y_0^*(1670)$ resonance is quite doubtful. Nor is this conclusion contradicted by the results of [6, 7].

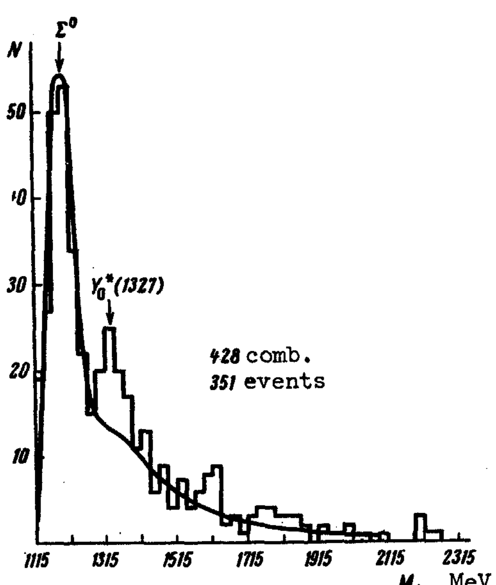

Fig. 1. Effective-mass spectrum of $\Lambda\gamma$ combinations in π^-p events. The background curve was calculated by the Monte Carlo method and normalized to the area of the histogram outside the 1290 - 1440 MeV region.

Reactions proceeding via known resonant and nonresonant states, as shown by calculations [3 - 5], cannot produce a narrow peak in the $\Lambda\gamma$ mass spectrum. It seems therefore that the appearance of a peak in the $\Lambda\gamma$ mass spectrum in the (1290 - 1440) MeV region may be due to the existence of a new $Y_0^* \to \Lambda + \gamma$ resonance.

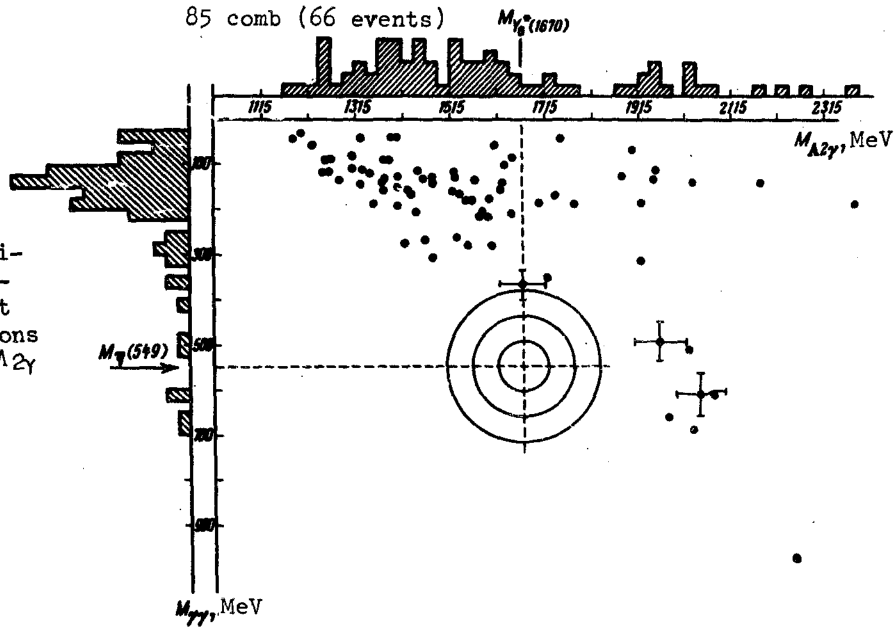

Fig. 2. Effective mass distribution of γγ and Λ2γ combinations. The circles represent 1, 2, and 3 standard deviations in the masses of the γγ and Λ2γ combinations for the regions M and $M_{Y_0^*}(1670)$.

If we assume that $Y_0^*(\Lambda\gamma)$ can experience only radiative decay, and that its width is close to zero, then the values of its mass can be determined by approximating the effective-mass spectrum of the Λγ combinations by means of the following functions

$$f(m) = a_1(m - m_\Lambda)\exp - b(m - m_\Lambda) + a_2 \exp - (m - c_2)^2/2d_2^2 + + a_3 \exp - (m - c_3)^2/2d_3^2 \quad (2)$$

in which the first term describes the common background of the final states, with the exception of the Σ^0 hyperon, whose contribution is described by the second term. The least squares method yields for the $Y_0^*(\Lambda\gamma)$ mass a value $c_3 = (1327.5 \pm 3.5)$ MeV at a mean-square deviation $d_3 = (20 \pm 4.4)$ MeV; for the Σ^0 hyperon the corresponding values are $M_{\Sigma^0} = C_2 = (1191.0 \pm 2.0)$ MeV and $d_2 = (33.0 \pm 2.1)$ MeV.

The possible existence of the $Y_0^*(\Lambda\gamma)$ resonance was discussed earlier in theoretical papers [8, 9]. The decay $Y_0^*(1327) \to \Lambda\pi$ is forbidden by isotopic spin; on the other hand, if the mass of Y_0^* is smaller than the sum of the Σ and π masses, then the decay $Y_0^*(1327) \to \Sigma + \pi$ is forbidden. On the other hand if the Y_0^* mass exceeds slightly the sum $(M_\Sigma + M_\pi)$, then, assuming that the quantum numbers of Y_0^* and $I^P = 1/2^+$, then the $Y_0^*(1327) \to \Sigma\pi$ decay is suppressed, since the orbital angular momentum of the Σπ system is odd.

Ascribing all events over the background in the $M_{\Lambda\gamma}$ mass interval (1290 - 1440) MeV to the $Y_0^*(1327)$ resonance we find that the cross section for its production in $\pi^- p$ collisions at 5.1 GeV/c is (59 ± 15.3) μb.

Both the relatively small width of the obtained $Y_0^*(1327)$ resonance, and its small production cross section, agree with the characteristic features of the resonances experiencing radiative decay.

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INFRARED HOLOGRAPHY BY METHODS OF NONLINEAR OPTICS

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Holography in the infrared cannot be obtained by usual methods, since the photographic emulsions are not sensitive to infrared.

Nonlinear optics makes it possible to transform, with the aid of an auxillary pump beam of frequency ω_1, infrared radiation of frequency ω_2 into radiation of visible frequency $\omega_3 = \omega_1 + \omega_2$ [1 - 3]. In this paper we propose a new image-conversion scheme, which unlike the published ones makes it possible to transform a three-dimensional image, and also obtain holograms of three-dimensional objects illuminated with infrared.

If the object is located at a distance z_1 from the nonlinear crystal then, as can be shown, the image at the summary frequency is located at the distance

$$z_2 = z_1(\omega_3/\omega_2) - \ell[1 - (1/2n_3) - (\omega_3/2n_2\omega_2)] \tag{1}$$

from the crystal. Here ℓ is the length of the crystal, and n_1, n_2, and n_3 are the refractive indices for the corresponding waves. As seen from (1), the longitudinal dimensions of the image at the summary frequency change, compared with the object, by a factor equal to the frequency ratio. The transverse dimensions remain unchanged.

The transverse resolution is in this case of the order of

$$\Delta x = \Delta y = 1{,}4\sqrt{n_1\omega_1 c\ell/n_2 n_3\omega_2\omega_3}\,, \tag{2}$$

where c is the velocity of light, and the longitudinal resolution (in object space) is

$$\Delta z \approx \ell/n_2\,. \tag{3}$$

These formulas are valid when $z_1 < d/\Delta\phi$, where d is the effective transverse dimension of the crystal (the diameter of the pump beam) and $\Delta\phi$ is the permissible angular deviation of the wave of frequency ω_2 from exact synchronism. When the system is properly adjusted, $\Delta\phi$ is of the order of $\pi(2n_2n_3\omega_3c/\ell n_1\omega_1\omega_2)^{1/2}$ and amounts to several degrees when ℓ is of the order