

## SEARCHES FOR RADIATIVE DECAYS OF RESONANCES INVOLVING $\Lambda$ HYPERONS

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The present work provides preliminary data on radiative decay modes of resonances involving  $\Lambda$  hyperons [1]. Sixty thousand photographs obtained with a 7–8 GeV/c meson beam in a 24-liter propane bubble chamber of the High-Energy Laboratory were used.  $\pi N$  and  $\pi C$  events were chosen in which the creation of the  $\Lambda$  hyperon was accompanied by at least one electron-positron pair from a  $\gamma$ -quantum conversion. The mean  $\gamma$ -recording efficiency, allowing for the effective  $\Lambda$ -recording volume, is  $0.09 \pm 0.01$ . The total correction for the loss of  $\gamma$ -quanta escaping at large azimuthal angles and for the asymmetry of the primary pion beam with respect to the chamber walls is  $1.5 \pm 0.40$ .

The events were distributed as follows over the number of recorded  $\gamma$ -quanta:  $\Lambda + \gamma = 118$ ,  $\Lambda + 2\gamma = 15$ ,  $\Lambda + 3\gamma = 1$  (altogether 134 events).

For these events the distributions over the effective masses  $M_{\Lambda\gamma}$  were calculated and plotted. The resulting distribution (Fig. 1) has a maximum in the mass range of the  $\Sigma^0$  hyperon and deviates somewhat from the background curve at an effective mass of 1300 – 1400 MeV. The second maximum may be interpreted as a contribution to the  $M_{\Lambda\gamma}$ -distribution of some known resonance, which decays into a strange particle and a  $\pi^0$  meson, where the  $\pi^0$  meson decays into two  $\gamma$  quanta. Due to the low  $\gamma$ -recording efficiency in the

chamber, in most cases only one  $\gamma$  quantum from the  $\pi^0$  decay was observed. Therefore, the influence of the known resonances  $Y^*_1$  (1385 MeV),  $Y^*_0$  (1405),  $Y^*_0$  (1520) and others will be exhibited in the  $M_{\Lambda\gamma}$ -distribution. However, calculation shows that the existence of these resonances leads to distributions which are shifted with respect to the maximum at 1300 – 1400 MeV, or to distributions which partly coincide with the above range, but have a larger width  $\Gamma$  (Fig. 2).

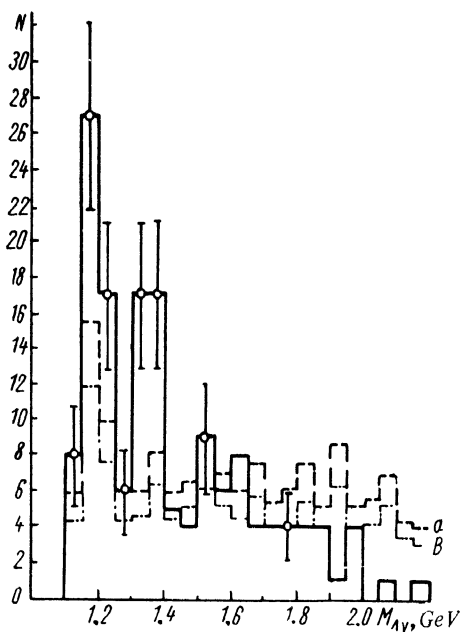


Fig. 1. Histogram of the effective-mass distribution. The background curves were calculated by the Monte Carlo method: *a* -- normalized to the total number of events; *b* -- to the background.

The experimentally obtained maximum is possibly due to a resonance which decays into  $\Lambda$  and  $\gamma$  [2]. If such a resonance exists, the  $\gamma$ -momentum spectrum should have a maximum at  $\sim 200$  MeV/c. However, according to Fig. 3 such a maximum does not exist at the above value. Better agreement with the experimental data is achieved when assuming a  $\Lambda\eta^0$ -resonance, the possibility of which was pointed out by B.L. Ioffe [3].

Analyzing the fast variation of the  $\eta^0$ -production cross section with the energy of the incoming  $K$  meson in the reaction  $K^-p \rightarrow \Lambda\eta^0$ , the author arrived at the conclusion that this may be due to a resonance in the  $\Lambda\eta^0$  system with a mass of 1680 MeV,  $\Gamma \lesssim 20$  MeV, and  $T=0$ . Assuming that such a resonance actually exists, the value of  $M_{\Lambda\gamma}$  at which this resonance begins to have an effect can be shown. The result of a calculation, similar to that made for known hyperon-pion resonances, is shown in Fig. 2. As can be seen, the position and width of the  $M_{\Lambda\gamma}$  maximum for the  $\Lambda\eta^0$  (1680) resonance satisfactorily agrees with the experimental value.

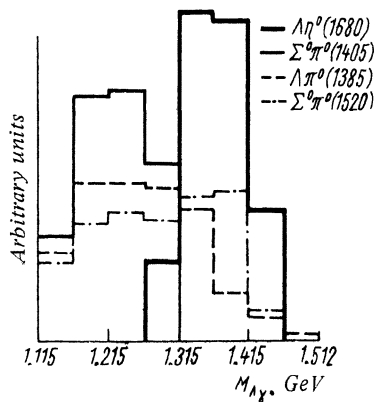


Fig. 2. Theoretical histograms for known resonances for the determination of their contribution to the combination of  $\Lambda$  and  $\gamma$ . The curves are normalized to the same area.

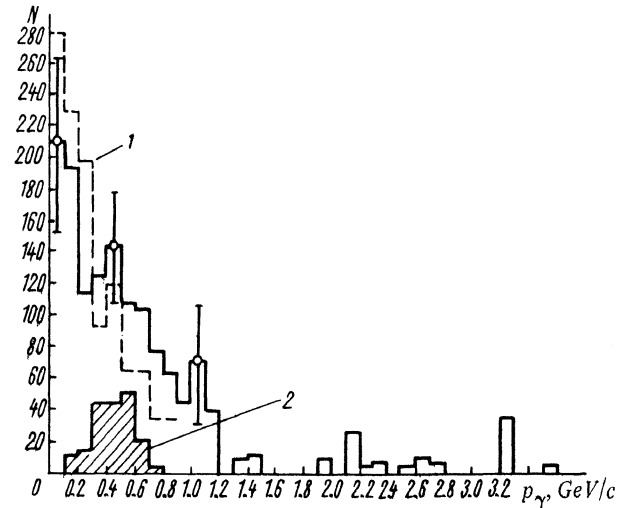


Fig. 3.  $\gamma$ -momentum distribution in the laboratory system: 1 –  $\gamma$ -momentum spectrum [3]; 2 – momentum spectrum of  $\gamma$ -quanta from the mass range of  $M_{\Lambda\gamma}$  (1300 – 1400 MeV).

The reverse problem can be solved: let us assume that the process  $Y_s^* \rightarrow \Lambda + \eta^0$  exists and that the creation of  $\Lambda$  and  $\eta^0$  particles in another way is suppressed. Then, knowing the experimental limits of the deviation in the  $M_{\Lambda\gamma}$  distribution,  $M_{\Lambda\eta^0}$  and the mass of  $\eta^0$  can be calculated. Assuming the limits 1300 and 1400 MeV for  $M_{\Lambda\gamma}$  for  $Y_s^* \rightarrow \Lambda + \eta^0$ , we obtain  $M_{\Lambda\eta^0} = 1660$  MeV and  $M_{\eta^0} = 495$  MeV. These are close to the expected values.

In support of the above interpretation of the peak at  $M_{\Lambda\gamma} \approx 1340$  MeV as a  $\Lambda\eta^0$  resonance may also be the distribution (see Fig. 3) of the  $\gamma$ -momenta taken from the mass range of  $M_{\Lambda\gamma}$  (1300 – 1400 MeV). The shape of the distribution and the position of the  $p_\gamma$  maximum satisfactorily agree with that expected from the decay of an  $\eta^0$  meson. The confidence limit of the deviation in the range from 1300 to 1400 MeV cannot be decisive in the choice of the interpretation of this deviation. Work on increasing the amount of statistical data is being continued at the present time.

#### REFERENCES

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