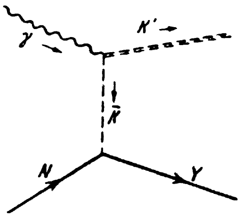

FIG. 2

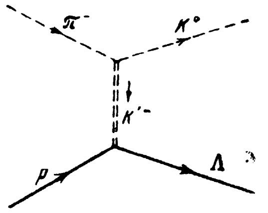

FIG. 3

a special investigation of the contribution due to a diagram of the type shown in Fig. 2, when not a vector but a pseudoscalar particle (respectively a K or π meson) is present in the intermediate state. The contribution of this diagram proved to be considerably less than the contribution explicitly isolated in Eq. (2) for the same unfavorable values of the coupling constants.† The coupling constant f was estimated from experimental data on the reaction $\pi^- + p \rightarrow \Lambda + K^0$ under the assumption that the diagram shown in Fig. 3 is responsible for this reaction. The coupling constant $f_{K'K\pi}$ was estimated on the basis of data concerning the width of the $K\pi$ resonance. A magnitude ~ 2 was obtained as the result for f^2. For this value of f^2 with $k = 4$BeV, $\theta = 0$ and the anomalous part of the magnetic moment equal to zero, the first term in Eq. (2) amounts to 10^{-31} cm^2/sr. For $\theta = 30°$ this term decreases by a factor of two. It is possible to use the standard method of separating out the pole part, which was developed (see, for example, [4]) for the analysis of nucleon-nucleon scattering data, for a determination of the product f^2g^2 from experimental data; the quantity B depends slightly on θ.

Thus, a measurement of unstable particle photoproduction cross sections in the region of small angles seems extremely desirable to us.

The authors express their gratitude to Professor M. A. Markov for his interest in the work.

*rot = curl.

†It is also necessary to note that the amplitude corresponding to this diagram does not interfere with the principal pole diagram.

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RADIATION OF MOLECULES UNDER RESONANT CONDITIONS

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WE report briefly the results of an investigation of the effects of radiation in the coherent field of a beam of molecules in a mixed energy state. A two-quantum system in a mixed state is described by the function

$$\psi = a\psi_1 + b\psi_2,$$

with $|a|^2 + |b|^2 = 1$. When a molecule beam in such a state enters a cavity tuned to the transition frequency $h\nu_{12} = E_1 - E_2$, it will continue to radiate [1,3] in spite of the fact that the number of molecules in upper and lower energy levels is the same. In the ordinary case the expression for $|a(t)|^2$ can be represented in the form [4]

$$|a(t)|^2 = \frac{(\mu E/h)^2 \sin^2 \{\pi t\,[(\nu - \nu_0)^2 + (\mu E/h)^2]^{1/2}\}}{(\nu - \nu_0)^2 + (\mu E/h)^2},$$

where μ is the dipole moment and E is the intensity of the resonant field of frequency ν, close to the frequency of the molecular transition $\nu_0 = \nu_{12}$.

A mixed quantum state can be obtained in an ammonia molecule beam at the output of the cavity of an ordinary maser. It is customary to assume that when saturation is reached in the output beam, i.e., when the population of both levels is the same and $N_2 - N_1 = 0$, the beam becomes inactive and can radiate spontaneously only incoherent oscillations. In the papers cited it was shown that when a molecule beam enters the second cavity, the molecules emit electromagnetic radiation at the frequency of the first cavity, regardless of the tuning of the second cavity. This phenomenon was called a "molecular bell" or "preliminary induction." [3,4]

To investigate the properties of such radiation, we constructed a maser comprising a NH_3-beam spectroscope with three cascaded cavities, the first of which was in the ordinary maser mode. The frequency ν_2 of the radiation in the second cavity was quite monochromatic (as in an ordinary maser) and coincides with the radiation frequency in the first cavity accurate to better than 10^{-12}.

The radiation power in the second and third cavities was investigated as a function of the settings of the first and second cavities, of the voltage on the sorting system, and of the pressure of the gaseous ammonia in the molecular beam source; the measurement setup was the same as employed by us earlier [5] in the investigation of the characteristics of ordinary masers. A complicated dependence of the radiation power in the second cavity on these parameters was observed. The power W_2 radiated in the second cavity goes through three minima as the frequency ν_1 of the first cavity is varied over a wide range, and the character of its variation depends on the voltage V on the sorting system and on the pressure p in the molecular beam source. These variations are plotted in Figs. 1 and 2. The value $V = V_k$ at which the radiation power in the second cavity drops to zero, $W_2 = W_2(V)_p = 0$, depends on the pressure of the ammonia in the beam source. This dependence is shown in Fig. 3.

When $W_2 = 0$, the molecule beam no longer radiates as it goes through the third cavity, and the radio spectroscope shows a strong absorption line.

It is quite interesting that at certain values of V and p the beam leaving the first cavity also absorbs energy even in the second cavity. In this case, as the beam travels along the cavity in the usual generation mode, the population of the energy levels is a periodic function of the time and depends on the number of active molecules in the beam.

As the first cavity is detuned by an amount $\Delta\nu_1 = \pm 4$ Mc, when the microwave field in the cavity decreases, beats are observed in the second cavity between the frequency set in the "molecular bell" by the first cavity and the natural frequency of the second cavity. The frequency of these beats is 3—4 kcs. Further detuning of the first cavity stops generation in the first cavity and the "molecular bell" disappears from the second cavity, leaving only the natural oscillations. More complete experimental and theoretical results will be published in the future.

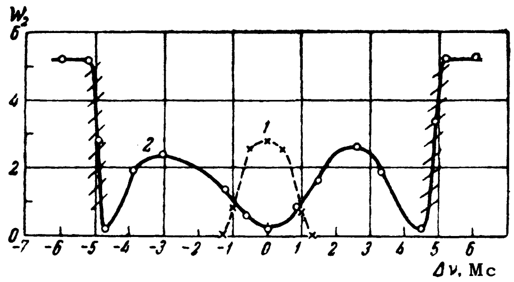

FIG. 1. Dependence of the radiation power W_2 in the second cavity as the detuning $\Delta\nu_1 = \nu_1 - \nu_{21}$ of the first cavity is varied, for two values of the sorting-system voltage: 1 – V = 4.5 kV, 2 – V = 8 kV.

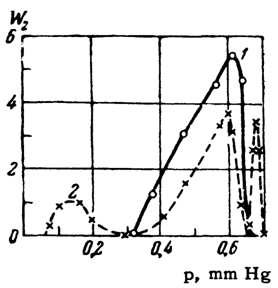

FIG. 2. Dependence of the power W_2 radiated in the second cavity on the voltage V on the sorting system and on the ammonia pressure p in the beam source: curve 1 – V = 4.5 kV, 2 – V = 8 kV

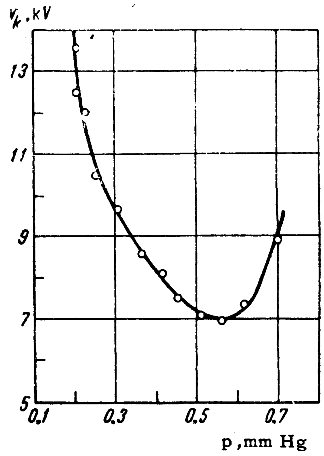

FIG. 3. Dependence of the voltage V_k, at which $W_2 = W_2(V) = 0$, on the pressure p in the molecular-beam source.

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CROSS SECTION FOR THE INTERACTION BETWEEN NEUTRONS AND NUCLEI AT 8.3 BeV

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THE total and inelastic cross sections for the interaction between neutrons of effective energy 8.3 BeV and nuclei of C, Al, Cu, Sn, and Pb were