1)The modulation coefficient m can amount to $\sim 10^{-4}$–10^{-5} if modern coherent light generators are used (see [7]).

2)Of course, if (5) can be satisfied at all.

3)We note that inasmuch as Q_1 and Q_2 are quite large in the optical band, self-excitation of the oscillations is possible also in the case when the mirrors are installed only in one of the directions.

*sh = sinh; ch = cosh.

[1] Bass, Franken, Hill, Peters, and Weinreich, Phys. Rev. Lett. **8**, 18 (1962).

[2] J. Giordamine, ibid. **8**, 19 (1962).

[3] Maker, Terhune, Nisenoff, and Savage, ibid. **8**, 21 (1962).

[4] H. Heffner and G. Wade, J. Appl. Phys. **29**, 1321 (1958).

[5] P. Tien, ibid. **29**, 1347 (1959).

[6] M. D. Karasev, Usp. Fiz. Nauk **69**, 217 (1959), Soviet Phys. Uspekhi **2**, 719 (1960).

[7] Franken, Hill, Peters, and Weinreich, Phys. Rev. Lett. **7**, 118 (1961).

Translated by J. G. Adashko
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POWER INCREASE IN A PULSED RUBY LASER BY MEANS OF MODULATION OF RESONATOR Q

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MODULATION of the Q of the resonator permits an increase in the power radiated by a quantum mechanical generator by the accumulation of active particles during the time the pump is in action, when the Q of the resonator has its minimum value. By means of a rapid increase in the resonator Q to its maximum value, an "emission" of particles results. The time of this "emission" is determined by the lesser of two times, the time of growth of Q or the time of establishment of vibrations in the resonator. Ideas of this kind have been discussed, in particular, by Hellwarth.[1]

We briefly describe below a generator in which the resonator Q is modulated by means of a rapidly rotating disk, and present some characteristics of such a generator. The basic plan of the generator is shown in Fig. 1. As can be seen from this figure, a decrease in the on-time of resonator Q is achieved by interrupting the emitted beam in the focus of the objectives 2, 2. Such an arrangement allows the simultaneous decrease in the number of the various modes that can be excited in the system. The on-time of maximum Q was 10^{-6} sec. In the experiments the power of a generator operating with constant Q was compared with the power of a generator in which the Q was modulated.

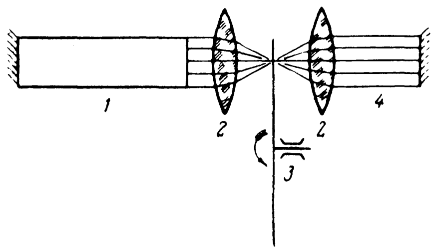

FIG. 1. 1 – ruby; 2 – objectives; 3 – rotating disk with aperture; 4 – external mirror.

In Figs. 2 and 3 are shown oscillograms of the radiation obtained in these two cases; the amplitude of the oscillograms in Fig. 3 was reduced by 2×10^3 times relative to Fig. 2 by means of neutral filters on the photomultipliers. The majority of the experiments were performed on crystals whose total energies were ~ 1 J. The maximum Q of the resonator was turned on from 0.3 to 0.5 μsec after the exciting lamp was turned on. The

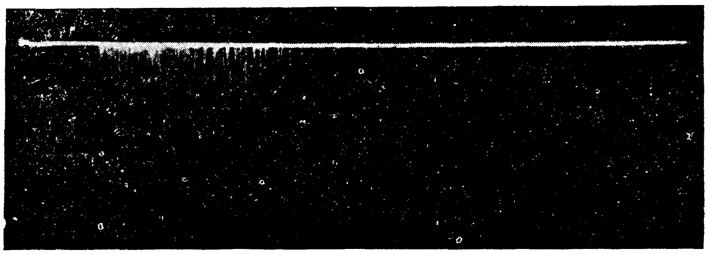

FIG. 2. Emission of an optical generator with constant Q. Length of scan – 1 μsec.

FIG. 3. Emission of an optical generator with modulated Q. Length of scan – 100 μsec. The second trace records the approximate position of the aperture at the moment of pulse generation.

power of the radiation was not changed significantly by this. During operation of the generator with Q-modulation the energy was emitted in the form of one or several peaks (not more than ten) of varying amplitude.

Such Q-modulation can be useful in the design of amplifiers, since the number of active particles in the upper level accumulated during the flash time is practically independent of the power level of the pump.

The authors express their sincere thanks to M. D. Galanin and A. M. Leontovich for their assistance in the work.

[1] R. W. Hellwarth, Advances in Quantum Electronics, edited by Jay R. Singer, Columbia University Press, 1961, p. 334.

Translated by L. M. Matarrese
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MEASUREMENT OF THE PROBABILITY FOR THE REACTION $\mu^- + He^3 \rightarrow H^3 + \nu$

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THE probability of the reaction

$$\mu^- + He^3 \rightarrow H^3 + \nu \qquad (1)$$

was measured in order to study the question of the muon-electron symmetry in interactions with nucleons.

We used a method which had been developed earlier.[1] A diffusion cloud chamber filled with He^3 gas at a pressure of 20 atm was exposed in a magnetic field of 6000 Oe to an extracted beam of 217-MeV/c pions from the synchrocyclotron at the Nuclear Problems Laboratory of the Joint Institute for Nuclear Research. The mesons were slowed down by a copper filter placed in front of the chamber.

The entire experimental material (about 10^5 pictures) was scanned twice. Since the stopping mesons could be identified with great reliability for a track length $L_0 \geq 20$ mm, we considered only such stopping particles. It was found that the scanning efficiency for stopping mesons was close to unity and was practically independent of the character of the events at the end of the track.

The absolute probability of capture can be determined from the well-known muon lifetime (2.21×10^{-6} sec) and the observed ratio of the number of capture events to the number of μ-e decays from the He^3 mesic-atom state. Since the triton produced in reaction (1) has a unique energy (1.897 MeV), the problem of identifying these reactions (triton stars) was reduced to the separation of a group of one-prong stars of corresponding range from the background due to other processes. We used the following two methods to determine the total number of events of type (1):

1. We considered the spectrum of the visible lengths of secondary particle tracks from all stars, except those which could not be triton stars because of the character of their ionization (Fig. 1).

2. We considered the range spectrum of secondary particles which were reliably found to come to rest (Fig. 2). In this case it is necessary to introduce an additional correction to take into account the number of triton stars with stopping H^3, but whose endings were of an uncertain nature.

Two peaks are clearly visible in both spectra. One peak falls within the ranges 2.0–2.6 mg/cm^2, corresponding to reaction (1), and another falls within the ranges 5.3–5.9 mg/cm^2, corresponding

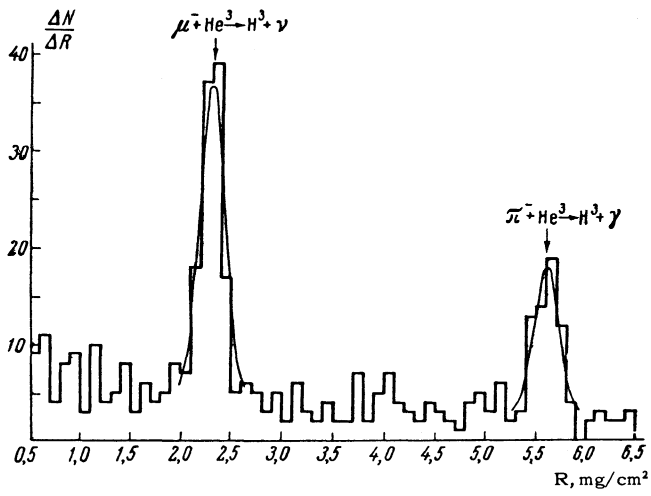

FIG. 1. Spectrum of visible track lengths of secondary particles for all stars produced by stopping mesons.