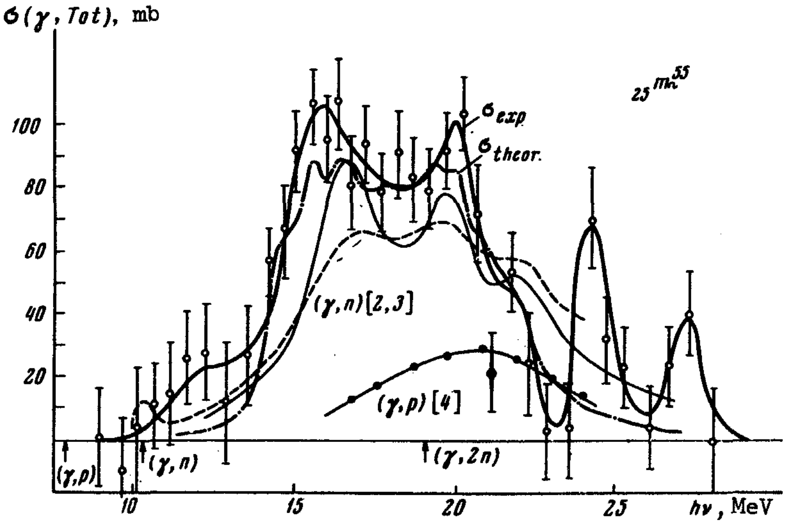


Cross section for the photoabsorption by Mn^{55} nuclei in the giant-resonance region.

The dashed line in the figure is the result of calculation performed by us, within the framework of the dynamic collective model, using a deformation parameter $\beta = 0.30$ ($E_{dip} = 18.1$ MeV, $E_q = 0.845$ MeV). The theoretical curve describes well the form of the main peak, predicting correctly its width (∿ 9 MeV) and its splitting into two maxima. Our calculation based on the dynamic collective model is valid only for even-even nuclei and therefore, strictly speaking, the presented curve describes the excitations of the nucleus Mn^{54}. As seen from the figure, the course of the cross section for $E_\gamma > 25$ MeV (resonances at 24.2 and 27.4 MeV) does not agree with the predictions of the dynamic collective theory.

The integral cross section in the 9 - 29 MeV range is equal to 816 ± 50 mb-MeV, which amounts to 71% of the classical dipole sum with exchange term 60 (NZ/A) (1 + 0.8x). The integral cross section $\sigma_0(\gamma, \text{Tot})$ coincides within the limits of errors with the sum of the cross sections of the partial (γ, n) and (γ, p) reactions.

[1] Alpha-, Beta- and Gamma - Ray Spectroscopy, Edited by Kai Siegbahn, North - Holland Publ. Comp. Amsterdam, 1965.

[2] P. A. Flournoy, R. S. Ticle, and W. D. Whitehead, Phys. Rev. 120, 1426 (1960).

[3] P. W. Parsons, Canad. Journ. of Phys. 37, 1344 (1959).

[4] K. Shoda, K. Abe, T. Ishizuka, N. Kawamura, M. Oyamada, and Baig - Nung Sung, J. Phys. Soc. Japan, 25, 664 (1968).

YAG:Nd^{3+} LASER WITH EMISSION SPECTRUM WIDTH LESS THAN 10^{-9} Å

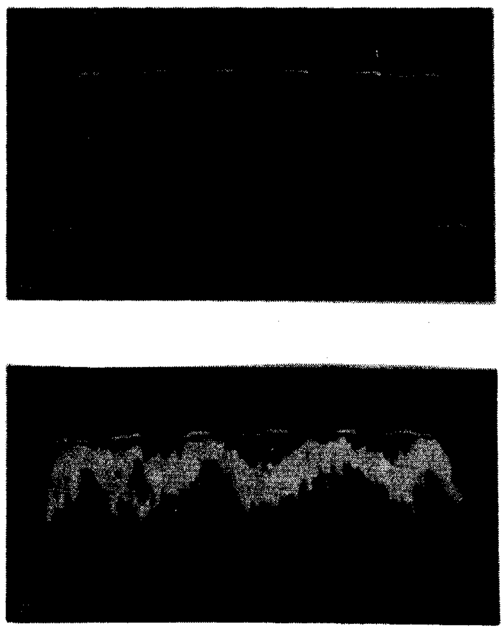
G. N. Vinokurov, N. M. Galaktionova, V. F. Egorova, and A. A. Mak

Submitted 1 September 1969
ZhETF Pis. Red. 10, No. 8, 367 - 369 (20 October 1969)

Until recently, the minimum emission spectrum width obtained in solid-state lasers was ∿ 10^{-4} Å (∿ 10^6 Hz) [1]. The production of highly monochromatic coherent radiation in solid-state lasers is limited both by the number of the excited modes and by the spiked character of the radiation of each mode. Whereas the separation of one mode in the generation entails no special difficulties (see, for example, [2]), the problem of the spiked radiation of a solid-state laser, which is among the fundamental problems of the physics of solid-state lasers, has not yet been satisfactorily solved. When the radiation has a spiked character, the mode width $\Delta\nu$, which represents the limiting width of the generation spectrum, is determined by the relation $\Delta\nu\Delta t \sim 1$ (where Δt is the spike duration), and ranges from 1 to 100 MHz, depending on the spike duration. We have obtained a spikeless generation in a single TEM_{00q} mode of a laser based on YAG:Nd^{3+}. The total width of the generation spectrum was less than 50 Hz ($\sim 10^{-9}$ A).

A crystal 3 mm in diameter and 50 mm long, with flat end faces, was placed in a resonator made up of flat dielectric-coated mirrors. The mirror tansmissions were 0.5 and 2%. The resonator length was 250 mm. The pump source was an incandescent iodine lamp fed with direct current, and the oscillations of the pump intensity did not exceed 0.5%. Much attention was paid to elimination of mechanical vibrations, principally connected with the system used to cool the crystal with running water.

The axial-mode selector was a plane-parallel uncoated glass plate 2.5 mm thick, placed in the resonator on the side of the semitransparent mirror at an angle $\sim 2°$ to the mirror. The separation of the TEM_{0c} mode was ensured by the chosen diameter and length of the resonator. We investigated the spatial, temporal, and spectral characteristics of the radiation, and in addition we registered the spectra of the high-frequency and low-frequency beats. The figure shows photographs of the oscillograms (S1-19 oscilloscope, exposure 1/30 sec) of the emission of the laser operating in the stationary and in the spiked modes, respectively. The mode composition of the radiation was monitored against the far-field and near-field pictures, and also against the emission spectrum investigated with the aid of a Fabry-Perot interferometer in conjunction with an electron-optical converter. Spikeless radiation was obtained both in the presence of either one or several axial modes, provided the pump was highly stabilized and there was no vibration of the resonator elements. In the case of the single-mode regime, the width of the radiation spectrum, measured by registering the "zero"



Laser emission oscillograms: a) stationary regime, b) spiked regime. Markers - 2 msec.

beats with a spectrum analyzer (ASChKh-1) was less than 50 Hz (10^{-9} Å). There were no beats in this case in the spectral range 50 - 200 MHz.

It should be noted that under stationary generation conditions, the selection of the axial modes is much more reliable than in the presence of spikes, and the single-mode radiation is highly stable. Thus, elimination of the spiked character of the radiation of solid-state lasers makes it possible to obtain an exceedingly narrow generation spectrum.

We regard the following spike-production mechanism as being the most probable: Thermal heating of the active medium during the optical pumping or any mechanical instability of the resonator element can lead to a change of the effective resonator shape. If the change of the resonator length is homogeneous over the cross section, the Doppler shift causes the radiation frequency in each mode to follow exactly the shifting resonator frequency. If the change of the optical length of the resonator is not homogeneous over the cross section, as is practically always the case if the temperature variation is inhomogeneous and mechanical deformations set in, diffraction spreading causes radiation with different frequencies corresponding to the Doppler shift at different different points of the resonator cross section to pass through each point of the resonator cross section. As shown by preliminary computer calculations, radiation nonmonochromaticity of this type leads to the spikes.

Thus, to eliminate the spikes of the radiation it is necessary to prevent nonstationary deformation of the resonator which is inhomogeneous over the cross section.

[1] A. A. Mak and B. M. Sedov, Zh. Tekh. Fiz. 38, 2119 (1968) [Sov. Phys.-Tech. Phys. 13, 1704 (1969)].
[2] A. L. Mikaelyan, L. N. Razumov, N. A. Sakharova, and Yu. T. Turkov, ZhETF Pis. Red. 5, 148 (1967) [JETP Lett. 5, 119 (1967)].
[3] N. M. Galaktionova, V. F. Egorova, and A. A. Mak, Opt. Spektrosk. 25, 305 (1968).

PHOTOCONDUCTIVITY OF p-CdSb IN THE MILLIMETER BAND

V. M. Afinogenov, G. I. Goncharenko, V. I. Trifonov, and V. Ya. Shevchenko
Institute of Radio Engineering and Electronics, USSR Academy of Sciences
Submitted 9 September 1969
ZhETF Pis. Red. 10, No. 8, 370 - 373 (20 October 1969)

When pure samples of p-CdSb ($N_A - N_D \sim 10^{15}$ cm^{-3} at 77° K) was exposed to radiation in the mm band ($\lambda \approx 4$ mm), an alternating voltage (response) of the same frequency as the modulation of the radiation incident on the sample was observed on the contacts used to apply the constant electric bias field. The absence of a response in p-CdSb at zero bias, and the linear variation of the response with increasing bias field (Fig. 1) in analogy with [1, 2], apparently signify that the observed effect is due to the change produced in the sample conductivity by the radiation, i.e., to the photoconductivity effect. Investigations of the field dependences of the Hall constant (R), the resistivity (ρ), and the Hall mobility ($R\sigma$) shows that these quantities (R, ρ, $R\sigma$) do not depend on the field in the range of fields corresponding to the region of linear variation of the response (ΔV). The response reaches saturation and then decreases in the region of fields in which carrier heating and impurity-center ionization sets in. Figure 2 shows the temperature dependences of ρ, R, and ΔV. The R(T) dependence has a singularity characteristic of a semiconductor with an impurity band. An