The radiation power of the 3C120 source, the distance to which is 100 mps, amounts to $\sim 2 \times 10^{47}$ erg/sec during the time of the flash, for γ quanta with energy $E_\gamma \geq 100$ MeV.

The authors are deeply grateful to Prof. N.L. Grigorov and to Prof. I.L. Rozental' for a discussion of the work and for useful remarks.

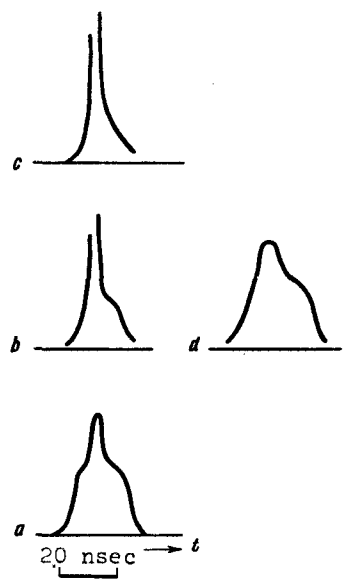
[1] K.I. Kellerman and I. Paclini Toth. Astrophys. J. Lett. 152, 169 (1968).
[2] I. Locke, B.H. Andrew, and W.I. Medd. Astrophys. J. Lett. 157, 81 (1969).
[3] I.S. Shklovskii, Preprint IKI, Pr-30, 1970; Astron. zh. 47, 742 (1970) [Sov. Astron. AJ 14, No. 4 (1971)].
[4] G.M. Frye, Jr., J.A. Staib, A.D. Zich, V.D. Hopper, W.R. Rawlinson, and J.A. Thomas, Nature, 223, 1320 (1969).
[5] C.E. Fichtel, D.A. Kniffen, and H.B. Ogelman, Astrophys. J. 158, 193 (1969).
[6] G.M. Frye, Jr. and C.P. Wang, Astrophys. J. 158, 925 (1969).
[7] G.G. Fazio, Nature 225, 905 (1970).

Q SWITCHING OF A RUBY LASER BY DYE VAPORS

V.P. Klochkov, V.L. Bogdanov, and B.S. Neporent
S.I. Vavilov State Optical Institute
Submitted 23 November 1970
ZhETF Pis. Red. 13, No. 1, 47 - 48 (5 January 1971)

The appreciable differences between the processes occurring after the absorption of a quantum of light in free molecules of complex organic compounds, compared with dissolved ones, differences established earlier by us in various investigations of the absorption and luminescence of vapors of organic substances [1], have induced us to experiment with the use of such vapors for Q-switching of a ruby laser.

Q-switching with vapor of phthalocyanine (H_2Pc) and phthalocyanine of copper (CuPc) was observed at vapor optical densities $D < 0.6$ in a cell 6 cm long at a temperature close to 500°C. At $D > 0.6$, the generation stops. The data presented below pertain to CuPc. An increase of the peak power and narrowing of the pulses are observed already at $D \sim 0.06$, and the comparatively narrow pulse is accompanied by spike-like generation that begins approximately 10 μsec later. With increasing D, the pulse power increases and its width decreases, reaching at $D \sim 0.2 - 0.4$ the values obtained usually when the Q-switching is produced by solutions ($\Delta t \sim 20$ nsec). Further increase of D leads to an appreciable change in the pulse shape. A narrow peak (Fig. a) with duration $\Delta t < 5$ nsec (the resolution limit of the apparatus) appears against the background of a "broad" pulse. When the optimal value of D is approached, the slope of the leading front increases and a pulse of the type shown in Fig. b is produced. At the optimal optical density, which is close to the critical $D \sim 0.6$, a narrow pulse is observed, without the broad pedestal (Fig. c). The subsequent spike-like generation is either missing or weak (1 - 3 spikes are observed). The energy of the obtained pulses amounted to 1 - 3 J and was approximately equal to the energy of the free generation. The power developed in the pulse was $\sim 10^{18} - 10^{19}$ W,



correspondingly. The beam divergence was less than 10', and the distribution of the intensity over its cross section was more uniform than in the case of Q-switching with solutions.

The observed features of Q-switching with vapors of phthalocyanines can be attributed to double passive modulation.

The vapor is first bleached by the mechanism characteristic of passive shutters based on dye solutions. After bleaching of the vapor, the field density in the resonator increases more rapidly and reaches larger values than in the case of Q-switching by solutions, owing to the high homogeneity of the vapor. Indeed, introduction into the resonator of a cell with pure carbon tetrachloride greatly decreases the growth rate of the pulse (Fig. d) and its amplitude. In a light-absorbing solution, the perturbing action of the liquid medium, which is connected with the appearance of optical inhomogeneity, will undoubtedly be even larger.

At high field densities, two- and multiphoton stepwise excitation causes intense decomposition and ionization of the medium. Absorption of light by short-lived products of the intermediate stages of the complicated photochemical process leads to a rapid closing of the shutter. The results of the rapid Q-switching at high density of photons in the resonator is a sharp increase of the conversion coefficient of the energy and power of the pulse, as shown by Vuylsteke [2], although the parameters of our scheme greatly differed from those of the scheme considered in [2].

In conclusion we note that the decomposition of the medium does not prevent the repeated utilization of the phthalocyanine-vapor shutter, since the low-volatility decomposition products settle only on the side walls. We have obtained hundreds of pulses without cleaning the cell.

[1] B.S. Neporent, in the collection "Molekulyarnaya fotonika" (Molecular Photonics), Leningrad, 1970, p. 18.
[2] A.A. Vuylsteke, J. Appl. Phys. 34, 1615 (1963).

TRANSVERSE SOUND IN LIQUIDS

A.A. Berdyev and I.B. Lezhnev
Physico-technical Institute of the Turkmenian Academy of Sciences
Submitted 1 December 1970
ZhETF Pis. Red. 13, No. 1, 49 - 51 (5 January 1971)

The fine structure of the Rayleigh-line wing, first observed in [1], was attributed to the modulation of the light by transverse thermal waves, a broad spectrum of which exists in liquids. Such a point of view was subsequently confirmed by optical experiments both with variation of the scattering angle [2, 3] and by experiments using lasers at different frequencies [4, 5]. The gist of these transverse phonons, the lifetimes of which in liquids is exceedingly short, lies in their collective associated motion, which embraces hundreds, and in some liquids also thousands of molecules. Such investigations, made for a number of low-viscosity objects [6], are of fundamental interest to the study of the structure of liquids. The present investigation, suggested by I.L. Fabelinskii, is the first attempt to study the physics of these phenomena by acoustic methods with artificial generation of transverse sound.

The experimental setup for our measurements employs a standard pulsed circuit [7 - 9] of the impedance type. The acoustic channel constitutes a flow-through coaxial resonator, in which a quartz or lithium niobate crystal of cylindrical shape with plane-parallel ends is placed at the maximum of its