fission thresholds [8], the α-particle binding energies from [9], and the relation for the level-density parameter $a = A/8$, which was also used to calculate other values of J_{eff}^{-1} shown in Fig. 1. The errors shown in Fig. 1 for J_{eff}^{-1} include only those incurred in the determination of p. The deviations of the points for Re from the calculated values may be due to a deviation of the parameter a from the employed smooth dependence [6].

The data obtained in the present investigation on the effective moment of inertia also confirm the presence of a maximum in accordance with the consequences of the liquid-drop model [4]. Its position agrees with a value $(Z^2/A)_{\text{crit}} = 45 \pm 1$.

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PASSIVE Q-SWITCHING IN SOLID-STATE LASERS, BASED ON STIMULATED MANDEL'SHTAM-BRILLOUIN SCATTERING OF LIGHT

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The generation of single pulses of coherent laser emission with an instantaneous power exceeding 1 MW, based on Q-switching, presupposes the maximum speed of transition (< 20 nsec) from the initial high-loss conditions in the system to low-loss conditions at the instant of time for which the pump ensures maximum gain in the active element.

The phenomenon of stimulated Mandel'shtam-Brillouin scattering (SMBS) is characterized by a number of parameters which permit its use for passive Q-switching of a laser resonator:

1. The electrostriction pressure waves - acoustic phonons - which are produced and amplified effectively by the field of the light waves, satisfy the condition $\bar{q} = \bar{k}_{\text{exc}} - \bar{k}_{\text{sc}}$, where $\bar{q}$, $\bar{k}_{\text{exc}}$, and $\bar{k}_{\text{sc}}$ are respectively the wave vectors of the phonon and of the exciting and scattered photons [1].

2. SMBS is a process having a sharp threshold dependence.

3. The magnitude of the Stokes shift for the components of the scattered light is determined by the velocity of the hypersound in the medium, and amounts to approximately 0.2 cm^{-1} for most liquid media in the optical band [1], i.e., the corresponding component lies within the limits of the amplification-line half-width of solid-state lasers even in the case of multiple scattering.

4. The polarization of the exciting and scattered light is the same [1].

5. In SMBS, the coefficient of conversion of the energy of the exciting light into the scattered Stokes component approaches unity when the volume in which the conversion takes place is increased [2].

Thus, Q switching of the exciting laser takes place to a greater or lesser degree in almost all experiments aimed at the investigation of SMBS. However, in an experimental optical-system geometry such as used, for example, in [3], the greater part of the generated radiation is localized inside the resultant resonator, in which the role of the front mirror is played by the phonon generator.

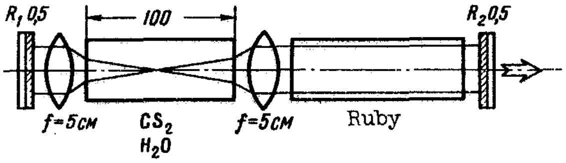

Fig. 1. Optical scheme of laser with Q-switching based on the SMBS phenomenon

Figure 1 shows the diagram of a laser with SMBS Q-switching used in our experiments. Measurement of the instantaneous power of the flashes of a free-running ruby laser (120 mm ruby, two IFP-200 lamps, cylindrical illuminator, $C = 70\ \mu F$, $L = 25\ \mu H$), performed with the aid of an FEK-09 coaxial photocell with known absolute spectral characteristic, shows that when the pump power is changed from P_{thr} to 1.36 P_{thr}, the flash power increases by almost two orders of magnitude (from 0.6 to 70 kW). This feature of the nonstationary emission regime of a laser with a confocal lens system that does not distort the resonator makes it possible to reach the SMBS threshold in a number of liquids. Figure 2 shows the energy and power characteristics of a ruby laser with an SMBS Q-switch using CS_2. The initial resonator loss was reduced by increasing the reflection coefficients of the mirrors (R_1 and R_2). The temporal variation of the radiation under conditions below threshold was usual; the emission spectrum with line width $\sim$0.3 cm^{-1} is shown in Fig. 3a. Satisfaction of the threshold conditions for the SMBS process is accompanied by generation of a monopulse (1 or 2 cm, Figs. 3c and 3d) with a power $\sim$2.2 MW and with a spectrum as shown in Fig. 3b. Simultaneously with satisfaction of the threshold conditions for SMBS, the threshold conditions for the generation of stimulated Raman scattering (SRS) are satisfied. The spectrum of the monopulse therefore

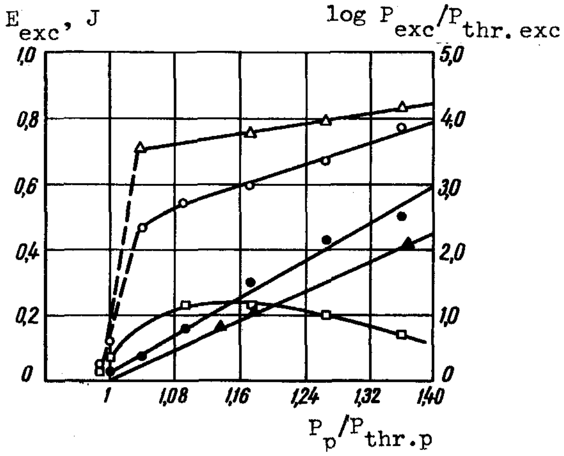

Fig. 2. Energy and power characteristics of ruby laser and SMBS modulator with CS_2: Δ - output power in the presence of a Q-switch on the R_2 side; o - output energy in the presence of a Q-switch on the R_2 side; □ - output energy in the presence of a Q-switch on the R_1 side; ● - output energy in the absence of a Q-switch (on one side only); ▲ - output power of flashes in the free-running regime.

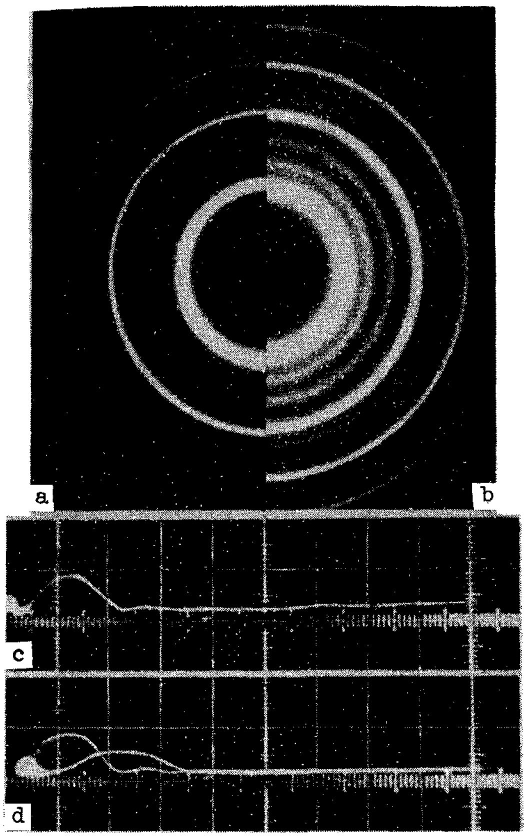

Fig. 3. Spectra and time variation of the emission; a - free running regime, line width ∿0.3 cm^{-1}, deispersion region 1.66 cm^{-1}; b - monopulse, line width 0.4 cm^{-1}, dispersion region 1.66 cm^{-1}; c, d - monopulse, scale 20 nsec/cm, S-1-10 oscilloscope.

contains, besides the multimode line emission (line width ∿0.4 cm^{-1}; it is seen that the broadening takes place in the long-wave region) also four Stokes components of the 655 cm^{-1} oscillation, whose energy amounts to ∿5% of the total energy of the monopulse (the less intense rings in Fig. 3b). With further increase of the pump, the monopulse power increases monotonically and reaches 16.4 MW at $P = 1.36P_{thr}$.

The variation of the remaining parameter with pump power, and a comparison with and without the SMBS Q-switch, are clear from Fig. 2.

It is obvious that from the point of view of spectral purity and maximum attainable power in the monopulse, media with Raman lines offer no promise for use as SMBS Q-switches. An investigation of an SMBS Q-switch with H_2O in our system showed a monopulse generation threshold of $1.4P_{thr}$, a monopulse power ∿50 MW, and a spectrum containing no additional components. A Q-switching effect was obtained under analogous conditions with an Nd^{3+}-glass rod.

The investigated method of Q-switching is thus apparently one of the most promising ones, although it is not free of the shortcoming connected with the inhomogeneity of the beam energy over the cross section.

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