of the 5P atomic states. Apparently the cascade population 6S → 5P of the 5P levels occurs with the aid of two fields that differ in frequency by an amount on the order of ε_1. This should lead to an effect analogous to phase modulation, which is characterized by a broad and symmetrical spectrum.

In spite of the few unclear aspects, it can be regarded as established that the observed effects are connected with the splitting of the atomic levels in the external field.

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FORMATION OF POWERFUL NANOSECOND PULSES WITH THE AID OF MANDEL'SHTAM-BRILLOUIN SCATTERING AND STIMULATED RAMAN SCATTERING

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We observed self-excitation and the time evolution of stimulated Mandel'shtam-Brillouin scattering (SMBS) in compressed nitrogen gas in a cell placed in a ruby-laser cavity (Fig. 1). Powerful pulses (~100 MW) were then simultaneously generated at two wavelengths, λ = 6943 Å (SMBS) and λ_1 = 8280 Å (first Stokes component of SRS in nitrogen).

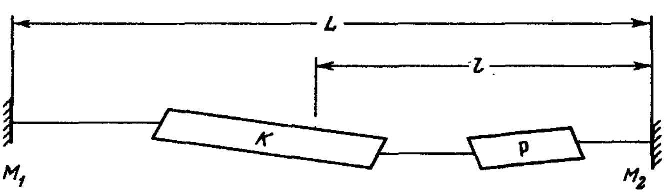

Fig. 1. Block diagram of setup: M_1 and M_2 - mirrors with reflection coefficients R_1 (99% and 12% at 6943 and 8280 Å, respectively) and R_2 (60% and 97% at 6943 and 8280 Å), C - cell 1 m long with nitrogen compressed to 500 atm, R - ruby 23 cm long and 1.5 cm in diameter, L = 4 + 13.5 m, ℓ = 2.5 m.

The time evolution of the process is shown in Fig. 2. Generation is first produced at mirrors M_1 and M_2 (Fig. 1). A microsecond pulse is produced, having a regular structure with period 2L/c (Fig. 2a). Its power is ~10 kW and the line width is < 0.01 cm^{-1}. The radiation passing through the cell with the nitrogen is partly reflected as a result of the Mandel'shtam-Brillouin scattering and goes over into its first Stokes component. This leads to the appearance of additional spikes (Fig. 2b) together with regular pulsations. The maxima of the additional

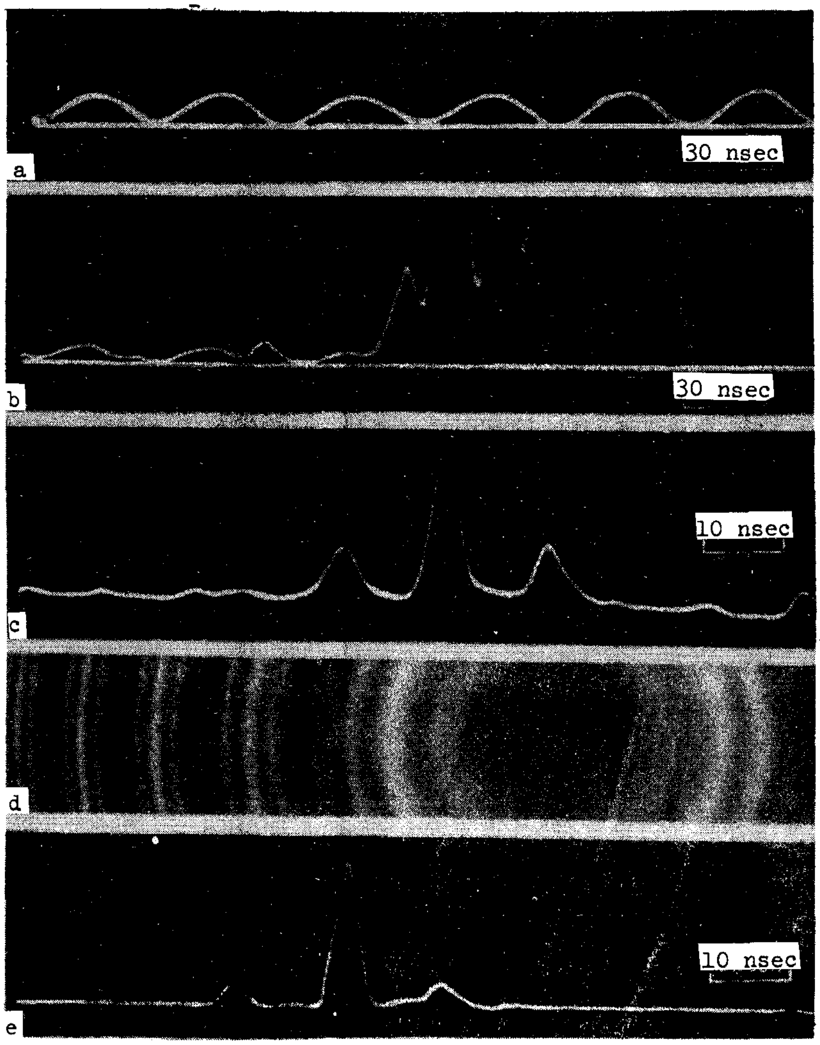

Fig. 2. Oscillograms of formation of nanosecond pulses: a - pulse structure in the free-running regime, b - self excitation of SMBS, c - pulse structure at wavelength 6943 Å, d - emission spectrum in the 6943 Å region, e - pulse at wavelength 8280 Å. The resonator length is 7.5 m, the pump energy ∿2.7 kJ, the time resolution of the apparatus ∿1.5 nsec, and the distance between the Fabry-Perot etalon mirrors is 2 cm.

spikes were shifted in time relative to the maxima of the regular pulsations by $2\ell/c$. The fraction of the light reflected by the nitrogen increases with increasing intensity of the first Stokes component of the SMBS; this is equivalent to the action of a mirror with an increasing reflection coefficient. The role of such a mirror becomes subsequently decisive, and the lasing develops in the resonator made up by this mirror and the mirror M_2. As a result, a powerful pulse of light of energy 0.3J and duration ∿4 nsec appears at the output of the generator behind the mirror M_2 (Fig. 2c). The emission spectrum (Fig. 2d) reveals several lines, the distance between which equals the Brillouin shift in nitrogen (0.06 cm^{-1}),

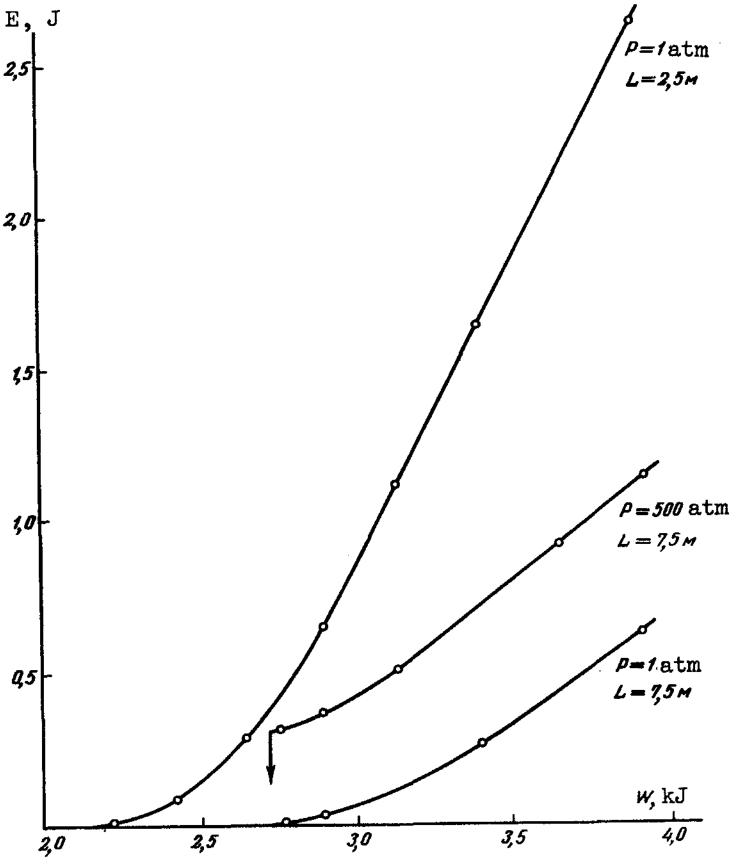

Fig. 3. Emission energy in various generator regimes vs. the pump energy (W). E - total emission energy at λ = 6943 Å and λ_1 = 8280 Å, P - nitrogen pressure, L - resonator length.

and whose intensities correspond to the time distribution of the radiation energy (Fig. 2c).

During the course of the generation, the light intensity in the resonator can exceed the threshold for the stimulated Raman scattering in the nitrogen (about 10 MW/cm^2 at a nitrogen pressure 500 atm and a cell length 1 m). As a result, a light pulse with wavelength λ_1 = 8280 Å with energy up to 0.2 J and duration ∿3 nsec appears behind the mirror M_1 (Fig. 2e).

With increasing pump energy, the entire process described above repeats. Several powerful nanosecond pulses are thus produced, having the same form as in Figs. 2c and e.

The energy characteristics of the laser are shown in Fig. 3. It should be noted that the laser emits in the form of nanosecond pulses up to 70% of the free-generation energy (in the latter case the mirror M_1 is located in the position of the cell with the nigrogen).

SMBS was previously obtained by using high-intensity light fluxes. This was achieved either by Q-switching the laser with an optical shutter [1] or by focusing the radiation, as was done for example in [2], where SMBS in CS_2 was used for Q-switching. In the scheme described in the present paper there is neither focusing nor Q-switching, making it possible to trace the entire development of the SMBS, and also to avoid certain undesirable phenomena (heating and breakdown at the focus [3], self-focusing, etc.) The results of this work show that SMBS can be observed at very low intensities of the exciting radiation.

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