sets in at the wavelength λ_ℓ corresponding to the higher-Q common modes of the pair of coupled resonators. Therefore the generation threshold $i^*_{\ell.thr}$ turns out to be smaller than the threshold value of the current for the long diode, and the radiation shifts twoards the longer wavelengths.

Emission at the common modes, becoming amplified in the short diode, reduces the population inversion for the levels corresponding to λ_s, as a result of which the radiation intensity at λ_s decreases, i.e., it becomes hindered. Radiation at the wavelength λ_s is absorbed as it passes through the long diode, the absorption coefficient decreasing with increasing current i_ℓ up to the instant of occurrence of generation at the common modes. With further increase in the current i_ℓ, the absorption coefficient (which can become negative) remains unchanged, but owing to the hindrance in the short diode, the radiation at the wavelength λ_s observed from the side of the long diode, becomes attenuated.

When the current through the short diode is sufficiently large, and the radiation intensity at λ_s in the long diode exceeds the emission at the common modes, the radiation at the larger wavelength becomes attenuated as a result of the population-inversion decrease connected with the intensified radiation at λ_s. This leads to the appearance of maxima on the plots of Figs. 1a and 1b.

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ON THE COMPLEX LINE STRUCTURE IN THE SPECTRA OF STIMULATED RAMAN SCATTERING OF LIGHT

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We observed a unique splitting of the lines into several components in an investigation of the spectra of stimulated Raman scattering in the region of the first Stokes component. This phenomenon is manifest particularly clearly at a small excess of excitation-radiation power over the threshold value. The splitting has an irregular character: the number of components changes from 1 or 2 to 5 or 6, and the distance between the outermost components changes from 1 - 2 to 10 - 12 cm^{-1}. The number of components and the distance between them decrease with increasing power of the exciting radiation, leaving only a single sharp line when the excitation exceeds the threshold by a factor 2 - 4.

This splitting was observed in several liquids, for example styrene, isoprene, and pentadiene-1,3, and was investigated in detail in benzene and nitrobenzene, with a detailed study of the first Stokes line. The investigations were carried out with the apparatus described in [1,2].

The exciting radiation from a ruby laser was focused inside a cuvette containing the scattering substance by a lens of 24 cm focal distance. The power of the exciting radiation was attenuated to the necessary value with a stack of glass plates mounted directly behind the cavity mirror. The spectra were photographed with a diffraction-grating spectrograph of approximately 13 Å/mm dispersion. Samples of the obtained spectra are shown in Fig. 1.

Fig. 1. Samples of spectra

Special experiments have shown that the phenomenon does not change essentially when the incident and scattering light beams are diaphragmed, or when the mutual placement of the ruby, cuvette with investigated substance, and spectrograph is changed. The phenomenon changes essentially in the same manner when the ruby pump power is decreased as when the exciting radiation is attenuated with glass plates. These and other control experiments give grounds for assuming that the observed splitting of the lines is not connected with the features of the employed apparatus or the operating mode of the laser. At the same time, it must be noted that such splitting was never described in the literature before. Stoicheff [3] indicates small line splitting, with separation on the order of 0.2 cm^{-1}, connected with the complex structure of the exciting ruby line. Stoicheff and Jones [4] indicate that some of the stimulated Raman lines become smeared out, and that their background has a complicated structure. This remark, however, does not pertain to the first Stokes component, the sharpness of which is emphasized in [4].

The line splitting observed by us can seemingly be attributed to the fact that in experiments similar to ours the Raman scattering is produced by molecules which move with large velocity. Let the molecule move with velocity $\underline{v}$ at an angle θ to the direction of the incident beam and an angle θ' to the direction of the scattered beam (Fig. 2). In a coordinate system connected with the scattering molecule, the frequency of the Raman line ω_R is connected with

the frequency ω_{exc} of the exciting line and the vibrational frequency Ω of the molecule by the formula

$$\omega_R = \omega_{exc} - \Omega \qquad (1)$$

If ω_{0R} and ω_{0exc} are respectively the frequencies of the exciting and Raman lines in the stationary system, then (see, for example, [5])

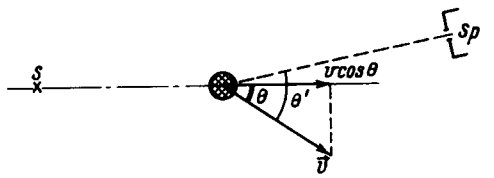

Fig. 2. Schematic diagram of combination scattering by a moving molecule: S - light source, v - velocity of scattering molecule, Sp - spectrograph

$$\omega_{exc} = \omega_{0exc}\frac{\sqrt{1 - (v^2/c^2)}}{1 + (v/c)\cos\theta} \approx \omega_{0exc}[1 - (v/c)\cos\theta] \qquad (2)$$

$$\omega_{0R} = \omega_R\frac{\sqrt{1 - (v^2/c^2)}}{1 - (v/c)\cos\theta'} \approx \frac{\omega_R}{1 - (v/c)\cos\theta'} \qquad (3)$$

In our case $\cos\theta \approx \cos\theta'$. Substituting (2) and (3) in (1), we obtain when $\theta \neq \pi/2$

$$(\Delta\Omega)/\Omega = (v/c)\cos\theta \qquad (4)$$

The presence of several components of the scattered line can be explained by assuming that at relatively low excitation power the formation of the "spark" in the scattering liquid is accompanied by the appearance of streams of molecules in several directions. With increasing laser-beam power, these directions come closer and closer to the plane perpendicular to the beam, and accordingly there remains only one component, for which $\cos\theta \approx 0$. The transverse Doppler effect gives only a small line shift, which we could not register with our apparatus.

Substituting in (4) the value of the splitting obtained by us, we obtain approximately $v \approx 10^7 - 10^8$ cm/sec. It was found in [6] that the ion velocity in a spark produced in the focus of a laser beam in a gas is of the same order. Such high molecule velocities are unexpected for liquids.

It must be also noted that a calculation of the energy released in the scattering liquid when the exciting radiation passes through it shows that such velocities can be possessed only by a very small number of molecules (on the order of 10^{13}).

Thus, in spite of the fact that the foregoing explanation makes it possible to interpret the observed splitting qualitatively, this interpretation cannot be regarded as final at all. Allowance for the peculiarities of Raman scattering of light at high excitation powers may lead to a different explanation.

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VARIATION OF LOW-FREQUENCY COMPONENT OF THE ELECTRIC-RESISTANCE OSCILLATIONS OF ZINC IN A MAGNETIC FIELD AT PRESSURE 16,000 kg/cm^2

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In [1] there was observed a strong influence of pressure on the frequency of the lowest-frequency quantum oscillations of the electric resistance of zinc in a transverse magnetic field. At a pressure of 8100 kg/cm^2 (maximum pressure developed at helium temperatures by the bomb described in [2]) the period of the oscillations of $\Delta(1/H)$ for $\underset{\sim}{H}\parallel[0001]$ and for current flowing through the sample in a direction lying in the (0001) plane was 2.1×10^{-5} Oe^{-1}, compared with 6.3×10^{-5} Oe^{-1} without pressure.

In fields stronger than 2500 Oe these oscillations are due, according to the latest data [3,4], to magnetic breakdown of the energy gap between the needle-like electronic part of the Fermi surface of the zinc, located along the side edge of the third Brillouin zone, and the hole surface of the second zone, called the "monster." The value of the gap includes the differences of the energies of the higher populated Landau level of each zone and the Fermi energy, which are periodic in the magnetic field. In the given particular case, owing to the fact that the effective mass for the needle-like part of the surface is approximately 100 times smaller than the mass for the "monster" [5], the periodicity is determined entirely by the value of the extremal section S_m of the needle-like surface, parallel to the (0001) plane. The periodicity of the energy gap in the magnetic field leads to periodicity of the electric resistivity.

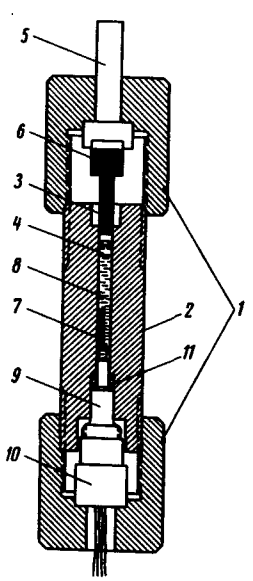

Fig. 1. Bomb

We have produced a new bomb (see Fig. 1), which makes it possible to develop hydrostatic pressure up to 18,000 kg/cm^2 at helium temperatures. Using this bomb, we traced the variation of the period of the oscillation in question to higher pressures.

We can note two important features of this bomb: a) the bomb container is self-sealing, b) the piston and the bearing are made of solid nonmagnetic microlite ceramic and nonmagnetic material. The maximum bomb diameter is 48 mm, the diameter of the working channel is 6.5 mm. The construction of the bomb is clear from Fig. 1, where 1 - locking nuts, 2 - bomb container, 3 - microlite piston with beryllium-bronze jacket, 4 - anvil and gasket, 5 - ram to