"spike" of microwave radiation along the pulse, so that the value of the current J at the instant of appearance of the "spike" remains practically constant, while the field changes noticeably.

The dependences of the radiation frequency f on the indicated parameters are fully regular and are well reproducible. The frequency of the coherent oscillations decreases in most cases with increasing interval Δt, and can either increase or decrease with increasing current. The slope of the f(J) curve can vary with H, changing from negative to positive with increasing H (Fig. 2).

The f(H) dependence can also be either increasing or decreasing (Fig. 3). The rate at which the frequency changes can vary over a wide range, reaching 700 MHz/mA and 1 MHz/Oe. The coherent radiation is critical to the orientation of the sample in the transverse magnetic field, and is observed as a rule in narrow angle intervals ($\Delta\alpha \approx 10 - 15°$) near the largest values of the magnetoresistance. The $f(\alpha)$ dependence for H = const (Fig. 3) is determined by the variation of the H component normal to the broad face of the sample with changing α.

The mechanism of the described phenomena is not yet clear. It can be supposed that it is connected with the instability of the magnetoactive electron-hole plasma produced near one of the contacts as a result of hole injection or impact ionization. The time of establishment of the stationary crystal resistance is 0.3 - 1.5 μsec (see Fig. 1a) and is apparently determined by the rate of filling of the near-contact section, which has an increased resistance, with plasma. The plasma concentration in this section may greatly exceed the electron concentration ($n_0 = 10^{13}$ cm^{-3}) in the volume of the crystal, and can reach values $p \approx n \geq 3 \times 10^{15}$ cm^{-3}, which are sufficient to produce two-stream instability in InSb [4]. The theory developed for this case in [4], however, does not explain the experimental dependences even qualitatively. The question of the nature of coherent radiation from InSb calls therefore for further study.

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FINE STRUCTURE OF RAYLEIGH LINE IN SAPPHIRE CRYSTAL

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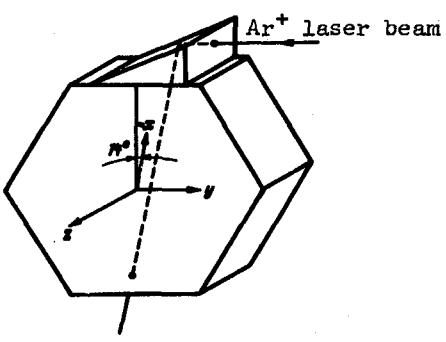
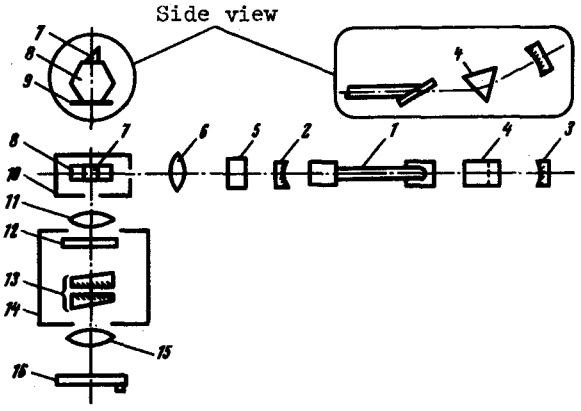
We present here results of an investigation of the fine structure of the Rayleigh scattering line in a synthetic sapphire crystal.

The scattering excitation source was the 4880 Å line of the Ar^+ laser whose construction was described in [1]. The investigated sample of sapphire crystal of high optical quality[1)] was cut, as shown in Fig. 1, in the form of a hexagonal prism. The optical axis of the crystal

[1)] The crystal was grown at the Crystallography Institute and kindly placed by Kh. S. Bagdasarov at I. L. Fabelinskii's disposal. The authors are grateful to Kh. S. Bagdasarov for the opportunity of working with a first-class crystal.





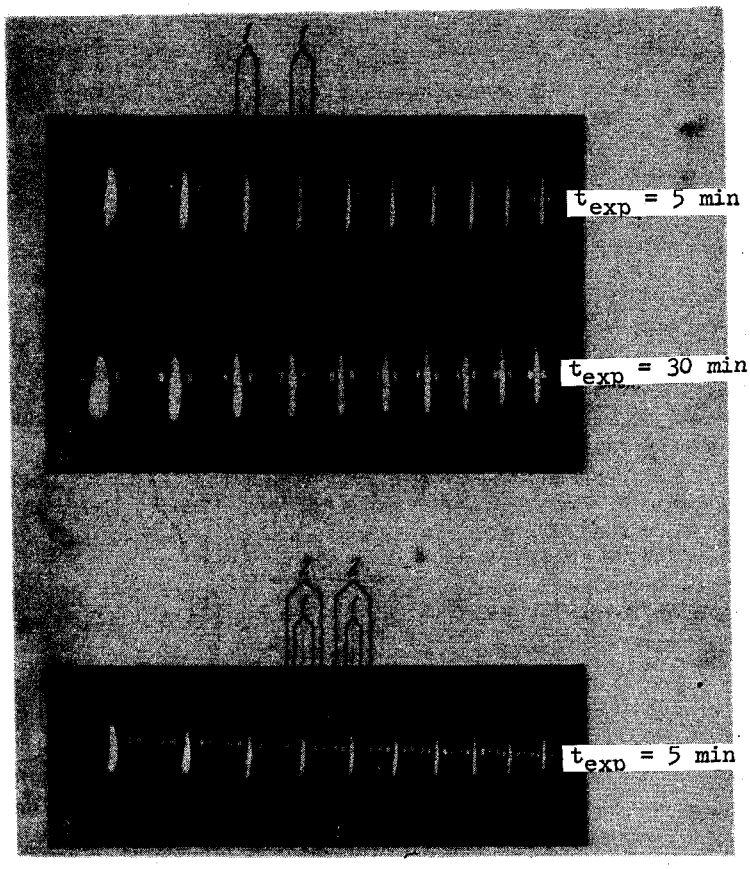


Fig. 1. Orientation of principal axes of sapphire crystal relative to the incident and scattered light. The exciting light is directed along the x axis and the scattered light is observed along the z axis.

Fig. 2. Experimental setup: 1 - gas-discharge tube, 2, 3 - dielectric mirrors, 4 - Brewster prism ensuring generation at 4880 Å, 5 - quartz plate, 6 - lens with f_1 = 208 mm to focus the radiation into the crystal, 7 - rotating prism, 8 - sapphire crystal, 9 - plate of black glass, 10 - light-tight black box, 11 - collimator lens, f_2 = 300 mm, 12 - SZS-3 light filter, 13 - Fabry-perot etalon 1 mm thick, 14 - thermostat, 15- camera lens, f_3 = 270 mm, 16 - cassette.

Fig. 3. Spectrograms of scattered light: a - vector E of exciting light perpendicular to scattering plane; b - vector E parallel to scattering plane. The arrows under No. 1 indicate "transverse" MB components, and under No. 2 "longitudinal" ones.

coincided with the z axis. The scattered light was observed along this axis. The exciting light was directed along the x axis (crystallographic direction $11\bar{2}0$), which made an angle of 14° with the normal to the entrance face of the crystal, using a glass prism.

The experimental setup is shown in Fig. 2. The radiation from a 0.5 W Ar^+ laser (λ = 4880 Å) was focused by lens f_1 into the sapphire crystal. The Rayleigh-scattering spectrum was investigated with the aid of a Fabry-Perot etalon working in a parallel beam of rays, and was

photographed.

The vector $\vec{E}$ of the exciting light was either perpendicular to the scattering plane (xz) or parallel to it. The plane of polarization was rotated 90° with the aid of a quartz plate 8.7 mm. thick.

To eliminate imperfections of the surface polish and to reduce the parasitic light to a minimum, and immersion liquid (glycerine) was used. To eliminate the red luminescence light of the crystal, a yellow filter SZS-3 was placed ahead of the Fabry-Perot etalon.

The obtained spectrograms are shown in Figs. 3a and 3b. The vector $\vec{E}$ of the exciting radiation was perpendicular to the scattering in the case of 3a, and parallel in the case of 3b. In the former case (3a) we actually observed only the Mandel'shtam-Brillouin components corresponding to scattering by the quasi-transverse hypersonic wave ("transverse"MB components). The components corresponding to scattering by the quasi-longitudinal sound wave ("longitudinal" MB components) have a negligibly low intensity. In the latter case (3b) both"transverse" MB components (intensity I_T) and "longitudinal" ones (I_L) are observed. The intensities of these components are close to each other and their measurement by ordinary photographic photometry yields $I_L/I_T = 0.74$.

It was established that the vector $\vec{E}$ of the transverse components is parallel to the scattering plane in case 3a, and perpendicular in case 3b. The vector $\vec{E}$ of the "longitudinal" components (3b) is parallel to the scattering plane.

The absence of "longitudinal" components from the scattered light when the crystal is illuminated with light having $\vec{E}$ perpendicular to the scattering plane was never observed in the hitherto investigated crystals (quartz, rock salt, Iceland spar, diamond, etc) [2]. For all crystals the intensity of the "longitudinal" MB components is maximal in this case, including quartz, which has trigonal syngony, like sapphire. Only in diamond is the intensity of the "transverse" components larger in this case than that of the "longitudinal" ones, but only by about two times. For sapphire, the intensity of the "longitudinal" components maximal when the vector $\vec{E}$ is parallel to the scattering plane.

The singularity observed by us for light scattering in sapphire is apparently due to the molecular structure of the unit cell of the crystal.

Reduction of our spectrograms yields a value 10600 m/sec for the velocity of the longi-t udinal hypersound in the sapphire crystal, and 6170 for the quasi-transverse one.

The velocities of the longitudinal and transverse hypersound waves, and also the ratios of the MB component intensities, can be calculated if one knows the elastic and elastooptical cons tants of the crystal. To calculate these velocities we used the elastic cons tants determined from ultrasonic measurements [3] ($C_{11} = 4.968\times10^{12}$, $C_{33} = 4.981\times10^{12}$, $C_{44} = 1.474\times10^{12}$, $C_{12} = 1.636\times10^{12}$, $C_{13} = 1.109\times10^{12}$, $C_{14} = -0.235\times10^{12}$ dyne/cm). The intensities of the MB components in the sapphire were calculated from the elastooptical constants of pink ruby [4] ($P_{11} = -0.23$, $P_{33} = -0.20$, $P_{44} = -0.10$, $P_{12} = -0.03$, $P_{13} = 0.02$, $P_{14} = 0.00$, $P_{31} = -0.04$, $P_{41} = 0.01$). The intensity calculations were made by using well-known formulas [5, 2].

The results of the calculations are listed in the table, which gives also the experimental results of the present investigation.

Hypersound velocity in sapphire m/sec				MB component intensity ratio МБ (I_L / I_T)		
	Experiment				Experiment	Calculation
	3, *a*	3, b	Calcul.			
v_L	–	10620 ± 300	10680	3, *a*	0	0,0017
v_T	6180 ± 200	6150 ± 300	6210	3, b	0,74	0,736

It is seen from the table that the calculation agrees well with experiment.

The use of the Ar^+ laser in our study has made it possible to observe simultaneously both the "longitudinal" and the "transverse" MB components and to determine their positions and intensity ratios. In [6], the 2537-Å mercury-lamp line was used to excite scattering in sapphire. One can assume that the MB components observed in [6] were due to the transverse hypersonic wave. Under the conditions of [6], as shown by our calculations, the intensity of the "transverse" component is 5 times the "longitudinal" intensity.

The singularity of light scattering in sapphire can apparently be used for selective excitation and longitudinal and transverse hypersonic waves by using the stimulated-scattering technique.

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GENERATION IN THE ULTRAVIOLET WITH FREQUENCY TUNING, USING A PARATERPHENYL SOLUTION AND EXCITATION WITH A FLASH LAMP

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We report here attainment of lasing with smooth frequency variation in the 330 - 350 nm range, using a solution of paraterphenyl and excitation with a flash lamp.

The development of tunable UV lasers is one of the vital problems of quantum electronics. The use of organic solutions as the active medium offers great possibilities in this respect. Generation in the near ultraviolet (330 - 370 nm) was attained in [1, 2] on a number of organic scintillators excited by the fourth harmonic of a neodymium laser. Investigations of the generation and spectral characteristics (especially the absorption spectra on the excited states) have shown that the most promising of the compounds that fluoresce in the UV is