points obtained by both methods fit the same parabola.

$H_\sim$, Oe	$-\delta_{or}(I)\cdot 10^4$	$-\delta_{or}(II)\cdot 10^4$	$H_\sim$, Oe	$-\delta_{or}(I)\cdot 10^4$	$-\delta_{or}(II)\cdot 10^4$
8	0,2	0,19	50	1,58	1,54
14	0,4	0,38	56	1,76	1,75
20	0,63	0,63	62	1,87	1,91
26	0,85	0,82	68	1,97	2,03
32	1,03	1	72	2,08	2,09
38	1,2	1,2	78	2,2	2,2
44	1,47	1,42			

However, a direct proof of the quadratic dependence of δ_{or} on the magnetization component perpendicular to the plane of incidence and a justification for the normalization used for δ^s_{or} is the following result: Let the angle ϕ change from ϕ_1 to ϕ_2 in the region of rotation of $\vec{I}_s$. The $\vec{I}_x/\vec{I}_s$ component changes in this case from $\sin\phi_1$ to $\sin\phi_2$, and the $\vec{I}_y/\vec{I}_s$ component from $\cos\phi_1$ to $\cos\phi_2$. If the effect δ_{or} is proportional to the square of the magnetization, then $\delta_{or}/\delta^s_{or} = \sin^2\phi_1 - \cos^2\phi_2$ in the case of equatorial magnetization (I), and $\delta_{or}/\delta^s_{or} = \cos^2\phi_2 - \cos^2\phi_1 = \sin^2\phi_1 - \sin^2\phi_2$ in the case of meridional magnetization (II), i.e., the effects corresponding to identical values of H should coincide in cases (I) and (II). Understandably, this coincidence occurs only if the effect depends quadratically on the magnetization. In addition, this verification method cannot be affected by errors connected with the measurements of $\vec{I}_R/\vec{I}_s$ and $\vec{H}_s$ or of the amplitudes of $\vec{H}_=$ and $\vec{H}_\sim$. The table shows a comparison of the measured values of δ_{or} in cases (I) and (II) at $\hbar\omega = 0.59$ eV and at different values of $\vec{H}_\sim$ ($\vec{H}_= = \vec{H}_s$), while Fig. 2 shows the corresponding comparison of the effects $\delta_{or}(I)$ and $\delta_{or}(II)$ when the magnetization changes from $\vec{I}_R$ to $\vec{I}_s$ for different λ. The good agreement between the numerical values of δ_{or} in cases (I) and (II) proves that the effect δ_{or} is proportional to the square of the magnetization component perpendicular to the plane of incidence of the light.

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STIMULATED ENTROPY (TEMPERATURE) SCATTERING OF LIGHT IN LIQUIDS

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The existence of stimulated (entropy) scattering of light (STS) was first proved with full assurance in our earlier paper [1].

Subsequent experimental [2 - 5] and theoretical [6 - 8] investigations have shown that STS can be due to two different causes. It follows from a general analysis [7] of the STS phenomenon that the STS line due to the electrocaloric effect should be shifted to the Stokes side relative to the frequency of the exciting radiation (STS-I), and the STS line due to the direct absorption of light should have an anti-Stokes shift (STS-II).

The STS-I phenomenon was observed by us experimentally in hydrogen gas [2,3], and STS-II was observed in liquids by Rank et al. [4] and in gases by Wiggins et al. [5].

Unlike in [2 - 5], no detailed spectral measurements of the position of the STS line were made in our first investigation [1], making it uncertain whether STS-I or STS-II was observed in the pure liquids.

We report here the first observation of the STS-I line in liquids, with an intensity maximum shifted in the Stokes direction relative to the frequency of the exciting radiation. We have thus observed the STS due to the electrocaloric effect. In thermal (spontaneous) scattering, this form of STS corresponds to scattering of light by entropy fluctuations (the central component of the Rayleigh triplet) [9].

From the theory, in which account is taken of the effect of the electrocaloric effect and light absorption on stimulated scattering, it follows that the gain in the stationary regime is [7]

$$g_T = \frac{|K_1| \frac{\partial \epsilon}{\partial T_p} C}{8\pi\rho C_p n} \left\{ 2k_\omega + \frac{1}{2nc} T_0 \chi q^2 \left(\frac{\partial \epsilon}{\partial T}\right)_p \right\} \frac{\Omega}{\Omega^2 + (\chi q^2 + \delta\omega_0)^2} |E_0^m|^2.$$

Here $\Omega = \omega_0 - \omega_1$; $q = \vec{k}_0 - \vec{k}_1$; $\vec{k}_0$, $\vec{k}_1$, ω_0, and ω_1 are the wave vectors and the frequencies of the exciting and scattering light waves; c is the velocity of light in vacuum, $2k_\omega$ is the light absorption coefficient; χ is the temperature conductivity coefficient; $2\delta\omega_0$ is the half-width of the exciting-radiation line; the remaining symbols are standard [7, 9].

It is seen from (1) that for liquids $[(\partial\epsilon/\partial T)_p < 0]$ at

$$2k_\omega < \frac{1}{2nc} T_0 \chi q^2 \left|\left(\frac{\partial \epsilon}{\partial T}\right)_p\right|$$

the gain is positive ($g_T > 0$) when $\Omega > 0$ (Stokes), and at large $2k_\omega$ the gain is positive when $\Omega < 0$ (anti-Stokes).

Indeed, our investigations have shown that either STS-I or STS-II can be realized in liquids, depending on the value of the light absorption coefficient.

We chose benzene and ethyl alcohol as the objects of the investigation. The scattering was excited by a ruby-laser pulse of maximum power ∿ 180 MW, duration 10 - 15 nsec, and emission-line spectral width $(2 - 3) \times 10^{-2}$ cm^{-1}. The exciting light was focused into a vessel with the investigated liquid by a lens of focal length f = 2.5 cm. The light scattered at an angle $\theta = 90°$ was analyzed by a Fabry-Perot interferometer. The spectrum of the exciting radiation was measured at the same time.1)

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1) Part of the exciting light was split from the main beam and passed through a $\lambda/2$ plate. Its polarization was therefore rotated 90° relative to the polarization of the exciting light. Analyzers placed in front of the photographic plate have made it possible to register in one half of the interference pattern the light polarized in the scattering plane (exciting radiation), and in the second half the light polarized in a direction perpendicular to the scattering plane (scattered light).

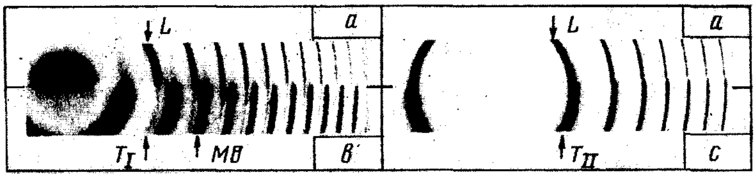

Fig. 1. Interference pattern of stimulated light scattering in benzene: a - spectrum of exciting radiation, b - spectrum of stimulated scattering in a pure liquid, c - spectrum of stimulated scattering in the same liquid to which a light absorber was added; L - exciting-radiation line, T_I - STS-I line, T_{II} - STS-II line, MB - stimulated Mandel'shtam-Brillouin scattering line. Fabry-Perot interferometer dispersion region $\Delta\nu = 0.25$ cm^{-1}

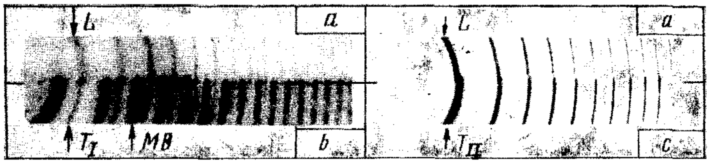

Fig. 2. Interference pattern of stimulated scattering of light in ethyl alcohol (notation the same as in Fig. 1)

Figures 1b and 2b show interference patterns of scattered light in pure benzene2) and in absolute ethyl alcohol. A comparison of the spectrum of the scattered light with that of the exciting light (Figs. 1a and 2a) reveals clearly a Stokes shift of the scattered light in both liquids. The values of this shift ($\sim 10^{-2}$ cm^{-1}) are of the same order as half the half-width of the exciting-radiation line ($\delta\omega_0/2$).

When an absorber (I_2) was added to these liquids, the STS was shifted to the anti-Stokes side (Figs. 1c and 2c). At small absorption coefficients, this shift was of the same order as the Stokes shift of the STS-I line.

At large light absorption coefficients, close to the critical value [8], and at high exciting-radiation intensities, the shift of the STS-II line can exceed $\delta\omega_0/2$ by several times. It is still unclear whether this is an increase of the shift as a result of a repeated scattering in the STS-II in the interaction region, or whether other factors enter here.

Under the conditions of our experiment, the STS-I line in pure benzene was observed at a radiation power lower than $\sim$ 50 - 80 MW. At high power, the STS-II line was observed. It can be assumed that at high exciting-radiation intensities the STS is strongly influenced by the nonlinear absorption of light [see formula (1)] and the STS-I changes into STS-II.

In conclusion, the authors are grateful to V. N. Biryukov and V. P. Zaitsev for help.

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IMMOBILE SHOCK WAVE PRODUCED UPON STATIONARY EVAPORATION OF METAL BY LASER RADIATION

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We have investigated the dynamics of spreading of metal vapor produced by surface heating of a metal target by powerful laser radiation. The laser-pulse duration was long compared with the characteristic settling time of vapor motion, so that the observed picture of the motion assumed a stationary character. We observed here for the first time an immobile (relative to the target) shock wave (SW), on the front of which supersonic vapor flow was transformed into subsonic flow[1].

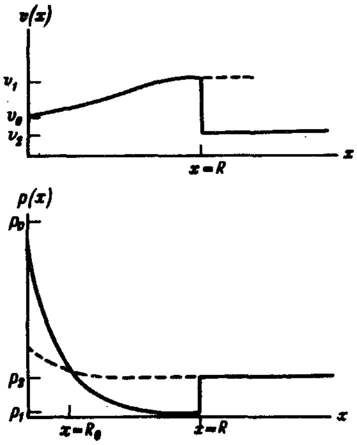

Fig. 1. Qualitative picture showing the change of the vapor velocity v and pressure p along the x axis (solid curves). The x axis is perpendicular to the target surface. The laser beam propagates in the negative x direction. The point x = R denotes the diameter of the immobile SW. The point x = 0 corresponds to the target plane, on which the initial conditions of the motion v_0, ρ_0, p_0) are specified. The indices 1 and 2 pertain to the values ahead of and behind the SW front.

The supersonic flow is produced in the region between the target and the SW front (the region x < R in Fig. 1) if the vapor pressure p_0 at the target is much larger than the external gas pressure p_∞. This is accompanied by escape of matter from the target, and the vapor velocity v(x) in the interval 0 < x < R increases from its initial value v_0 like [1]

$$v(x) = v_0\sqrt{1 + \frac{2}{\gamma - 1} M_0^{-2} \left(1 - \frac{c^2(x)}{c_0^2}\right)}, \tag{1}$$

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[1] A similar gasdynamic picture is observed in supersonic escape of gas from a nozzle in the underexpansion regime. The authors are grateful to P. I. Ulyakov and L. Ya. Min'ko for calling their attention to this analogy.