μsec, which coincides in order of magnitude with the lifetime of the magnetic moment (Fig. 1). Thus, the FB model explains satisfactorily a large number of phenomena.

We are grateful to graduate student L. Kolomiitsev for taking part in the experiment.

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## REFRACTIVE-INDEX CHANGE AND ABSORPTION OF CERTAIN LIQUIDS IN A STRONG LIGHT FIELD

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We have observed by an interference method the increase in the refractive index of a liquid in the field of a giant pulse of a ruby laser with 120 MW/cm$^2$ power. The absorption k was also determined by interference, from the change in the refractive index of the liquid as a result of the increase in temperature.

The increment of the refractive index of an absorbing nonlinear isotropic medium in which an intense light beam propagates is determined, for intrinsic polarization, by the expression [1]

$$\delta n_{||} = (2\pi/n)3\{\chi_3^{1122}[\omega] + \chi_3^{1212}[\omega] + \chi_3^{1221}[\omega]\}E^2 .$$

Here n is the refractive index of the medium, $\chi_3^{ijkl}$ are the components of the nonlinear susceptibility, and E is the intensity of the light-wave field with frequency ω.

Rotation of the polarization ellipse and induced birefringence in strong field were already reported earlier [2,3]. These observations make it possible to measure the component $\chi_3^{1221}$ and the sum of the components $(\chi_3^{1212} + \chi_3^{1221})$. We succeeded in measuring $\delta n_{||}$ and by the same token determine the sum of the indicated three tensor components $\chi_3^{ijkl}$.

The experimental setup is illustrated in Fig. 1. The laser cavity is made up of mirrors $M_1$ and $M_2$, and the generation passes through the cell with the investigated liquid. The cell is simultaneously in one of the arms of a Michelson interferometer, which consists of mirrors $M_2$, $M_3$, and the splitting plate SP. The cells used in the experiment were 10 cm long.

The measurements were made in the following fashion. The initial distribution of the equal-optical-path interference fringes over the section of the cell was photographed in the light of the He-Ne laser (λ = 0.63 μ) prior to the giant pulse (Fig. 2a). The same distribution was then photographed during the time of the giant pulse, in the light of the generation itself (Fig. 2b). The value of $\delta n_{||}$ was determined from the shift of the interference fringes at the center (Fig. 2b), where the field is maximal, relative to the shift at the edges, and also by comparison with the distribution of the fringes in a weak field. In addition, control experiments were carried out, in which part of the beam leaving the interferometer was attenuated with a neutral filter. In order that the position, shape, and contrast of the interference fringes be independent of the divergence of the light beam at the exit from the

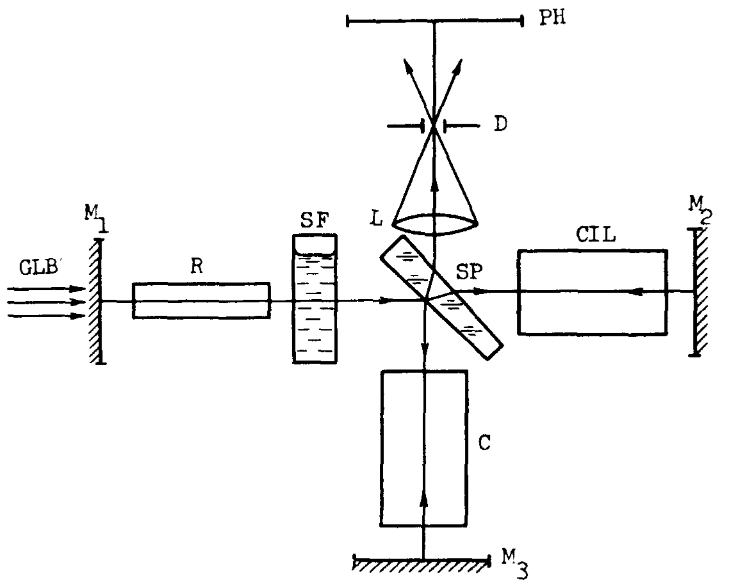


Fig. 1. Diagram of experimental setup. $M_1$,$M_2$,$M_3$ - dielectric mirrors with reflection coefficients 50, 98, and 98% respectively at wavelength $\lambda = 0.7$ μ. GLB - light beam from He-Ne laser, R - ruby rod of pulsed laser, SF - saturating filter, SP - splitting plate of interferometer, CIL - cell with investigated liquid, C - compensating cell, L - lens, D - diaphragm, PH - photographic plate.

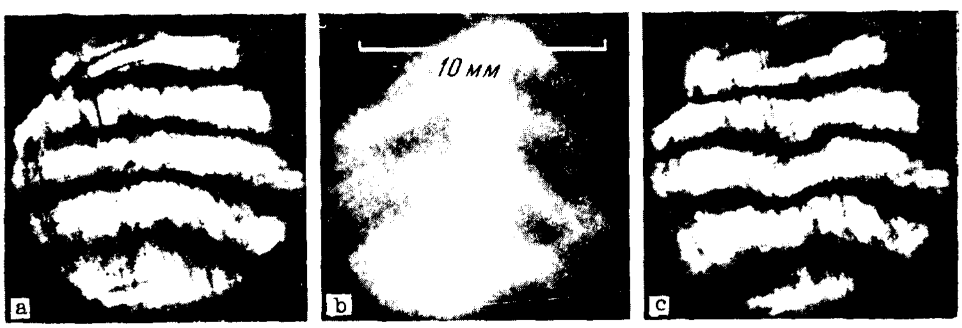


Fig. 2. Interference patterns in the case of nitrobenzene: a - before giant pulse, b - during pulse, c - 0.1 - 0.2 sec after the pulse.

interferometer, the length and the refractive indices of the interferometer arm were carefully adjusted.

Figure 2b shows the interference pattern obtained in the light of an He-Ne laser 0.1 - 0.2 sec following the giant pulse. The observed bending of the interference fringes (in a direction opposite to the bending in a strong field) is due to the local rise in the temperature of the liquid in the cell section, due to the absorption, and to the corresponding decrease in its refractive index. We make no assumptions whatever with respect to the nature of the observed absorption.

The results of the measurements of $\delta n_{\parallel}$ and k are listed in the table. All the measurements pertain to the maximal local values over the cross sections of the generation beam. The pulse energy was also measured at the most intense location in the cross section, through a diaphragm of 1 mm in diameter. In calculating the local power, we took account of the fact, described for similar conditions in [4], that the generation field shifts in time from the center of the beam cross section towards the edges.

T a b l e

| Liquid (analytically pure) | $\delta n_{\parallel} \times 10^6$ | $(K_a)_{exp} \times 10^8$ | $(K_a)_{calc} \times 10^8$ | k ($cm^{-1}$) $\times 10^3$ |
|---|---|---|---|---|
| Acetone | < 1 | - | 1.03 | 3.4 |
| Benzene | < 1 | - | 5.73 | < 0.8 |
| Water | < 1 | - | - | 16 |
| Nitrobenzene | 5 | 42 | 26.4 | 2.7 |
| Toluene | 2 | 17 | 6.5 | < 0.8 |
| Ethyl alcohol | < 1 | - | 0.21 | 3.4 |

The observed changes in the refractive index can be attributed to the orientation of the anisotropically polarized molecules of the liquid in the alternating field. This process is characterized by a certain Kerr constant $K_a$, which is connected with the change in the refractive index [5] by the formula $\delta n_{\parallel} = (1/3)K_a\lambda E^2$. As seen from the table, for nitrobenzene and toluene, the calculated values taken from [5], $(K_a)_{calc}$ are in satisfactory agreement with the obtained experimental values $(K_a)_{exp}$.

In conclusion, I am grateful to M. D. Galanin and E. A. Sviridenkov for a useful discussion of the results.


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## RADIO EMISSION OF EXTENSIVE AIR SHOWERS (EAS) OF COSMIC RAYS

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Following a number of theoretical [1-3] and experimental investigations [4-8], the comprehensive experimental setup of the Nuclear Physics Institute of the Moscow State University