longer: 5–10 sec, then the detectable density flux is correspondingly equal to $(5-2) \times 10^6$ erg/sec $\times$ cm^2. It is not difficult to estimate that the attained level of sensitivity is 1.5 orders of magnitude worse than the potential sensitivity of an antenna with such f, Q, and m (for details, see[3]). This is due, on the one hand, to the relatively high level of nonthermal bursts and, on the other, to the inadequate resolution of small displacements because of electronics noise ($\delta x_0 = 2 \times 10^{-14}$ cm).

The discrepancy between the results obtained in this series of measurements and in the investigations[1] is possibly explained by the nongravitational effects described in the papers[4].

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V. I. Pustovoĭt. Effects Connected with Phonon Production in Semiconductors. We consider effects which arise in semiconductors in a strong electric field and which are connected with phonon production. It turns out that a magnetic moment should appear in a homogeneous semiconductor crystal located in an electric field which is strong enough for phonon generation to occur (the electroacoustomagnetic effect[1]). Physically, the magnetic moment is due to the appearance of a rotational current component generated by the extra force which the phonons produced exert on the electrons. For a rotational current component to appear, it is necessary that the directivity diagram for the phonon radiation inside the Cerenkov cone be nonsymmetric about the direction of the drift velocity vector. The observation of the electroacoustomagnetic effect (it has not as yet been experimentally detected) will be easiest in piezoelectric semiconductor crystals in which a sufficiently strong electron-phonon interaction exists and in which, furthermore, one can always ensure the necessary anisotropy of the directivity diagram of the phonon radiation by the proper choice of the crystal orientation.

To explain the physical essence of the electroacoustomagnetic effect, let us consider the equilibrium conditions for a unit volume of the electron gas under the conditions when phonon production arises:

$$en\mathbf{E} - \nabla nT - mvn\mathbf{v} = 0; \quad (1)$$

here e is the charge, m the electron mass, n the electron concentration, ν the effective rate of collision of the electrons with the scattering centers, **v** the velocity, T the absolute temperature in energy units, and **E** is the electric field (in the low-frequency case being considered here the inertial terms are, naturally, unimportant). In the presence of phonon production the electron concentration n(**r**, t) and the electric field **E**(**r**, t) fluctuate with amplitudes proportional to the amplitude of the generated sound waves, and therefore we must assume that

$$\mathbf{E}(\mathbf{r}, t) = \mathbf{E}_d + \mathbf{E}_\sim(\mathbf{r}, t), \; n(\mathbf{r}, t) = n_0 + n_\sim(\mathbf{r}, t), \quad (2)$$

n_0 and $\mathbf{E}_d$ being here slowly varying functions of the coordinates and time. Now substituting (2) into Eq. (1) and averaging over time and space, we obtain the equilibrium conditions (1) in the form

$$\mathbf{E}_d - \frac{1}{\sigma_0}\mathbf{j} + \mathbf{F} = 0, \quad \sigma_0 = \frac{en_0}{m\nu}, \quad (3)$$

where $\mathbf{j} = \langle en\mathbf{v}\rangle$ is the average value of the current density and $en_0\mathbf{F} = e\langle n_\sim \mathbf{E}_\sim\rangle$ is the density of the so-called acoustoelectric force exerted by the generated phonons on an element of volume of the electron gas. It is precisely the appearance of this force that changes all the properties of a crystal in an external field. The electric field $\mathbf{E}_d$ is a potential field; therefore, from (3) follows immediately the relation

$$\mathrm{rot}\,\mathbf{j} = \sigma_0\,\mathrm{rot}\,\mathbf{F}, \quad (4)$$

from which we can see that when rot $\mathbf{F} \neq 0$, a rotational current component arises in the crystal and, as a result of this, a magnetic moment appears in the sample.

We consider the anomalous Hall effect in a semiconductor located in a strong electric field and show that under the conditions of phonon generation the experimentally measurable Hall constant R, given by the relation $R = E_H/JB$, where E_H is the Hall emf, J is the current in the source circuit, and B is the magnetic field (we have in mind a Hall open sample in the form of a parallelepiped, in which **B** is directed along the z axis, **J** along the x axis, and the Hall emf is measured along the y direction), sharply decreases, changes sign, and increases in absolute value. As in the case of the electroacoustomagnetic effect, such behavior of the Hall constant is due to the appearance of the extra force exerted on the electrons by the generated phonons[1]. Such anomalous behavior of the Hall constant was recently discovered in p-tellurium (see[2]).

Phonon generation in a strong electric field leads to a sharp change in the scattering of x-rays, γ-rays, and slow neutrons[3]. The random motion of the atoms in a crystal lattice leads to a decrease in the structural-scattering intensity and, furthermore, to the appearance of a diffuse peak in the scattered radiation. In a strong electric field, when the generation of nonequilibrium phonons appears, the random motion of the atoms and nuclei sharply intensifies and the intensity of the structural scattering peak decreases sharply, while the proportion of the diffuse scattering increases. It is significant that the characteristic generation time for the nonequilibrium phonons can be fairly small (this is the transit time of a phonon across the crystal, i.e., of the order of $10^{-6}-10^{-7}$ sec) and, consequently, the effect can be used for high-frequency modulation of x-ray and, in particular, γ-ray radiation.

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L. V. Dubovoĭ, A. G. Smirnov, V. G. Smirnov, D. I. Stasel'ko. The Use of Holography for Investigating Processes in a Thermonuclear Plasma and in a Moving Arc Discharge. Interest in ultrahigh-speed heavy-current discharges has grown considerably in recent years, since it is comparatively easy to produce with the aid of such discharges dense, high-temperature plasmas with thermonuclear parameters[1]. However, the study of the dynamics of the development of such discharges is made highly complicated by the absence of sufficiently simple methods of plasma diagnostics, which would have provided information about the space-time development of the processes under investigation. The necessary data on the space-time structure of a plasma can be extracted with the aid of the methods of holography[2].

In the report we present the results of work done on the construction of a holographic apparatus for plasma diagnostics, as well as results of the use of the apparatus for the investigation of fast processes in a heavy-current Z-discharge and in a fast-moving electric arc. The investigated Z-discharge was characterized by a small ($\sim 1\ \mu$sec) time of rise of the discharge current to a peak value of 270 kA, which allowed the realization of a stable regime for the heating up of the plasma. The experimental setup included a discharge chamber with an arrangement for shaping the heavy-current ultrafast discharge, a pulsed, single-mode ruby laser, a holographic chamber, and a control and synchronization unit. Using the methods of holographic interferometry, we obtained a number of interference patterns corresponding tc the shaping and maximum compression phases of the current filament, and to the dispersion phase of the plasma. From the holographic-interferogram data we determined a number of important plasma characteristics: the transverse dimension of the current filament at the moment of maximum compression (about 8 mm), the maximum value of the electron concentration ($N_{e\,max} = 1.2 \times 10^{17}$ cm^{-3}), as well as the radial plasma-density distribution, which turned out to be close to the distribution anticipated for the case of a stable discharge with a slightly diffused boundary. The value of the gas-kinetic pressure determined from the pressure balance equation under the conditions of the experiment was 10^{21} eV/cm^3, which corresponded to a plasma temperature of about 10^4 eV.

As a result of an holographic investigation of an electric arc that moved over the electrodes of the spark gap with supersonic velocity, we have established that the discharge process has the character of a single-channel process, and we have also determined the velocity of translation of the discharge channel (420 m/sec) and its transverse dimensions. We have constructed on the basis of these results a simple but reliable spark gap with a high charge-transmitting capacity which is being widely used at present for current commutation in "Tokamak" installations.

The results obtained show that the holographic methods of plasma diagnostics enable us to measure accurately and comparatively simply three-dimensional plasma-density distributions. Further progress in the development of the holographic methods of diagnostics is tied up with the working out of methods of and the development of a camera for high-speed holographic filming, as well as with the introduction into practice of the investigations of the holographic-interferometric methods involving the use of several wavelengths[3].

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JOINT SCIENCE SESSION OF THE DIVISION OF GENERAL PHYSICS AND ASTRONOMY OF THE USSR ACADEMY OF SCIENCES, THE ACADEMY'S SCIENCE COUNCIL ON THE PHYSICS AND CHEMISTRY OF SEMICONDUCTORS, AND THE NUCLEAR PHYSICS DIVISION OF THE ACADEMY

(May 24—25, 1972)

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A joint science session of the Division of General Physics and Astronomy of the USSR Academy of Sciences, the Academy's Science Council on the Physics and Chemistry of Semiconductors, and the Nuclear Physics Division of the Academy was held on May 24 and 25, 1972, in the Conference Hall of the P. N. Lebedev Physics Institute. The following papers were presented at the session:

1. Zh. I. Alfërov. Semiconductor Devices with Heterojunctions.
2. V. S. Vavilov and E. A. Konorova. Semiconductor Diamonds.
3. L. N. Kurbatov. Photoelectric Solid-State Receivers and New Methods of Optical-Radiation Reception.
4. S. M. Ryvkin. Solid-State Nuclear-Radiation Counters.
5. V. L. Ginzburg. Gamma Astronomy and Cosmic Rays*).
6. N. A. Dobrotin, V. M. Maksimenko, Yu. A. Smorodin, and S. A. Slavatinskiĭ. On the State and Prospects of the Study of Particle Interactions at Ultrahigh Energies.

*An expanded text of V. L. Ginzburg's report is published in Usp. Fiz. Nauk, 108, 273 (1972).