$$\left\{\omega^2 - \omega_0^2 - \gamma^2 - i\omega\gamma + 2\omega_0 \sum_k \frac{|F_k|^2(2n_k^0 + 1)(\omega - 2\omega_k + 2i\gamma_k)}{(\omega - 2\omega_k)^2 + 4\gamma_k^2 - 4|F_k|^2|x|^2}\right\} x = -2\beta\omega_0 E_0. \tag{9}$$

The last equation replaces the solution of (3) and, as seen from a simple analysis, the solution of formulas (3) and (6), being much simpler than (9), is at the same time a good approximation of the latter. Therefore the rms fluctuations described by (8) can be obtained by substituting $\underline{x}$ from (3) (below the instability threshold and excluding a small region near threshold).

The author is grateful to G. M. Genkin for useful discussions.

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INVESTIGATION OF THE MAGNETIC FIELD OF A SPARK PRODUCED BY FOCUSING LASER RADIATION

V. V. Korobkin and R. V. Serov
P. N. Lebedev Physics Institute, USSR Academy of Sciences
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The spark produced when a sufficiently powerful laser beam is focused was investigated in a number of recent papers [1-4].

Raizer [5] investigated the crowding out of a longitudinal magnetic field by the plasma of the spark, as a result of the diamagnetism of the plasma.

We have observed the spark's own magnetic field, which exists only during the time when the plasma is fed by the laser beam. A Q-switched ruby laser was used in the experiment. The pulse power was 2 J and the pulse duration 30 nsec.

The magnetic field of the spark was measured with coils of 10 mm diameter, each consisting of two turns of wire. The signals from the two coils, which were disposed in various manners relative to the spark, passed through two different delay lines (cables 20 and 50 m long), amplified by two UZ-4 amplifiers, and displayed on an SI-11 oscilloscope. The delay-time difference was 150 nsec, so that it was possible to measure simultaneously arbitrarily chosen components of the magnetic fields at two points of space on a single oscillogram.

To suppress the photoeffect from the inductive pickups, the spark was surrounded by a tube of black paper of 5 mm inside diameter. In addition, the signal from each pickup was fed to the input of the delay line through a special isolating transformer with a grounded primary-winding center tap. The photoeffect caused an increase in the pickup potential, the currents charging the pickup capacitor relative to ground flowed symmetrically (Fig. 1a, dashed), and there was no signal at the transformer output. The currents due to the change in the magnetic flux through the coil (Fig. 1a, solid line) always produced a signal at the transformer output. Without these precautions, the signal due to the photoeffect exceeds the signal due to the magnetic field by a factor 10 - 20.

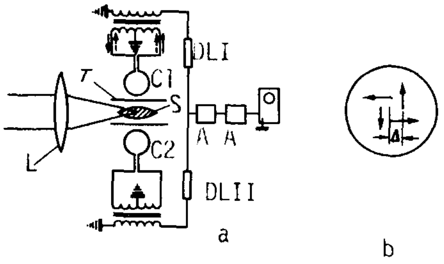

Fig. 1. a - Experimental setup: L - lens with f = 50 mm, S - spark, T - tube of black paper, C1 and C2 - coils, DLI and DLII - delay lines, A - amplifiers, O - oscilloscope; b - diagram showing the directions of the magnetic dipole. Δ - displacement of the laser beam relative to the center of the lens.

The results of the experiments can be summarized as follows: A magnetic dipole moment exists in the spark. This moment is perpendicular to the laser-beam propagation direction. In addition, the direction of the moment depends essentially on the part of the lens through which the beam passes. This dependence is shown in Fig. 1b. The arrow shows the direction of the moment (viewed from the lens side). Thus, for example, if the center of the lens is displaced downward relative to the beam, then the magnetic moment is directed to the left.

Similar results are obtained also when part of the beam passing through the center of the lens is obstructed. A magnetic moment appears also when the laser beam passing through the center of the lens is allowed to pass also through a glass wedge with an apex angle 11°. When the beam is deflected downward by the wedge, the magnetic moment is directed to the right of the lens, etc. (Fig. 1b). The direction of the magnetic moment is determined somehow by the rotation of the beam prior to the breakdown. If the wedge is replaced by a plane-parallel plate, no magnetic moment is produced.

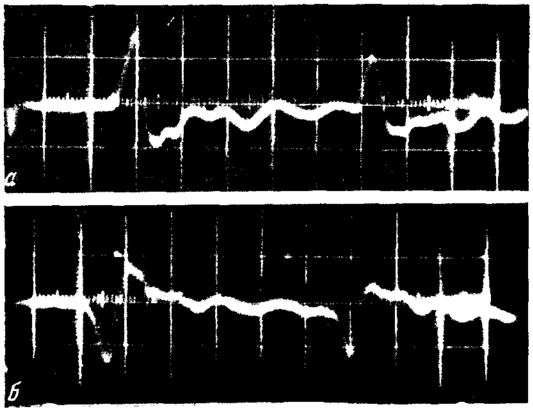

Fig. 2. Oscillograms of magnetic dipole. Sweep 20 nsec/div. Laser beam displaced 5 cm relative to the lens center: a - upward, b - downward.

Figure 2 shows oscillograms corresponding to the coil arrangement shown in Fig. 1a. When the lens is displaced downward or upward relative to the laser beam, the magnetic moment is directed perpendicular to the plane of the coils. (In the case of such a displacement, the spark is also displaced somewhat in space, and the inductive pickups are displaced by a suitable distance.) The voltage on the coils is

$$U \approx -\frac{nS}{c}\frac{\Delta H}{\Delta t} \approx \frac{nS}{cR^3}\frac{\Delta m}{\Delta t},$$

where n is the number of turns, S the area of each turn, R the distance from the center of the coil to the spark, and m the magnetic moment.

The magnetic moment measured in our experiments was approximately (3 - 5) x 10^{-2} Oe/cm^3. This dipole is apparently localized on the front of the shock wave moving toward the lens, for only in this region does the laser beam interact with the plasma. Supplementary experiments have shown that signals from the pickups are not the result of the crowding out of the earth's magnetic field by the plasma.

We did not observe in our experiments the magnetic field connected with the appearance of an electric dipole, reported by Askar'yan et al. [6]. This magnetic field is apparently much weaker than the field due to the magnetic dipole observed in our experiments.

At present the mechanism of occurrence of the magnetic dipole is not completely clear. It can be assumed that it is due to the turning of the shock-wave front moving towards the lens. The reasons for the turning may be distortion of the ray caustic and inhomogeneity of the angular distribution of the laser radiation [7].

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BREMSSTRAHLUNG OF ELECTRONS WITH $\bar{E} = 2.4$ GeV

J. Bem, V. G. Grishin, and V. D. Ryabtsov
Joint Institute for Nuclear Research
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1. Bremsstrahlung of electrons with $E_1 \leq 100$ MeV was investigated in many experiments. A detailed analysis of the results of these experiments and a comparison with the theory are presented in [1]. At higher energies there are data for E = 500, 550, 247, and 1000 MeV [2-6]. A detailed study of the bremsstrahlung spectrum of 600-MeV electrons was made with the aid of a propane bubble chamber [7]. An advantage of this procedure is the possibility of observing each bremsstrahlung event and the exact localization of the interaction region ($\Delta \approx 3 \times 10^{-4} L_{rad}$, where L_{rad} is the radiation length for propane).

There are no experimental data at present for $E \geq 1000$ MeV. It is therefore of interest