Thus, near the critical Curie point the coefficients $(\partial E_g/\partial T)_p$ and $(\partial E_g/\partial p)_T$ become infinite like $(\theta - T)^{-1/2}$, and the signs of these coefficients near the Curie point are determined by the sign of the constant a.

As shown in [8], the phase transition in SbSI is close to the critical Curie point. Accordingly, anomalously large values of $\partial E_g/\partial T$ and $(\partial E_g/\partial p)_T$ were observed in [3,4], with signs corresponding to positive a ($d\theta/dp < 0$ for SbSI). Unfortunately, the constant a was not estimated numerically from these measurements, since the values of γ were unknown.

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INFLUENCE OF MAGNETIC-FIELD CONFIGURATION ON THE HEATING AND CONTAINMENT OF A PLASMA IN A MIRROR TRAP ("PROBKOTRON")

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It was observed earlier [1], that heating of a plasma by an electron beam in a mirror trap increases strongly with increasing mirror ratio. Further experiments have shown that heating and containment of the plasma depend strongly on the distribution of the magnetic field along the trap axis. The experiment was carried out with the installation of [1], which made it possible to operate with two different configurations of the magnetic field (Fig. 1).

The mirror ratio and the field in the center remained unchanged in both cases.

The plasma with initial density 10^{12} cm^{-3} was prepared with a titanium injector. A pulsed beam of electrons with current strength 1 A, energy 10 kV, and duration 500 μsec was injected into this plasma.

The heating and decay of the plasma were investigated by measuring the time variation of the energy content (nT) and of the density n.

It is seen from Fig. 2 that on going over from a field configuration with local mirrors

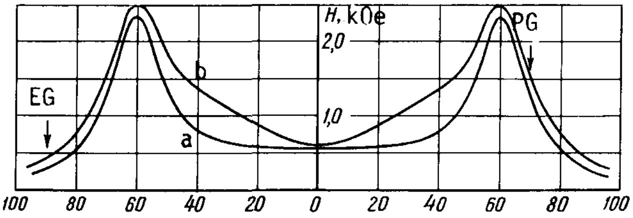

Fig. 1. Plot showing the distribution of the magnetic field of the trap. The arrows indicated the locations of the guns: electron (EG) and plasma (PG).

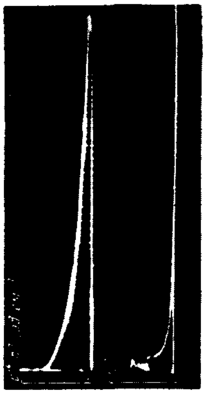

Fig. 2. Diamagnetic-probe signal. Sweep duration: a -- 10 msec, b -- 50 msec.

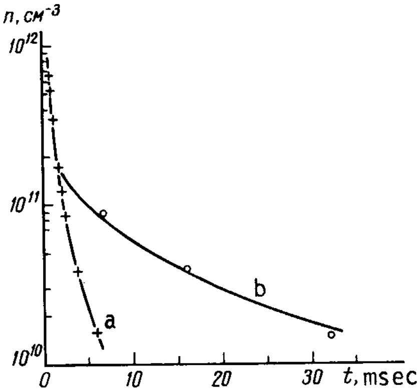

Fig. 3. Plasma decay for different magnetic-field configurations

(a) to a configuration with extended mirrors (b) the maximum value of nT increases by a factor 1.5. After termination of the electron-beam injection, nT decreases for both field configurations by approximately the same amount in 50 μsec. This rapid decrease is connected with the escape of the cold plasma from the trap. The remaining part of nT, ascribed to the hot electrons, decreases subsequently much more slowly, and the influence of the configuration is then even stronger.

The pressure (nT) of the hot electrons is three times larger in the field configuration with extended mirrors than in the configuration with the local mirrors, and the decrease by a factor e occurs after 20 msec, whereas in the second case its duration does not exceed 2 msec.

The time variation of the electron density (Fig. 3) is similar to that of nT. After a relatively rapid decay of the cold plasma, the density decrease slows down. A slow density decrease, from the 10^{11} cm^{-3} level to the 10^{10} cm^{-3} level, due to the escape of hot electrons, occurs after 6 msec in the case of the configuration with local mirrors (a). In the case of a field with extended mirrors (b), this time lengthens to 30 msec. The true value of the concentration of the hot electrons differs from the concentration shown in Fig. 3, since the hot electrons, on ionizing the neutral gas, produce a noticeable number of secondary electrons. Therefore the observed electron concentration exceeds the concentration of the hot electrons by $(n_0\langle\sigma v\rangle_{\text{ion}}\tau_{\text{sec}} + 1)$ times, where τ_{sec} is the time of escape of the secondary electrons from the trap, and n_0 is the concentration of the neutral particles.

The prolonged containment of hot electrons in a trap with extended mirrors is further evidenced by the x-ray bremsstrahlung, which is observed for 100 msec.

Thus, the heating and containment of the plasma by a pulsed electron beam increase on going from a mirror trap with local mirrors to a mirror trap with extended mirrors. This may be due not only to the more effective transfer of energy from the beam to the plasma, but also to improvement in the containment of the hot electrons in the field with extended mirrors.

In conclusion the authors are sincerely grateful to A. V. Gordeev and G. V. Sholin for useful discussion, and also to G. A. Kudintseva and G. M. Kuznetsova for graciously furnishing the cathodes.

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Article by P. I. Blinov et al. "Influence of Magnetic-field Configuration on the Heating and Containment of a Plasma in a Mirror Trap." Figure 2 should be viewed with the page turned 90° clockwise. Then "a" and "b" denote the lower and upper curves, respectively.