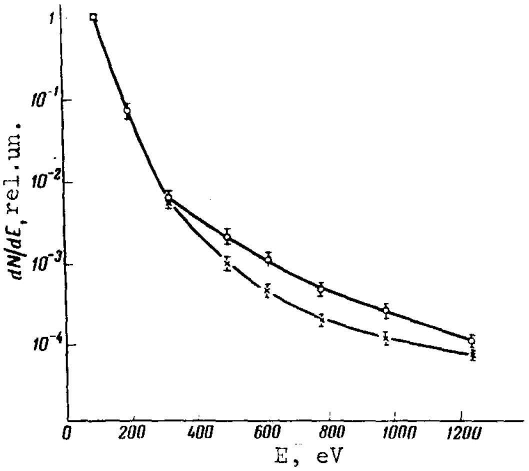

Fig. 3. Energy distribution of the charge-exchange atoms in the presence (circles) and in the absence (crosses) of HF heating in the interval 21 - 26 msec.

An analysis of the neutral hydrogen atoms emitted from the plasma in the direction of the major axis of the torus ($R = 60$ cm) was carried out by the procedure described in [6]. The change of the energy spectrum of the charge-exchange atoms under the influence of the HF heating is shown in Fig. 3.

Thus, the aggregate of the obtained data offers evidence that the ion component of the plasma is heated when the dense part of the spectrum of the natural oscillations of the plasma filament is excited.

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INFLUENCE OF PRESSURE ON THE FERMI SURFACE OF ZINC

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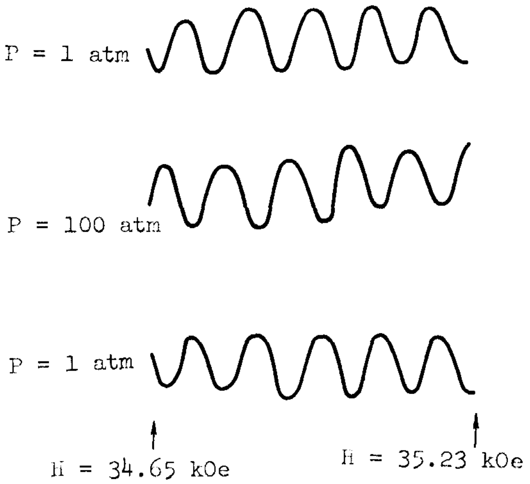
Pressure produces changes in the lattice parameters, leading in turn to a change in the area S of the extremal sections of the Fermi surface (FS) both as a result of the change in the parameters of the Brillouin zone (BZ) and as a result of a change in the lattice potential. Significant changes in the main parts of the FS should be expected at pressures on the order of the elastic moduli of the crystal. Pressures on the order of 10 - 15 kbar at low temperatures, transmitted with the aid of a solid medium, are very far from hydrostatic, and this makes it impossible to observe large cross sections of the FS, which are very sensitive to inhomogeneous deformations. In the present study, in order to observe the influence of pressure on large sections of the FS, we used truly hydrostatic pressures up to 100 bar, transmitted by liquid helium. This yields a coefficient $d \ln S/dP$, which can be regarded as constant at pressures much lower than the elastic moduli.

The investigation was made on zinc, since it has a hexagonal lattice with a large compressibility anisotropy [1], and its FS is well described in the model of almost-free electrons (the 1-OPW approximation [2]) and has been thoroughly studied at atmospheric pressure [3 - 6].

The influence of pressure on small electronic sections ("needle" elongated along the vertical edge HK of the third BZ) and on the complicated multiply-connected hole surface in the first and second BZ ("monster") was investigated in a number of studies [7 - 9], but these data were not satisfactorily interpreted with allowance for the lattice potential.

Measurement of the areas of the extremal cross sections of the FS was carried out by observing the de Haas - van Alphen effect by a modulation method at the 12th harmonic of the modulating signal in a field of a superconducting solenoid up to 50 kOe at temperatures 2 - 4.2°K. A detailed description of all the units of the apparatus will be presented in a separate communication.

We observed experimentally the phase shift of the oscillations at a certain fixed field H_0 : $\Delta F/F = (H_0/F)(\Delta\phi/2\pi)$, where $F = \hbar cS/2\pi e$. The constancy of the magnetic field was monitored by a compensation method with the aid of an F-116/2 photoamplifier. To eliminate the possible null drift of the photoamplifier, the pressure was raised and lowered many times in order to average the results.



Sample plot of the magnetic-moment oscillations connected with the "cigar" section. The upper and lower curves are without pressure, and the middle one at a pressure of 100 atm.

The measurements were performed on samples of three types in the form of rods measuring 5 × 1 × 1 mm, elongated along one of the principal crystallographic axes ([0001], [10$\bar{1}$0], and [11$\bar{2}$0]). Table I lists the data on the measured oscillation frequencies corresponding to the sections of the electronic parts of the FS - the "lens," "butterfly," "cigar," and "needle," and the hole part ("monster"), and also data on the variation of these sections with pressure. The table gives also the published data on the influence of quasihydrostatic pressure on the FS of zinc.

In the case of the "lens" the obtained data can be compared with the predictions of the theory in the 2-OPW approximation and we can separate the factors influencing the change of the area S as a result of the change of the BZ dimension and of the radius of the Fermi sphere k_F from those due to the change of the matrix element V_{0002} by the lattice potential.

In the 2-OPW approximation, the intersections of the lens with the planes (1010) and (1120) can be regarded as ellipses whose areas depend on the pressure like $d \ln S/dP = (-3.8 \times 10^{-3} - 0.16(d \ln |V_{0002}|dP))$ kbar^{-1}. The absolute value of the matrix element of the potential was chosen by starting from the area of the extremal intersection of the "lens" with the (0001) plane [5]. This quantity is listed in Table II, which gives also a comparison with the Animalu-Heine potential [10]. The experimentally obtained $d \ln |V_{0002}|/dP$ and the value $d|V_{0002}|/d(q/2k_F)$ calculated from the compressibility [1] at q = 2b are also given in Table II. For the other cross sections it is impossible to separate explicitly the change of the area S due to the changes of the lattice parameters and of the individual matrix elements of the potential. The experimental values of the matrix elements and their derivatives $d|V_q|/d(q/2k_F)$ at

TABLE I

Magnetic field direction	FS cross sec.	$S(\AA^{-2})$		$d\ln S/dP$ 10^{-3} kbar^{-1}		
		Appr. 1-OPW	Expt.	Appr. 1-OPW	Expt.	Pub. data
[0001]	Lens	2.65	2.0 [5]	- 1.74	–	–
	Butterfly	0.12	0.102	- 38.1	- 11 ± 1	–
	Cigar	0.12	0.105	- 38.1	- 14 ± 1	–
	Needle	0.00030	0.00015	+ 130	+ 282 ± 7	+ 329 ± 15 [9] 120 ± 30 [7]
28,5°K [0001]	Monster γ	0.06	0.0426	- 8 [9]	- 12.5 ± 0.3	- 12.7 ± 0.7 [9]
[1010]	Lens	0.73	0.695	- 3.48	- 3.1 ± 0.4	–
	Monster σ	–	0.325	–	- 4.4 ± 1.4	–
[1120]	Lens	0.73	0.690	- 3.48	- 3.0 ± 0.4	–
	Monster σ	0.34	0.257	- 7.03	- 5.1 ± 0.4	–
	Monster β	0.045	0.0043	+ 28$^{1)}$ [9]	+ 42.5 ± 0.5	+ 39.4 ± 1 [9]

$^{1)}$Modified 1-OPW

TABLE II

V_{0002}, Rydberg		$\left.\frac{d\lvert V_{0002}\rvert}{d(q/2k_F)}\right\rvert_{q=2b}$, Rydberg		$\frac{1}{\lvert V_{0002}\rvert}\frac{d\lvert V_{0002}\rvert}{dP}$, kbar^{-1}	
Animalu-Heine	Experiment	Animalu-Heine	Experiment	Animalu-Heine	Experiment
-0.014	-0.058	-0.4	-0.5	$-1.6 \cdot 10^{-2}$	$-0.49 \cdot 10^{-2}$

three values of the reciprocal vector q will be obtained from a computer processing of the data.

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