The experiments allow us to draw the following conclusions:

1. Effective excitation of waves in a dense plasma situated in a toroidal magnetic field is possible in the region of ion-ion hybrid resonance.

2. By choosing the length of the wave excited in the plasma and the relative concentrations of the working gases it is possible to ensure penetration of waves into a dense plasma in a wide range of experimental conditions.

3. The ions of a dense three-component plasma could be heated along the entire length of the torus when resonance conditions were satisfied near the axis of the plasma filament. The gas-kinetic pressure of the plasma under the experimental conditions reached values $nT \approx 10^{16}$ eV/cm^3 at a plasma density $n \approx 10^{14}$ cm^{-3}.

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EXCITON PLASMA RESONANCE IN SEMICONDUCTORS

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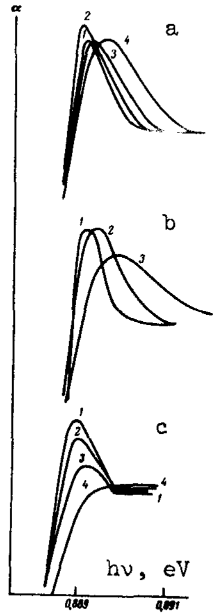
The presence of a high carrier density in a semiconductor leads to a screening of the Coulomb interaction of the carriers, which in turn causes attenuation or annihilation of the exciton absorption in the semiconductors [1 - 3]. At low densities other manifestations of the interaction between the excitons and the free-carrier plasma are possible.

We present here the results of an experimental investigation of the interaction of excitons with free carriers at densities when the exciton binding energy in the ground or excited state is higher than $\hbar\omega_p$, where ω_p is the plasma frequency. In this case the dielectric constant $\varepsilon(\omega, \vec{k})$ turns out to be smaller than the high-frequency dielectric constant of the semiconductor $\varepsilon(\infty)$ in a wide range of ω and k, so that the presence of free carriers intensifies the Coulomb interaction [4]. The interaction can be particularly intensified when $\varepsilon(\omega, \vec{k}) \to 0$, i.e., when the plasma oscillations are at resonance with certain Fourier components of the exciton wave function. Evidence of the presence of such intensification of the interaction should be an increase in the exciton absorption in the corresponding regions of the exciton spectrum when free carriers are produced in the sample.

We investigated the edge of direct absorption of germanium near k = 0. The absorption was measured on samples of antimony-doped n-type germanium placed in liquid helium. The free carriers were produced by pulsed breakdown of the shallow impurity centers. The experimental setup made it possible to plot the spectra of the absorption edge during the time of application of the electric-field pulses. Since the free electrons were at the extrema of the conduction band at k = [111], the errors connected with the filling of the states near the edges of the bands. The absorption spectra of doped germanium at different electric field intensities are shown in the figure. The absorption near the edge



Absorption edge of doped germanium in the region of direct transitions in different electric fields: a - $N_d = 6 \times 10^{14}$ cm^{-3}; 1) E = 0, 2) E = 7 V/cm, 3) E = 10 V/cm, 4) E = 15 V/cm. b - $N_d = 2 \times 10^{15}$ cm^{-3}: 1) E = 0, 2) E = 10 V/cm, 3) E = 30 V/cm. c - $N_d = 8 \times 10^{15}$ cm^{-3}: 1) E = 0, 2) E = 20 V/cm, 3) E = 25 V/cm, 4) E = 30 V/cm.

increases most strongly for the sample containing 6×10^{14} cm^{-3} antimony atoms. In a sample with $N_d = 2 \times 10^{15}$ cm^{-3}, an increase of the absorption was observed only at sufficiently low applied voltages, corresponding apparently to incomplete ionization of the impurity centers. In a sample with $N_d = 8 \times 10^{15}$ cm^{-3} we observed only a decrease of the exciton absorption. There are, however, grounds for assuming that at such a high impurity-center concentration and in the presence of compensation, the breakdown occurs initially in narrow "filaments" which expand with increasing applied voltage [5]. This is evidenced, in particular, by the constancy of the spectra of the modulation of the absorption edge by the electric field for this sample.

The spectral range in which an increase of the absorption is observed is quite broad and includes continuous-spectrum states. This can probably be explained by recognizing that the region where $\varepsilon(\infty) > \varepsilon(\omega, \vec{k})$ is quite broad even without allowance for the damping of the plasma oscillations and the exciton-electron collisions.

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