	Amplitudes of the signals shown in the figure			
	units $f_k\,(t-\tau)$	units $f_k\left(t-\frac{3\tau}{2}\right)$	units $f_k\,(t-2\tau)$	units $f_k\,(t-3\tau)$
$\frac{\langle S_{+1}\rangle}{P_1}$	$i\cos\xi_1\sin\xi_2$	0	$-i\sin\xi_1\sin^2(\xi_2/2)$	0
$\frac{\langle\{S_{+1}S_z\}\rangle}{P_2}$	$i\sin 2\xi_2 \times [1-{}^3/{}_2\sin^2\xi_1]$	0	$-i\sin 2\xi_2\sin^2(\xi_2/2) \times [3-4\sin^4(\xi_2/2)]$	$i\sin^2\xi_1\sin\xi_2 \times \sin^2(\xi_2/2)$
$\frac{\langle S_+^2\rangle}{P_2}$	$-\sin^2\xi_2 \times [1-{}^3/{}_2\sin^2\xi_1]$	$\sin 2\xi_1 \times \sin\xi_2\sin^2(\xi_2/2)$	$-\sin^2\xi_1\sin^4(\xi_2/2)$	$-\sin^2\xi_1\cos^4(\xi_2/2)$

ment and the crystal field, this effect furnishes a more accurate method for the investigation of transition processes. Finally, the shape of the EQP line will yield information about the local crystal field.

It is to be noted that EQP can also be excited by acoustic pulses.[3]

*sh = sinh, ch = cosh.

†[**ab**] = **a** × **b**.

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Translated by L. M. Matarrese
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RECOMBINATION RADIATION OF GaAs AND Ge ON EXCITATION WITH FAST ELECTRONS

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IT has been proposed earlier[1] to use the interband carrier transitions in semiconductors to obtain states with population inversion for the purpose of constructing an optical maser. Later a hypothesis was put forward on the possibility of obtaining a state with population inversion in semiconductors by irradiation with a flux of fast electrons.[2]

From this standpoint it was of definite interest to investigate the recombination radiation of semiconductors excited by fast-electron bombardment. Until now this radiation has not been investigated at all.

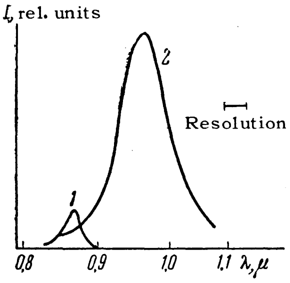
When semiconductors are irradiated with fast electrons there is a volume excitation of carriers and the influence of surface effects can be reduced to minimum.

In the present work we detected the recombination radiation of germanium and n-type gallium arsenide on irradiation with a beam of electrons of ≈ 0.6 MeV energy, obtained from a linear electron accelerator.

GaAs and Ge samples in the form of single crystals of $4\times4\times10$ and $10\times10\times2$ mm dimensions, respectively, were placed on a cold duct in a cryostat and cooled to the temperature of liquid nitrogen. The electron beam entered the cryostat through a window covered with aluminum foil $50\,\mu$ thick. Through another window the image of the sample was projected onto the slit of an IKS-12 spectrometer. The electron accelerator produced pulses of 2 μsec duration and 400 cps repetition frequency. The average current in the electron beam incident on the sample was $\approx 1\,\mu$A. An FÉU-28 photomultiplier (in the case of GaAs) and a PbS photoresistor (in the case of Ge) were used as radiation detectors.

The intensity of radiation from the samples increased sharply on cooling from room temperature to that of liquid nitrogen. The radiation of germanium decayed exponentially with a time constant of ≈ 200 μsec. The duration of GaAs radiation was equal to the duration of the electron pulse.

The spectrum of the GaAs radiation was deduced from the amplitudes of the photomultiplier pulses on the screen of an oscillograph. The spectrum obtained in this way is shown in the figure. The width of the radiation line in this experiment was governed by the minimum width of the IKS-12 spectrometer slit, which was 0.3 mm.



Spectrum of recombination radiation of GaAs on excitation with fast electrons: 1) T = 300°K; 2) T = 77°K. I is the intensity in relative units.

The limited power of the accelerator used in the present work did not make it possible to reach a carrier density sufficient for a state with population inversion. In later work it is proposed to increase the accelerator current considerably in order to carry out experiments at higher excitation levels.

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GALVANOMAGNETIC PROPERTIES OF RHENIUM

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We have already reported[1] that rhenium has an open Fermi surface. It was of interest to determine the topological nature of this surface. For this purpose we investigated single crystals of pure rhenium which had different orientations of the crystallographic axes with respect to the sample axes. The single crystals were obtained, as before, by melting and crystallization of rhenium rods (fired from a powder) in an electron-beam furnace.

From the prepared single crystals, plates mostly of dimensions 0.3 × 0.5 × 5 mm were cut by electro-spark machining. The electrical resistance of the samples changed between room temperature and 4.2°K [$\rho(300°K)/\rho(4.2°K)$] by a factor of between 1100 and 2100. Measurements were carried out both in a constant field and in pulse fields. During measurements in the constant field the field magnitude or its direction with respect to the crystal axes was varied linearly with time; this made it possible to record the dependence of the relative change in the resistance, $\Delta\rho/\rho = (\rho_H - \rho_0)/\rho_0$, on the magnitude and direction of

Sample No.	Orientation*		$\rho(300°K)/\rho(4.2°K)$	Sample No.	Orientation*		$\rho(300°K)/\rho(4.2°K)$
	θ	ξ			θ	ξ	
1	70	17	265	7	60	0	1740
2	0	0	1220	8	70	0	1550
3	0	0	1600	9	80	0	1100
4	90	0	1650	10	90	0	1650
5	40	0	1780	11	90	15	2000
6	50	0	1450	12	90	30	2100

*θ is the polar and ξ is the azimuthal angle of the sample axes with respect to the principal axes of the crystal (in degrees).