ENERGIES AND RELATIVE INTENSITIES OF 2201, 2490, AND 2508 keV γ LINES IN THE SPECTRUM OF Ga^{72}

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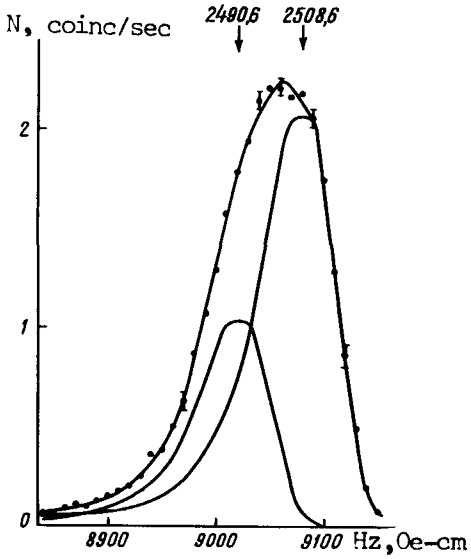
The Ga^{72} γ-ray spectrum was investigated in detail by Johns et al. [1], using the photoelectrons and a double-focusing spectrometer, and by Vitman et al. [2] using the recoil electrons and the VNIIM (Metrology Institute) elotron. However, the intensities given in the two papers for the strong hard lines differ by 20 - 60%, which is way beyond the experimental error. Yet these lines are suitable for energy and intensity calibration of γ spectrometers.

We measured the 2201, 2490, and 2508 deV lines of Ga^{72} with the FTI (Physico-technical Institute) elotron for the purpose of obtaining more accurate values for their energies and intensity. To resolve the 2490 + 2508 keV doublet into its components (see the Figure) we used the shape of the 2201-keV line, since it has already been shown [3] that the line shape is independent of the energy if $h\nu \geq 1.5$ MeV. Our results are listed in the table, which contains for comparison the results of [1,2] as well as the results of Hegran and Lind [4]. We see that our intensity values corroborate the results of [2]. The values of the intensities of the hard lines given by Johns et al. [1] are apparently too high.



The 2462-keV line reported in [2] did not show up in our experiments. The existence of a line having this energy appears doubtful.

Energies and relative intensities of the 2201, 2490, and 2508 keV lines of Ga^{72}

Our data		Hedgran and Lind [4]	Johns et al. [1]		Vitman et al. [2]	
E, keV	I_{rel}	E, keV	E, keV	I_{rel}	E, keV	I_{rel}
2201.3 ± 0.6	100		2201	100	2205 ± 4	100
2490.6 ± 1.8	25.4 ± 1.7	2491 ± 3	2490	33.4	2490 ± 5	23.8 ± 2.2
2508.6 ± 1.0	50.5 ± 1.6	2508 ± 2	2508	56.5	2508 ± 5	51.7 ± 3.3

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[1] Johns, Chidley, and Williams, Phys. Rev. 99, 1645A (1955).

[2] Vitman, Voinova, and Dzhelepov, Izv. AN SSSR ser. fiz. 27, 249 (1963), transl. Bull. USSR Acad. Sci. Phys. Ser. 27, 261 (1963).

[3] Sergeev, Voinova, Dzhelepov, Kalinichev, and Kaminker, PTE No. 5, 1965.

[4] A. Hedgran and D. Lind, Arkiv. fys. 5, 177 (1952).

EFFECT OF SPIN ON THE LONGITUDINAL MAGNETORESISTANCE IN INDIUM ANTIMONIDE AT 4.2°K

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The effect of spin on the longitudinal magnetoresistance for a degenerate electron gas with the carriers scattered by ionized impurities was considered theoretically by A. L. Efros [1]. He has shown that whenever

$$\zeta = h\Omega(N + \frac{1}{2}) + S\mu H \qquad (N = 1, 2, \ldots) \qquad (1)$$

the component σ_{zz} of the conductivity tensor has sharp minima, and the experimentally measured quantity $\rho_{zz} = 1/\sigma_{zz}$ has sharp maxima. Here μ is the spin moment of the electron, N the principal quantum number, ζ the chemical potential, $\Omega = eH/m^*c$ the Larmor frequency, and $S = \pm 1$. Thus, as in the transverse magnetoresistance, the spin should lead to doubling of the maxima. If the spin does not flip during the scattering process then, according to [1], no zeroth maximum 0^+ should be observed. The conditions for experimental observation of the influence of spin splitting of the Landau levels on the quantum oscillations of the resistance in a longitudinal magnetic field are the same as in a transverse field. We have observed earlier [2] the influence of spin splitting of the Landau levels on the transverse magnetoresistance in InSb.

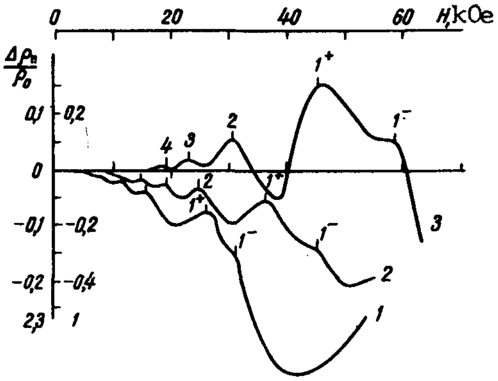

Fig. 1. Plot of $\Delta\rho_{\parallel}/\rho_0(H)$ for samples 1 - 3.

In this paper we present experimental evidence of the influence of the spin on the quantum oscillations of the longitudinal magnetoresistance in indium-antimonide samples at 4.2°K. The results of measurements of $\Delta\rho_{\parallel}/\rho_0(H)$ for samples 1 - 3 are shown in Fig. 1 (1 - $n = 4 \times 10^{16}$ cm^{-3}, 2 - $n = 7.35 \times 10^{16}$ cm^{-3}, 3 - 9.6×10^{16} cm^{-3}). To identify the maxima, the measurements were made up to magnetic field values for which the oscillations vanished and $\Delta\rho_{\parallel}/\rho_0(H)$ varied monotonically. Figure 2 shows the $\Delta\rho_{\parallel}/\rho_0(H)$ curve for sample No. 3. The same figure shows for comparison the $\Delta\rho_{\perp}/\rho_0(H)$ curve for the same sample. The bars in Figs. 1 and 2 mark the positions of the experimentally observed maxima, while the indices 0^+, 1^-, 1^+, 2, etc. indicate the numbers of the maxima.

It is seen from Figs. 1 and 2 that the first maxima split into 1^+ and 1^-. Comparison with the transverse oscillations in the same samples show that the positions of the longitudinal and transverse maxima for N = 1, 2, etc. coincide quite satisfactorily.