THE SHUBNIKOV-DE HAAS EFFECT IN INDIUM ANTIMONIDE

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Influence of spin splitting of the Landau level on the Shubnikov–de Haas effect is detected and studied in indium antimonide at helium temperatures.

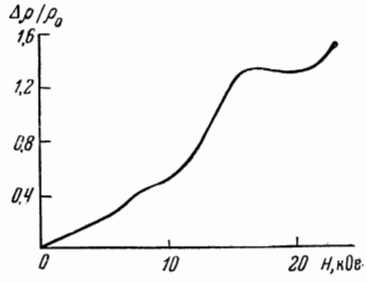
THE Shubnikov–de Haas effect in InSb was investigated by several workers [1-3]. The results of [1,2] were interpreted on the basis of the positions of the oscillation minima. The error of this analysis was demonstrated by Shalyt and Éfros [4]. Furthermore, the spin splitting was not investigated in [1-3]. The influence of the latter on the Shubnikov–de Haas effect was calculated by L. É. Gurevich and A. L. Éfros [5] and was observed by us experimentally [6] in strong magnetic fields at 20°K.

In magnetic fields up to 20—30 kOe, the influence of the splitting of the Landau levels with m = 1, 2, 3 on the Shubnikov–de Haas effect was not observed in either InSb [1-3] or in InAs [4]. It must be borne in mind, however, that the oscillating $\Delta\rho(H)/\rho_0$ curves can be expected to exhibit an additional maximum of oscillations of magnetoresistance as a result of the splitting of the Landau level with n = 0.

We measured $\Delta\rho/\rho_0$ in a transverse magnetic field in several InSb specimens, using an electronic automatic two-coordinate potentiometer, at liquid-helium temperature. A typical plot of $\Delta\rho/\rho_0$ against H for one of the samples is shown in the figure. The measurement and calculation results are summarized in the table.

In the table n —electron concentration, m* — effective mass, m_0 —mass of free electron, g — spectroscopic splitting factor, H_0 —magnetic field at which a maximum of $\Delta\rho/\rho_0$ is observed for n = 0, n —quantum number.

The values of g were calculated by the Gurevich–Efros formula [5] for the case when $|g| \gg 2$ [6]. In the calculation we used the values of H_0 which we determined experimentally; the values of $m^*(0) = 0.014\, m_0$ were taken from [7,8] with allowance for their variation in the magnetic field. We see from the table that the values we obtained for |g| in fields 8000—24,000 Oe fluctuate in the 64—70 range.



Dependence of the magnetoresistance on the magnetic field intensity for InSb sample No. 3. T = 4.2°K.

Sample No.	10^{-15} n,cm^{-3}	T°, K	H_0, Oe	m^*/m_0	|g|
1*	1.0	1.7	4980	0.0145	65
2	2.0	4.2	7900	0.0148	64
3	6.7	4.2	17000	0.0158	65
4	1.1	3.2	~23000	0.0159	70

*The experimental results for sample No. 1 were taken from [1].

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