APPENDIX: METHOD OF OBTAINING CARRIER DENSITIES AND MOBILITIES

Assuming a value of unity for the Hall scattering factor, the low-field Hall coefficient can be expressed as[26]

$$R(0)=-\frac{1}{e}\,\frac{nb^2-p}{(nb+p)^2}\quad, \tag{A1}$$

where n and p are the electron and hole concentrations, respectively, and b is the electron-to-hole mobility ratio. Since b is greater than 100, $nb^2 \gg p$ for very low values of n/p and

$$R(0)\simeq-\frac{1}{e}\,\frac{nb^2}{(nb+p)^2}\quad. \tag{A2}$$

Expressing $R(0)$ in terms of the electron and hole contributions to the conductivity and rearranging gives

$$n=-\frac{1}{R(0)e}\left(1+\frac{\sigma_p(0)}{\sigma_n(0)}\right)^{-2}\quad. \tag{A3}$$

The electron mobility can be expressed as

$$\mu_n=R(0)\,\sigma\,(0)\left(1+\frac{\sigma_p(0)}{\sigma_n(0)}\right)\quad. \tag{A4}$$

The conductivity, in a magnetic field, can be expressed as

$$\sigma(B)=\frac{\sigma_n(B)\,\sigma_p(B)[R_n(B)+R_p(B)]^2}{\sigma_n(B)R_n(B)^2+\sigma_p(B)R_p(B)^2}\quad, \tag{A5}$$

where $R_n(B)$ and $R_p(B)$ are the Hall coefficients which would be obtained if only the electrons or only the holes were present, and similarly $\sigma_n(B)$ and $\sigma_p(B)$ are the hole and electron transverse magnetoconductivities.

Because of the high values of b in $Hg_{1-x}Cd_xTe$, a range of fields exists for which $\mu B \gg 1$ and $\mu_p B \ll 1$. In this range, we can replace the coefficients for electrons in Eq. (A-5) by their saturation values and the coefficients for holes by their low-field values. Then

$$\sigma(B)=\frac{\sigma_n(\infty)\sigma_p(0)[R_n(\infty)+R_p(0)]^2}{\sigma_n(\infty)R_n(\infty)^2+\sigma_p(0)R_p(0)^2}\simeq\sigma_p(0)\quad. \tag{A6}$$

The approximation is valid for our samples where $n \ll p$ and $b \gg 1$. Thus, $\sigma_p(0)$ can be obtained from the "saturation" value of $\sigma(B)$ (see Fig. 4). $\sigma_n(0)$ can be obtained from the conductivity in zero field, since

$$\sigma_n(0)=\sigma(0)-\sigma_p(0)\quad. \tag{A7}$$

Having determined $\sigma_p(0)$ and $\sigma_n(0)$, n may be obtained from Eq. (A3) and μ_n from Eq. (A4). When $\sigma_n(0) \gg \sigma_p(0)$, the method reduces to obtaining n directly as $1/R(0)e$ and μ_n as $R(0)\sigma(0)$. When $\sigma_n(0) \ll \sigma_p(0)$, the determination of n and μ_n becomes inaccurate.

p is obtained from the high-field Hall coefficient, since

$$p=1/R(\infty)e+n\quad. \tag{A8}$$

For $n \ll p$

$$p\simeq 1/R(\infty)e\quad. \tag{A9}$$

The hole mobility μ_p is determined from

$$\mu_p=\sigma_p(0)/pe\quad. \tag{A10}$$

---

*Work sponsored in part by the Department of the Air Force. Some of the work was carried out at the Francis Bitter National Magnet Laboratory.

†Permanent address: Royal Radar Establishment, Malvern, Worcs., England.

[1]D. Long and J. L. Schmit, in *Semiconductors and Semimetals*, edited by R. K. Willardson and A. C. Beer (Academic, New York, 1970), Vol. 5, p. 175.

[2]T. C. Harman, in *Physics and Chemistry of II-VI Compounds*, edited by M. Aven and J. S. Prener (North-Holland, Amsterdam, 1967), p. 767; in *Proceedings of the International Conference on II-VI Semiconducting Compounds, Providence*, 1967, edited by D. G. Thomas (Benjamin, New York, 1967), p. 982.

[3]S. H. Groves and W. Paul, in *Proceedings of the International Conference on Semiconductor Physics* (Dunod, Paris, 1964), p. 41.

[4]E. O. Kane, in *Semiconductors and Semimetals*, edited by R. K. Willardson and A. C. Beer (Academic, New York, 1966), Vol. 1, p. 75; J. Phys. Chem. Solids 1, 249 (1957).

[5]S. H. Groves, T. C. Harman, and C. R. Pidgeon, Solid State Commun. 9, 451 (1971).

[6]T. C. Harman, W. H. Kleiner, A. J. Strauss, G. B. Wright, J. G. Mavroides, J. M. Honig, and D. H. Dickey, Solid State Commun. 2, 305 (1964).

[7]R. R. Galazka and T. Zakrewski, Phys. Status Solidi 23, K39 (1967).

[8]J. D. Wiley and R. N. Dexter, Phys. Rev. 181, 1181 (1969).

[9]R. A. Stradling and G. A. Antcliffe, J. Phys. Soc. Japan 21, S374 (1966).

[10]V. I. Ivanov-Omskii, B. T. Kolomiets, Yu. F. Markov, A. Sh. Mekhtiev, and K. P. Smekalova, Fiz. Tekh. Polnprov. 1, 1442 (1967) [Sov. Phys. Semicond. 1, 1203 (1967)].

[11]V. I. Ivanov-Omskii, B. T. Kolomiets, A. A. Markova, and A. Sh. Mekhtiev, Phys. Status Solidi 32, K83 (1969).

[12]W. Scott and R. J. Hager, J. Appl. Phys. 42, 803 (1970).

[13]C. T. Elliott and I. L. Spain, Solid State Commun. 8, 2063 (1970).

[14]C. T. Elliott, J. Phys. D 4, 697 (1971).

[15]S. Otmezguine, F. Raymond, G. Weill, and C. Vérié, in *Proceedings of the Tenth International Conference on the Physics of Semiconductors*, edited by S. P. Keller, J. C. Hensel, and F. Stern (U. S. Atomic Energy Commission, Cambridge, Mass., 1970), p. 536.

[16]R. Piotrzkowski, S. Porowski, Z. Dziuba, J. Ginter,