(42) and (43) of reference 3 should be primed; in the notation of their paper, with the exception of g which is defined in Eq. (2) above; and with F^2+G^2 now equal to the $|v|^2$ of their paper, we have

$$\Gamma_n'^{(r)}=-(2x/|v|^2)[(df_0/dE)-(dg/dE)]^{-1}{}_{E=E_r},$$
$$\Gamma_a'^{(r)}=-2h[(df_0/dE)-(dg/dE)]^{-1}{}_{E=E_r}; \quad (6)$$

$a^{-1}f_0$ is the real part of the logarithmic derivative of the wave function at the nuclear surface. The unprimed Γ's of expressions (41) and (12) remain unchanged.

An example where this correction is important is the 456-kev resonance in the $C^{12}(p\gamma)$ reaction. The quantity dg/dE, which can be obtained from Breit's tables,[2,4] is here actually larger than df_0/dE; the sign of dg/dE is such that Γ is about $2\frac{1}{2}$ times larger than the observed width, Γ'. With this correction the reduced width, γ^2, becomes about equal to $\hbar^2/Ma$, M is the reduced mass (the exact value of γ^2 is sensitive to the value of the nuclear radius that is used). This reduced width $\hbar^2/Ma$ is equal to that given by Eq. (64) of reference 1 for a square well interaction and likewise the limiting value given by Eq. (44) of this same reference. This is an indication that the s-wave $C^{12}+p$ interaction can be treated as a simple one-body problem. The reduced width of the low energy neutron s-wave scattering by C^{12} is also equally large. This width is determined by fitting a one-level dispersion curve, including s-potential scattering, to the neutron scattering data up to 2 Mev, where scattering from higher partial waves becomes important. The scattering length in the low energy region is positive, and the bound state associated with it is the 3.10-Mev level of C^{13}. The correspondence of this bound level with the 456-kev resonance level of N^{13} has been pointed out.[5] In showing this correspondence it is necessary to consider this correction given by Eq. (4). A detailed report on the s-wave proton and neutron interaction with C^{12} will be forthcoming.

In applying the one-level dispersion theory at energies considerably off resonance, formulas (1) above or (38) and (39) of reference 3 should be used rather than the approximate expression (3); that is, f_0 may be a linear function of E (basic assumption of the one-level formula) over a wider range of energies than g.

In the case of s-wave neutron reactions, g is zero so that there is no correction. For higher partial waves dg/dE can be calculated from the penetrability factors $|v|^2$ given by Eqs. (45a) of reference 3; in the case of p neutrons $Edg/dE=(ka)^2[1+(ka)^2]^{-2}$. For example, if the resonance at 1.2 Mev in the scattering of neutrons by He^4 is p-wave, then $dg/dE=0.16$ Mev^{-1}. Supposing $\gamma^2=\hbar^2/Ma$, a being taken as $2.5\cdot10^{-13}$ cm, then the observed width at resonance would be $\Gamma'=0.76$ Mev. Were γ^2 infinite, the observed width would be only 1.2 Mev.

An exact criterion for the application of this correction cannot be given. It is probably not negligible for resonances for which $\gamma^2\gtrsim\hbar^2/10Ma$ (s-neutron resonances, of course, being excepted).

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The Hall Coefficient of Semiconductors

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IN a recent letter Johnson and Lark-Horowitz[1] have given an expression for the Hall coefficient of a semi-conductor which takes into account both thermal and impurity scattering of electrons in the conduction band. This theory is based on the following assumptions. (1) The mean free path for thermal scattering, l_1, is independent of the velocity of the electrons, and the mean free path for impurity scattering, l_2, is proportional to the fourth power of the velocity. The actual mean free path l is thus given by

$$l=l_1l_2/(l_1+l_2). \quad (1)$$

(2) It is assumed that the resistivity ρ can be expressed as the sum of the resistivity ρ_T due to thermal scattering alone plus the resistivity ρ_I due to impurity scattering alone; i.e.,

$$\rho=\rho_T+\rho_I. \quad (2)$$

The Hall coefficient R is then given by the equation

$$R/(1/ne)=(\sqrt{\pi}/48)(\rho/\rho_I)^2\int_0^\infty x^{9/2}e^{-x}dx/(1+\theta x^2)^2, \quad (3)$$

where, as a result of Eq. (2), θ is set equal to $\frac{1}{6}[(\rho/\rho_I)-1]$. This theory, however, appears to be not entirely satisfactory, for assumption (2) is not consistent with Eq. (1), which leads directly to Eq. (3). If the resistivity is determined from Eq. (1), it is easy to show that the Hall coefficient can be expressed as a function of ρ_I/ρ by Eq. (3) and the equation,

$$\rho_I/\rho=\tfrac{1}{8}\int_0^\infty x^3e^{-x}dx/(1+\theta x^2), \quad (4)$$

in terms of the parameter $\theta=\rho_T/6\rho_I$, which is now no longer equal to $\frac{1}{6}\{(\rho/\rho_I)-1\}$.

Figure (1) shows $R/(1/ne)$ as a function of ρ_I/ρ as determined

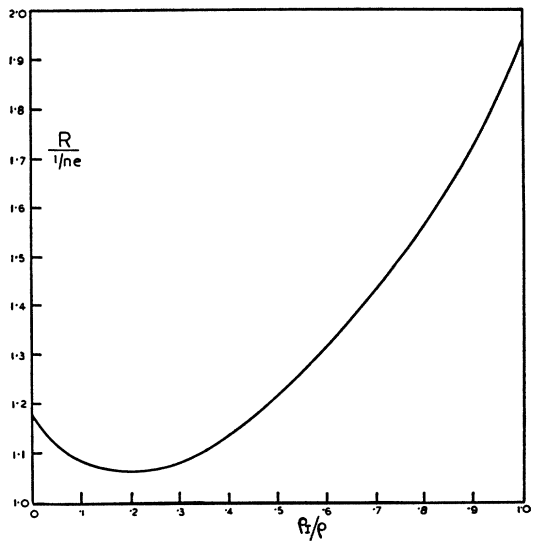

FIG. 1. Variation of the Hall coefficient R with the ratio of the resistance due to impurity scattering to total resistance; n is the number of electrons per cc.

from Eqs. (3) and (4). The integral of Eq. (4) can be expressed in finite terms, but Eq. (3) must be evaluated numerically. It will be noticed that, except at the end points, the values of $R/(1/ne)$ lie higher than those given by Johnson and Lark-Horowitz [Fig. 1, of reference 1]. A consequence of this is that the mobilities as given by these authors in a later letter,[2] should be generally reduced; e.g., by a factor of 1.8 at $\rho_I/\rho=0.2$ and by a factor of 2.0 at $\rho_I/\rho=0.5$. The discrepancy between the original values of the mobilities and the higher values found by Pearson, *et al.*,[3] would not, therefore, appear to be removed in the manner suggested.

From Eq. (4) it is easy to find the ratio $\rho/(\rho_T+\rho_I)$. It reaches a maximum value of approximately 1.43 at ρ_I/ρ in the neighborhood of 0.30.

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