COMMENTS AND ADDENDA

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Measurement of conduction-electron-spin relaxation in sodium, 14–20 K—A correction

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Surface relaxation was improperly treated in a previous paper by Wang and Schumacher. The treatment is corrected here, and the data are replotted. The correction leaves unchanged our measured values of T_2 in the temperature range 14–20 K, but changes our estimate of surface-relaxation probability per electron-surface collision from 10^{-3} to on the order of 10^{-4}.

In a paper on surface relaxation of electron spins in simple metals, Walker[1] gives the following expression for the surface-relaxation contribution to the inverse measured relaxation time T_2^{-1}:

$$\left(\frac{1}{T_2}\right)_{\text{surf}} = \frac{\epsilon(1+B_0)}{1-\epsilon}\,\frac{1}{\tau} \equiv \frac{\epsilon'}{\tau}\ , \qquad (1)$$

where ϵ is the electron spin-flip probability per surface collision, B_0 is a Fermi-liquid parameter, and τ^{-1} is the mean electron-collision rate with the surface. For a thin slab of thickness L, τ^{-1} is given by (v/L), where v is the Fermi velocity, as long as $(D\tau_s)^{1/2} > L$, where D is the diffusion constant for electrons, and τ_s the relaxation time for processes other than surface relaxation. $(D\tau_s)^{1/2}$ is the diffusion length in time τ_s. Equation (1) is valid whether or not the electron mean-free-path Λ is long or short compared to L, for reasons clearly explained by Walker.[1]

In our paper,[2] in which measurements of the conduction-electron-spin-resonance (CESR) linewidth in thin slabs of sodium metal were reported, τ was incorrectly given as the mean diffusion time across the sample, since the $\Lambda \ll L$ was satisfied in all of the samples in the liquid-H_2 temperature range. Consequently the measured inverse transverse relaxation time was plotted against L^{-2} in an attempt to extract the surface-relaxation contribution. The correct plot should be T_2^{-1} vs L^{-1}. We replot in Fig. 1 the data from groups I and III of Fig. 2 of Ref. 2, in the form T_2^{-1} vs L^{-1}, and replace Table I of Ref. 2 with the new results which we place in our Table I. The principal change from our previous interpretation of the data is that we now find $\epsilon' = (0.7 \pm 0.3)\times 10^{-4}$, and it is, of course, temperature independent. ϵ' now agrees with a rough estimate made on similar samples, similarly prepared, in a microwave-transmission experiment by Witt.[3] The reinterpretation of the data has left essentially unchanged the principal object of the measurement, $T_2(T)$, and Figs. 3 and 4 of Ref. 2 are left unaltered. Our results are not accurate enough to detect a contribution to surface relaxation proportional to ϵ'^2, which *does* depend

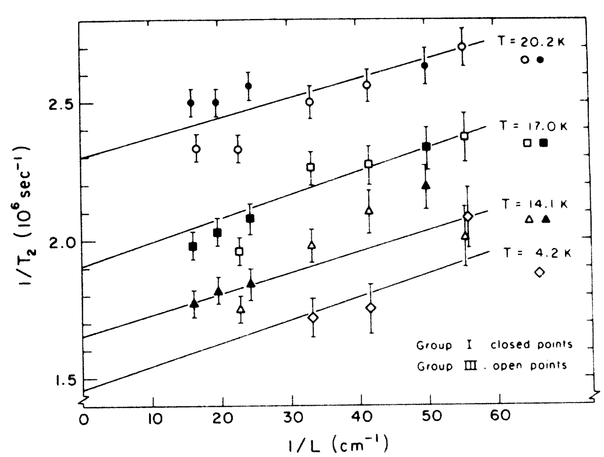

FIG. 1. The measured inverse linewidth T_2^{-1} vs the inverse sample thickness L^{-1} for the group I (solid dots) and group III (open circles) data of Ref. 2.

TABLE I. Slope and intercept vs temperature (from Fig. 1, we have used $v_F = 1.1 \times 10^8$ cm/sec).

T (K)	20.2	17.0	14.1	4.2
slope $= v_F \epsilon'$	0.0076 ± 0.0025	0.0084 ± 0.003	0.0076 ± 0.002	0.009 ± 0.006
$(T_2)^{-1}$ intr. + imp. (10^6 sec^{-1}) (intercept)	2.3 ± 0.15	1.9 ± 0.1	1.64 ± 0.08	1.46 ± 0.2
(T_2) intr. + imp. (10^{-7} sec)	4.35 ± 0.2	5.0 ± 0.2	6.1 ± 0.3	7 ± 1
ϵ' (10^{-4})	0.70 ± 0.25	0.76 ± 0.30	0.7 ± 0.2	0.8 ± 0.5

on Λ, and hence on temperature as recently calculated by Walker.[4]

We wish to thank Dr. J. H. Pifer and Richard Magno of Rutgers University, and M. B. Walker of the University of Toronto for pointing out the error in our interpretation; also Dr. Walker for sending his paper containing the term ϵ'^2 prior to publication.

[1]M. B. Walker, Phys. Rev. B 3, 30 (1971). The discussion in this addendum refers to Eq. (5.16) of this paper, and the subsequent discussion on p. 38, left column.

[2]S.-K. Wang and R. T. Schumacher, Phys. Rev. B 8, 4119 (1973).

[3]C. E. Witt, Ph.D. thesis (Carnegie-Mellon University, 1971) (unpublished).

[4]M. B. Walker, Phys. Rev. B 8, 5035 (1973).