Letters to the Editor

PUBLICATION of brief reports of important discoveries in physics may be secured by addressing them to this department. The closing date for this department is five weeks prior to the date of issue. No proof will be sent to the authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents. Communications should not exceed 600 words in length and should be submitted in duplicate.

IMPORTANT ANNOUNCEMENT

BEGINNING with the issue dated July 1, *The Physical Review* will no longer carry Letters to the Editor. These will be published in a supplemental semimonthly journal tentatively called ***Physical Review Letters***. By the use of offset printing the Letters will appear about two to three weeks after receipt instead of the present six to ten weeks. The new *Physical Review Letters* will also print copies of the abstracts of future Physical Review articles.

Physical Review Letters will initially be sent gratis to all subscribers of *The Physical Review*. However, beginning January, 1959, a subscription price will be charged amounting to $5 for members of the American Physical Society and $10 for nonmembers. At that date the publication charge in *Physical Review Letters* will be set at $30 instead of the present $25 per page.

The aim of *Physical Review Letters* is to improve communication among physicists, thereby speeding up the flow of ideas, increasing the interaction of results on related work, and reducing duplication of effort. It will make important results available promptly to all physicists and not merely to the privileged few whose names happen to appear on mailing lists for preprints.

Such a fast-publishing journal may become very popular with authors and could soon grow beyond reasonable bounds. It is therefore our intention to maintain the same strict standards for *Physical Review Letters* as are now in operation for Letters to the Editor. We expect that on the average only about fifteen letters will be acceptable for each issue. Letters will be accepted only if they contain important new discoveries or cover topics of high current interest in rapidly changing fields of research. Contributions that do not conform to these requirements do not deserve the very special handling given Letters and, no matter how short they may be, should be submitted for publication as Articles in *The Physical Review*. Letters must be self-contained in that readers should be able to understand the physics of the contribution—i.e., the procedure followed and the arguments used. We shall reject all Letters which *merely* claim results, announce future publications, or advertise papers published elsewhere. We shall also try to discourage the publication of a research program in a series of Letters instead of in a comprehensive article.

We have never adhered strictly to the size limitation of Letters (600 words) but we prefer that they be less than a printed page (1000 words) and contain no more than two figures. Contributions of excessive length cannot be accepted as Letters.

Since speedy publication allows no time for thorough refereeing, the Editor is likely to make mistakes and to include occasionally Letters of minor importance or below our usual standards. Such occurrences cannot be used as a precedent to require the Editor to accept similar Letters later on.

To assure speedy publication it is absolutely essential that manuscripts reach us in well-edited form. We have no time to perform a library research to complete faulty references, to locate references in the text, to correct errors in equations, to define undefined symbols, or to identify unclearly written symbols (s or S, κ or k or K, etc.). Figures should be in India ink with the lettering and symbols (also in India ink) large enough so that they are readable after reduction of the figure to three-inch width. Improperly prepared manuscripts will be returned, thereby being delayed in publication.

As in the past, Letters must be submitted in duplicate. From now on we request authors of each Article submitted to *The Physical Review* to enclose a duplicate copy of the abstract of their paper.

Dr. George L. Trigg is the Assistant Editor for *Physical Review Letters*. Circulation and subscriptions will be handled by the American Institute of Physics, 335 East 45 Street, New York 17, New York.

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EDITOR

Positron Annihilation in the Noble Metals

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IN earlier work[1,2] we have been concerned with the analysis of Compton scattering results for simple metals, with the object of deriving information on electronic momentum distributions. However, for heavy metals the Compton profile measurements suffer from the disadvantage that the momentum distribution of the outer electrons is, to a large extent, masked by the distributions associated with the inner-shell electrons.

Recently it has been pointed out by a number of workers that the annihilation of positrons may provide a further experimental technique for obtaining rather

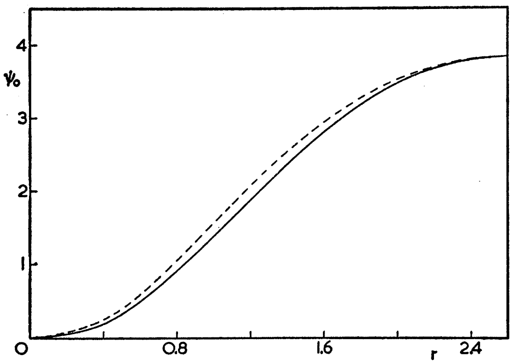

FIG. 1. Positron wave function ψ_0 as a function of radial distance r measured in atomic units. ——— Hartree ion core potential; – – – – Hartree-Fock ion core potential.

direct information on valence electron momenta in solids. Furthermore, at least in simple metals, it has been suggested by Ferrell[3] that there is no evidence of core annihilation, and if this is indeed the case then the advantages of such measurements over the more conventional Compton scattering experiments need no emphasis. However, the observed momentum distributions, and particularly those of the noble metals, reveal substantial contributions from high-momentum components,[4] and as an explanation of such "tails" DeBenedetti *et al.*[5] suggested originally that the positron should be thought of as effectively excluded from the region occupied by the ion core. This so-called "excluded volume effect" has been explored by Ferrell[3] in a semiquantitative manner in order to explain the large "tails" referred to above.

Here we report a computation of the positron wave function for $\mathbf{k}=0$ in Cu by applying the ideas of the Wigner-Seitz method, the potential in the Schrödinger equation for the positron being taken as the ion core potential plus the potential due to a uniform distribution of valence electrons. From a practical point of view it was found convenient to integrate inwards from the cell boundary, introducing directly the requirement that the wave function be flat there,[6] the eigenvalue being varied until a wave function was obtained which decreased smoothly to zero as the nucleus was approached. The results are shown in Fig. 1, where it can be seen that the differences caused by the use of the Hartree-Fock rather than the Hartree core potential are not large, and we think this gives some support to the view that a more realistic account of the potential due to the electrons will not greatly change the nature of this wave function. This function is clearly very appreciably different from that envisaged by earlier workers.

Finally, we have computed the Fourier transform of the wave function product which determines the details of the angular correlation between the photons emitted in the annihilation experiments. We have used the Wigner-Seitz 4s electronic wave function for Cu, and by methods described fully in reference 2, we find that no significant enhancement of the high-momentum components is caused by the deviations of the positron wave functions presented here from plane waves. There is, in fact, found to be no possibility of accounting for the experimental results by any kind of "excluded volume effect."

There is evidently some conflict between our findings and those of earlier workers, but some limited support for our conclusions seems to be provided by the very recent investigations of Lang and DeBenedetti,[7] who find that to obtain even rough agreement with experiment, the "excluded volumes" in the noble metals must be chosen much larger than the core volumes. Our calculation gives no support to such an assumption, and in view of the penetration of the positron wave function into the core we find it difficult to resist the conclusion that the high-momentum components are due to core annihilation. This possibility is now being investigated quantitatively.[8]

1 N. H. March, Proc. Phys. Soc. (London) **A67**, 9 (1954).
2 B. Donovan and N. H. March, Proc. Phys. Soc. (London) **B69**, 1249 (1956).
3 R. A. Ferrell, Revs. Modern Phys. **28**, 308 (1956).
4 See especially A. T. Stewart, Can. J. Phys. **35**, 168 (1957).
5 DeBenedetti, Cowan, Konneker, and Primakoff, Phys. Rev. **77**, 205 (1950).
6 See also the reference by Ferrell[3] to some unpublished work by R. Latter.
7 G. Lang and S. DeBenedetti, Phys. Rev. **108**, 914 (1957).
8 Since this article was prepared, a short abstract reporting work in essential agreement with our conclusions has appeared: see S. Berko and J. S. Plaskett, Bull. Am. Phys. Soc. Ser. II, **3**, 69 (1958).

Coercive Force *vs* Thickness for Thin Films of Nickel-Iron*

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IN recent years a considerable amount of attention has been directed toward the study of thin films of ferromagnetic materials deposited by evaporation from a melt. This interest has been guided by a twofold purpose: first, since the films are extremely thin in one dimension, they offer an aid in understanding the ferromagnetic processes,[1,2] and second, since they exhibit a square hysteresis loop and their magnetization can be reversed rapidly, they may have practical uses as information storage and switching elements.[3,4]

Reports of the variation of magnetic properties with thickness[3–8] of vacuum-deposited samples are numerous, but we have found only two papers which consider the variation of coercive force with thickness.[2,8] Néel has theoretically considered the changes that occur in the