TABLE I. Ratio of the differential cross section for an extended nucleus to that for a point nucleus for 16.5-Mev electrons being scattered by Al and Au nuclei.

$\theta=$	30°			90°			150°		
Z	R_B	R_C	R_{exp}	R_B	R_C	R_{exp}	R_B	R_C	R_{exp}
Al 13	1.00	0.99	0.97	0.97	0.95	0.75	0.89	0.84	0.94
Au 79	0.99	0.97	0.88	0.45	0.30	0.45	0.29	0.19	0.38

between models (B) and (C). R_{exp} would therefore be expected to lie between R_B and R_C. It is seen that in view of the preliminary nature of the experimental results agreement is quite satisfactory.

A full account of this investigation will be published in the *Proceedings of the Physical Society*.

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Stopping Power of K-Electrons

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An expression for the contribution B_K of the K-electrons to the stopping number has been given by Livingston and Bethe[1] in the form

$$B_K(\theta,\eta)=A(\theta)\ln\eta+B(\theta)-C_K(\theta,\eta),\quad [\eta=(mv^2/2Z_{eff}^2Ry)\gg 1]. \tag{1}$$

Here θ is the ratio of the observed ionization potential to the "ideal ionization potential" Z_{eff}^2Ry, m is the electronic mass, and v is the velocity of the incident particle; $A(\theta)$, $B(\theta)$, and $C_K(\theta,\eta)$ can be computed directly by using the excitation and ionization probabilities of the K-shell.[1,2] The coefficient of the $\log\eta$ term is described in reference 1 as "the total oscillator strength of all optical transitions from the K-shell into the continuous spectrum (and to the unoccupied discrete levels)," and the formula has been applied, with this interpretation of $A(\theta)$, to higher atomic shells.[3] It is the purpose of this letter to show that this coefficient, $A(\theta)$, is actually $1+f$ where $2f$ is the above-mentioned total oscillator strength.

The Born approximation expression for the stopping number (per K-electron) is

$$B=\sum_n{}' \int_{q_{\min(n)}}^{q_{\max}} (dq/q)\varphi_n(q), \tag{2}$$

with $\varphi_n(q)=(E_n-E_1)|(e^{iqx})_{1n}|^2/q^2$, E_n being the energy of the nth atomic state and q^2 being the square of the momentum loss of the incident particle divided by $2m$ (both E_n and q^2 measured in units of Z_{eff}^2Ry). Energy-momentum considerations give $q_{max}=(4\eta)^{\frac{1}{2}}$ and $q_{min}=(E_n-E_1)(4\eta)^{-\frac{1}{2}}$; Σ_n' indicates the summation over all unoccupied states. Letting q_1 be a small value of q, independent of n and η, and $q_0=q_{min}(n=\infty)=(4\eta)^{-\frac{1}{2}}$, we can write

$$B=\sum_{\substack{\text{all}\\\text{states}}}\int_{q_0}^{q_{\max}}\varphi_n(q)dq/q-\sum_{\substack{\text{occupied}\\\text{levels}}}\left[\int_{q_0}^{q_1}\varphi_n(0)dq/q+\int_{q_1}^{\infty}\varphi_n(q)dq/q\right]-\sum{}'\int_{q_0}^{q_{\min(n)}}\varphi_n(0)dq/q. \tag{3}$$

This expression is correct, except that in the second and last term $\varphi_n(q)$ has been replaced by $\varphi_n(0)$, neglecting higher terms in q^2 because q_0, q_1, and $q_{min}(n)$ are all small for large η. In the third term, the upper limit q_{max} has been replaced by ∞ because, for occupied states, $\varphi_n(q)$ decreases as q^{-14} with increasing q.

To evaluate the first term, we change the order of summation and integration and use the well-known rule[2] that $\Sigma\,\varphi_n(q)=1$; then we obtain simply $\ln(q_{max}/q_0)=\ln 4\eta$. Since q_0 and q_1 are both independent of n, we obtain for the second term

$$-(1-f)\ln(q_1/q_0)=-\tfrac{1}{2}(1-f)\ln 4\eta-(1-f)\ln q_1$$

where $f=\Sigma'\varphi_n(0)$ is the total oscillator strength per electron for transitions going to unoccupied states. Since q_1 is independent of η and since the third integral converges at $q=\infty$, it yields a result independent of η. The last term gives

$$-\Sigma'\,\varphi_n(0)\ln(q_{min}/q_0)=-\Sigma'\,\varphi_n(0)\ln(E_n/E_1)$$

which is also independent of η. The η-dependent part of B arises therefore from the first and second terms alone and is:

$$\ln\eta-\tfrac{1}{2}(1-f)\ln\eta=\tfrac{1}{2}(1+f)\ln\eta. \tag{4}$$

It is not possible to calculate $B(\theta)$ by this general method, but if we write Eq. (1) in the form

$$B_K(\theta,\eta)=(1+f)\ln(2mv^2/\lambda Z_{eff}^2Ry)-C_K(\theta,\eta), \tag{5}$$

a Born approximation calculation[2] using hydrogenic wave functions gives the results displayed in Table I. The first line of Table I refers to the complete hydrogen atom, the other lines to the K-shells of heavier atoms, θ increasing with Z. It is remarkable that λ is so very nearly constant; note that this makes the "effective ionization potential" close to Z_{eff}^2Ry, not to the observed ionization potential. It may also be useful to note that f is very nearly inversely proportional to θ^2 (last column of Table I).

TABLE I. Calculated results for hydrogenic wave functions.

	λ	f	$\theta^2 f$
Hydrogen	1.1018	1	——
$\theta=0.7$	0.9542	0.813	0.398
0.75	0.9392	0.722	0.406
0.8	0.9295	0.646	0.413
0.9	0.9207	0.525	0.425

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Decay of Au^{199}

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An estimate[1] given for the capture cross section of Au^{198} for slow neutrons was based on the intensity of a 159-kev transition from Au^{199}. A decay scheme for Au^{199} devised by Beach, Peacock, and Wilkinson[2] was used and a value of 3.5×10^4 barns was obtained for the cross section.

The radiations from a Au^{199} source[3] separated from Pt^{199} have since been studied and the complete identity of the spectra from Au^{199} produced by both methods has been shown. Further analysis of the Au^{199} electron conversion spectrum is given in Table I. Other lines present in the spectrum are due to the conversion of mercury K x-rays ($\sim$70 kev) and L x-rays ($\sim$10 kev). If a 230-kev γ-ray is present, as claimed by Beach *et al.*,[2] it can be estimated from the absence of its K conversion line that its intensity is less than 15 percent of the 158.5-kev transition.

The N_K/N_L ratio of 0.37 for the 158.5-kev transition suggests a 2^3-pole electric transition, for which according to Hebb and Nelson the theoretical value is 0.4. However, the N_{LIII}/N_{LI} ratio for electric 2^3, according to Goodrich and Drell,[4] is of the order of 20, whereas the experimental value is $0.55\pm<0.1$. Nor will a combination of 2^2 magnetic and 2^3 electric transitions assist in bringing these values into closer accord with theory. A similar conflict for