ON THE ELASTIC SCATTERING OF 22 MEV ALPHA-PARTICLES BY AU

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In the present note we calculate the elastic scattering of 22 Mev Alpha-particles (1) by Au using the W. K. B. method and a real potencial corresponding to a decreasing of the Coulomb repulsión.

The potencial used is

$$\text{(a)} \quad V(r) = \frac{Ze^2}{R}\left(3 - \frac{r^2}{R^2}\right) \text{ for } r < R; \qquad V(r) = \frac{2Ze^2}{r} \text{ for } r > R.$$

The Coulomb scattering for a point nucleus is given by

$$\sigma_c = |f_c(\vartheta)|^2$$

with

$$f_c(\vartheta) = \frac{1}{2ik} \sum_{l=0}^{\infty} (2l+1) P_l(\cos\vartheta) \left[e^{2i\eta_{lc}} - 1\right].$$

If we modify the potential inside the nucleus and calculate the phase shifts with the W. K. B. aproximation, the angular distribution function will be given by

$$f(\vartheta) = f_c(\vartheta) + \frac{1}{2ik} \sum_{l=0}^{l'} (2l+1) P_l(\cos\vartheta) \left[e^{2i\eta_l} - e^{2i\eta_{lc}}\right]$$

where l' is determined by

(1) N. S. WALL, J. R. REES and K. W. FORD, *Phys. Rev.* *97*, 726 (1955).

$$k^2 - \frac{2m}{\hbar^2}\frac{2Ze^2}{R} - \frac{(l'+1/2)^2}{R^2} = 0$$

and η_l is the new phase shift ([2])

$$\eta_l = \eta_{lc} + \varphi_l = \eta_{lc} + \int^R \left[k^2 - \frac{2m}{\hbar^2} V(r) - \frac{(l+1/2)^2}{r^2} \right]^{1/2} dr -$$

$$\int^R \left[k^2 - \frac{2m}{\hbar^2}\frac{2Ze^2}{r} - \frac{(l+1/2)^2}{r^2} \right]^{1/2} dr$$

m is the mass of the Alpha-particle.

With the potencial (a) φ_l is easily calculated analytically. The results of the calculations are shown in Figure 1.

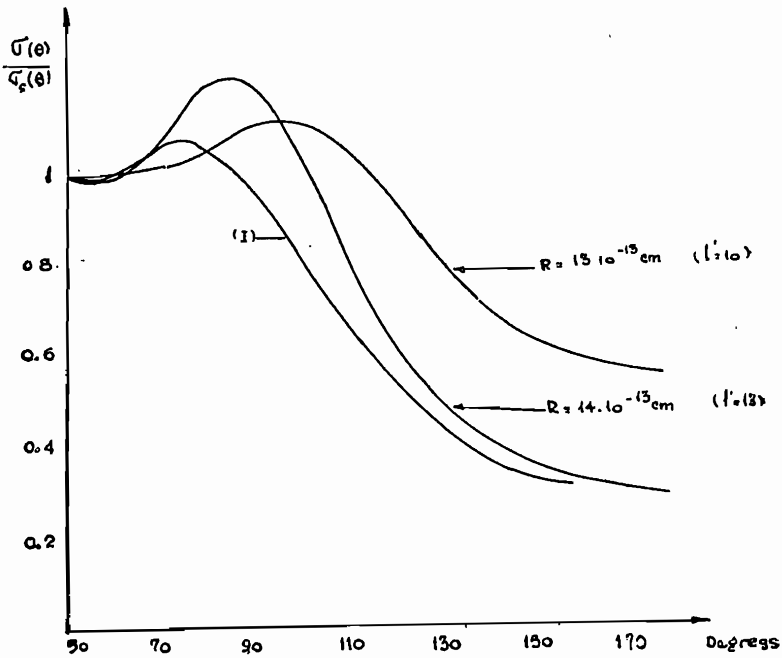

Figure 1

([1]) (I) Experimental curve

([2]) H. Marshall und G. Meyer, *Z. f. Phys. 143*, 17-30 (1955).

We can see that qualitatively the behavior of the calculated cross section is satisfactory, even without the usual introduction of a complex potencial. However the value of the interaction radius R is too big compared with the commonly accepted one, specially, taking into account the results obtained from experiments on high energy electron scattering (3). In this connection, we should emphasize that the potential (a) does not represent a definite charge distribution, but is instead a phenomenological potential including the nuclear interactions.

In a previous (umpublished) calculation (4), Ford and Wheeler using a W. K. B. approximation and an attractive potential inside the nucleus found curves which decreased too rapidly with increasing angles. This fact can be attributed to the particular potential they used.

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BIBLIOGRAFIA

P. B. Fischer, *Arithmetik*, Sammlung Göschen vol. 47, 3ª edición, 19 figuras, 152 páginas, 1958 (2,40 marcos).

Es la tercera edición, sin cambios, de la obra original. Se trata de un libro elemental de aritmética, que aparte del mecanismo operatorio discute claramente los fundamentos y las propiedades formales de las distintas operaciones. El índice dará una idea del contenido: 1. La operación de contar y los números; 2. Los números naturales (operaciones con ellos); 3. Los números enteros (con noticia histórica sobre la introducción de los números negativos); 4. Los números racionales (fracciones ordinarias y decimales); 5. Los números reales (cortaduras de Dedekind, cálculo de raíces, logaritmos); 6. Los números complejos.

En un apéndice se trata un poco de combinatoria, binomio de Newton y matemática financiera.

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(3) Hofstadter, *R.*, *Revs. of Modern Phys*, *28*, 214 (1956).

(4) Cited by H. E. Wegner, R. M. Eisberg and G. Igo, *Phys. Rev. 99*, 825 (1955).