

two carbon atoms close together, and thus diminish the valence angle.

The large discrepancy between the angles in the two compounds is supported by independent evidence. The permanent dipole movements of dimethyl oxide and ethylene oxide are 1.29×10^{-18} and 1.88×10^{-18} e.s.u., respectively, the latter value being thus much larger. Indeed the two moments bear a ratio $\frac{1.29}{1.88} = 0.69$, which is practically

the same as the value $\frac{\cos 51^\circ}{\cos 32^\circ} = 0.74$, which we should expect from their relative valence angles.

In connection with the above calculation of the valence angles from the Raman frequencies, we should add that in both the compounds the binding forces between the atoms come out of the proper magnitude.

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A Note on the Disintegration of α -Particle.

IN a recent paper announced in *Current Science*, 1933, and since published in *Phil. Mag.*, 14, p. 1097, 1933, we have derived the wave-statistical formula connecting the disintegration constant and the velocity of emission of α -particle, viz.,

$$\lambda = \text{Const.} \frac{\sqrt{E}}{\gamma_0^2 h \cot u_0} \cdot e^{-2k(2u_0 - \sin 2u_0)} \quad \dots (1)$$

where E = the energy of the α -particle,

γ_0 = the critical radius of emission, $k = \frac{4\pi z^* e^2}{h \sqrt{2E/m}}$

and $u_0 = \frac{\alpha \gamma_0}{4k}$ in which $\alpha = \frac{4\pi \sqrt{2mE}}{h}$. This

formula has been shown to closely agree with the experiment. From our theory we also obtain an interesting formula for the critical radius of emission, viz.,

$$\gamma_0 = \frac{9}{64\pi} \cdot \frac{hv}{\alpha z^* e^2} = \frac{9}{64\pi} \cdot \frac{h^2}{4\pi m z^* e^2} \quad \dots (2)$$

being independent of the velocity of emission as it should be. It is, however, inversely proportional to the effective atomic number z^* . This appears quite natural when it is remembered that the packing of the nucleus increases with z^* and so the emission is likely to take place even from a smaller γ_0 . For radium emanation Equation (2) gives $\gamma_0 = 1.2 \times 10^{-15}$ cm.

On the other hand, with decreasing z^* , γ_0 increases and so the density of matter within

the nucleus decreases. Ultimately a limit is reached when the damping coefficient or, in the language of wave-statistics, the viscosity of the corresponding phase space becomes vanishingly small and there is no longer spontaneous disintegration. Let us take the case of hydrogen, for which Equation (2) gives $\gamma_0 \sim 10^{-13}$ cm. There being no spontaneous disintegration in this case, the critical γ_0 should correspond to the size of the hydrogen nucleus consisting of a single proton. It is significant that γ_0 thus obtained is exactly of the right order for a free proton.

We shall conclude with a few remarks on the parallel wave-mechanical theories given by Gamow, Sexl and others. It may be noted that they do not obtain any expression for the critical radius of emission corresponding to the wave-statistical Equation (2). However, their equation for the disintegration constant is more or less similar to our equation (1). The important difference arises on account of their dropping the unknown constant which should involve the unknown normalising factor and some other unknown constant. They define $\lambda = \frac{G}{\tau}$, where G is the transmissibility and $\tau = \frac{2\gamma_0}{v}$, v being the velocity. It, however, appears to us that within the hard core τ can only be proportional to $\frac{2\gamma_0}{v}$ and not equal to it. This explains the latter constant. That the normalising factor has been dropped is evident from Sexl's rigorous treatment of the problem in *Zeit. f. Phys.*, 56, p. 62, 1929 and 81, p. 163, 1933.

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The Effect of Magnetic Field on Streams of Charged Particles.

ABOUT three months ago I announced the results of some of my observations on the effect of magnetic field on charged particles in motion. A short press report of this work was published later on in several newspapers in different parts of India on or about the 22nd January 1934. The following is a summary of some of those results obtained by me :—