Suspecting that wave interference from multiple path transmission is the cause of some of the fading, we have recently applied the frequency sweep method of demonstrating multiple paths. A short-circuiting ring rotating in the tank circuit coil of the transmitter oscillator gave a frequency variation of 6·2 megacycles at about 66 megacycles. The receiver band width, 3 db. down, was 3·2 megacycles. Observations were made by photographing with cinema camera the pattern of the cathode ray tube, whose sweep frequency was synchronised with the rotation of the short-circuiting ring. These pictures have indicated that the fading is usually tied up with wave interference. A sample observation covering 95 seconds is given in Fig. 1, where five frames best

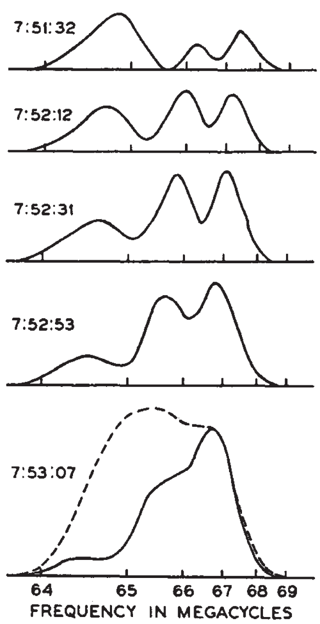

FIG. 1. Typical series of cathode ray oscillograph patterns. Ordinates are proportional to signal voltage squared. Dotted curve is the measured overall characteristic of the transmitter-receiver system for free space. Taken Dec. 13, 1935, 7.50 a.m.

illustrating the sequence have been copied from the film. The phenomenon is complex; apparently at least three components are here present. The multiple minimum structure suggests a pair of components with some 240 metres path difference ($3 \times 10^{10}/\Delta f = \Delta d$, Δf = frequency difference between minima, Δd = path difference in cm.), while the superposed broad moving minimum requires a close variable twin of one of the pair. (This fine structure can serve as a very sensitive indicator of path difference stability.)

It is our experience that while some fades are apparently due to only two components, in general the cathode tube pattern is so complicated that three or more components are required. A stratified atmosphere is the obvious explanation of these multiple transmissions, and the existence of such strata has been independently shown by plotting the dielectric constant of the air versus height from data furnished us by the U.S. Weather Bureau. This Bureau obtains daily pressure, temperature and humidity soundings of the atmosphere by aeroplane. No Kennelly-Heaviside layer reflection has yet been observed. It is hard to visualise a selective absorption condition which will yield an alternative explanation of these results. This work is being continued.

CARL R. ENGLUND.
ARTHUR B. CRAWFORD.
WILLIAM W. MUMFORD.
Bell Telephone Laboratories Exp. Station,
Holmdel, New Jersey.
Feb. 21.

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End-points of the β-ray Spectra of Radium E and Thorium C″

THE result of applying the Konopinski-Uhlenbeck[1] modification of Fermi's[2] theory of β-ray disintegration to data previously obtained separately by us for radium E [3] and thorium C″[4] is shown in Fig. 1. In agreement with the work of Kurie, Richardson and Paxton[5] on the β-ray spectra of light elements rendered artificially radioactive by positive ion bombardment, the Konopinski-Uhlenbeck modification is shown from curves (1) and (2) to give a linear relation for $(N/f)^{1/4}$ against E, where N is the number of cloud-chamber tracks of mean energy E and $f = \eta(1 + 0{\cdot}355\,\eta)$, η being equal to $H\rho/1700$.

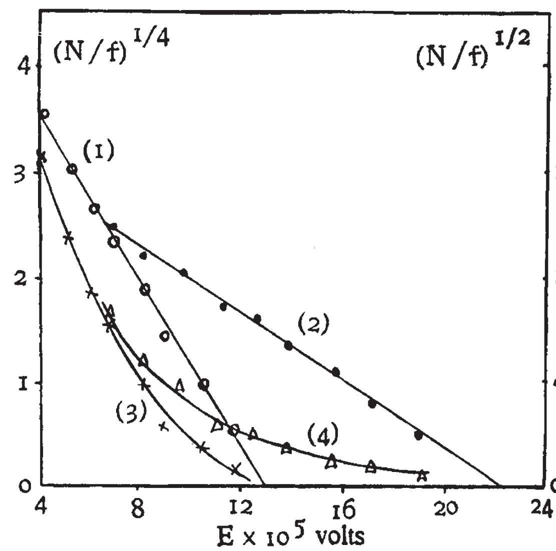

FIG. 1.

Curves (3) and (4) were obtained by plotting $(N/f)^{1/2}$ against E as on the unmodified Fermi theory. The end-points, which are situated considerably beyond the last measured track, are found to occur at $E = 1{\cdot}35 \times 10^6$ v. and $E = 2{\cdot}25 \times 10^6$ v., corresponding to $H\rho = 5975$ and $H\rho = 9030$ for radium E and thorium C″ respectively.

F. C. CHAMPION.
N. S. ALEXANDER.
King's College,
London.
March 27.

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