where n and n' denote neutrino and antineutrino, respectively. The processes (a) and (b) were considered by Wolfe and Uhlenbeck[3] on the basis of the original Fermi theory.

For processes (a) and (b) we find for the reciprocal of the lifetime

$$(mc^2/tr)G^2[\tfrac{1}{2}(\eta_0^2+1)^{3/2}\,\mathrm{arcsinh}\,\eta_0+\tfrac{1}{4}(\eta_0^2+1)^{1/2}\,\mathrm{arcsinh}\,\eta_0 +(1/105)\eta_0^7-(1/15)\eta_0^5-\tfrac{3}{4}\eta_0^3-\tfrac{3}{4}\eta_0]. \quad (2)$$

G is the dimensionless constant $gm^2c/(2\pi^3)^{1/2}\hbar^3=10^{-13}$ and η_0 is $(\Delta^2-1)^{1/2}$ where $m\Delta$ is the mass difference of proton and neutron. Transitions (a) and (b) can occur only if $\Delta>1$, either one occurring depending on the sign of the mass difference. One can obtain this formula by putting $|M|^2=1$ and integrating Eq. (12) of Konopinski's and Uhlenbeck's paper from 1 to W_0.

For small values of $(\Delta-1)$ the lifetime is given by

$$\tau=10^6(\Delta-1)^{-11/2}. \quad (3)$$

Taking for the masses of the neutron and proton the recent values given by Bethe[4] we find for the lifetime from Eq. (2)

$$\tau=3\times10^5 \text{ seconds.} \quad (4)$$

or about $3\frac{1}{2}$ days. This value, unfortunately, is much too large to be verified experimentally at present.

The process (c) will occur when the antineutrinos accompanying beta-rays collide with a nucleus. The result of this collision will be the absorption of the antineutrino with the emission of a positron. The cross section for this process is

$$\sigma\sim G^2(\hbar/mc)^2. \quad (5)$$

which is of the order of 10^{-47} cm^2. This is smaller than the cross section for the creation of pairs by beta-rays by a factor of about 10^{-18}.[5]

LLOYD MOTZ
JULIAN SCHWINGER

Department of Physics,
Columbia University,
August 27, 1935.

[1] Konopinski and Uhlenbeck, Phys. Rev. **48**, 7 (1935).
[2] In reference 1 the formulae defining B_0, **B** and B_0*, **B*** have to be interchanged.
[3] Wolfe and Uhlenbeck, Phys. Rev. **46**, 237 (1934).
[4] Bethe, Phys. Rev. **47**, 633 (1935).
[5] Nordheim, J. de physique **6**, 135 (1935).

A New Radio Transmission Phenomenon

A remarkable vagary of radio transmission has recently been found to occur at regular intervals, separated in time by twice the sun's rotation period. It is a world-wide phenomenon, or more accurately semi-world-wide, as it involves all high frequency radio transmission over the illuminated half of the globe and not the dark half. Depending apparently on some solar emanation lasting only a few minutes, it may be of interest to workers in sciences other than radio. In fact, its thorough elucidation appears to call for the study of such cosmic data as solar radiation intensities, terrestrial magnetism, atmospheric ionization, aurora, earth currents, etc.

If the next manifestation occurs in accordance with the cycle appearing in the last four occurrences, it will be some time between October 21 and 25. It is therefore suggested to those concerned with observations in the above fields as well as in long-distance radio propagation that they make special efforts to make continuous observations on these dates.

The phenomenon is a sudden disappearance of radio signals for several minutes, the complete process of fading out and reappearing occupying about 15 minutes. It occurred on March 20, May 12, July 6, and August 30. The time intervals between these dates are close to 54 days, twice the period of rotation of the sun.

The phenomenon was first brought to my attention by a correspondent in France, who reported that on May 12 in the receiving station near Paris all high frequency reception suddenly disappeared, so rapidly "that the surprised operator thought at first that a fuse had blown" in the receiving station. Beginning at 1157 GMT received signals disappeared completely in three minutes and then after a few minutes reappeared slowly, resuming normal intensity at 1215 GMT. I subsequently learned, through the courtesy of Mr. H. H. Beverage, Chief Research Engineer, that the same thing occurred in the R. C. A. Communications Inc. receiving station at Riverhead, N. Y., and from Mr. L. Espenschied, Radio Transmission Development Director of the Bell Telephone Laboratories that it also occurred in their receiving station at Netcong, N. J., at precisely the same time.

It was subsequently learned that these fadeouts had occurred also on March 20 at 0150 to 0205 GMT, and on July 6 at 1409 to 1425 GMT. The 54-day period was noticed and radio operators were requested to be on the watch for a similar occurrence during August 28 to 30. It duly put in its appearance on August 30, as reported by Mr. Beverage, lasting from 2320 to 2335 GMT.

The sudden intense disturbance causing these 15-minute anomalies in radio reception must have other effects, but none have so far been found. They occur in general during periods, lasting several hours or days, of terrestrial magnetic disturbance and of fluctuating earth currents, but no sharp anomalies in these quantities during the 15-minute period of the radio fadeout have been traced.

Perhaps the chief mystery in this phenomenon is why only one has occurred in every two solar rotation periods, throughout a total of seven periods. It may be merely fortuitous, and it would be desirable to look for it at 27-day intervals, say October 21–25, November 17–21, and December 14–18. Special interest will attach to determining whether it occurs at the next indicated time, October 21 to 25. It would be very desirable that observations, as nearly continuous as practicable, be made of high frequency radio intensities, solar radiation intensities, terrestrial magnetism, atmospheric ionization, earth currents, etc. I would be very glad to have anyone interested communicate with me on the subject.

J. H. DELLINGER

U. S. Department of Commerce,
September 21, 1935.