LETTERS TO THE EDITOR

GEOPHYSICS

Half-life of Radiocarbon

AFTER full discussion of the new determinations[1-3] of the half-life of carbon-14, the Fifth Radiocarbon Dating Conference, meeting at Cambridge (see p. 943 of this issue of *Nature*), adopted the following resolution:

"We commend the three groups of research workers on their new determinations of the half-life of carbon-14, and upon their joint presentation of a figure to be used as a most probable value. We agree that these results represent a significant improvement in our knowledge of this important physical constant, and that the mean of the values given, 5,730 ± 40 yr. is now the best value available.

"Inasmuch as further experiments may lead to an even more reliable result, we recommend, as a temporary expedient, that radiocarbon age results continue to be reported on the basis of the 'Libby half-life' 5,568 yr.[4], used heretofore. We anticipate that upon the conclusion of the experiments mentioned, the question of adopting a new procedure for reporting will be considered. In the interim, published dates can be converted to the basis of the new half-life by multiplying them by 1·03, without appreciably altering the standard errors as quoted.

"The delay in revising the basis of reporting will also allow time for evaluation of the carbon-14 content of dendrochronologically and historically dated samples."

A further action of the Conference was to confirm the practice of using A.D. 1950 as the reference year of 'zero age B.P.' for purposes of reporting radiocarbon measurements.

H. GODWIN
(Chairman)

Botany School,
University of Cambridge.

[1] Mann, W. B., Marlow, W. F., and Hughes, E. E., *Intern. J. App. Rad. and Isot.*, 11, 57 (1961). Hughes, E. E., and Mann, W. B., (submitted for publication to *Intern. J. App. Rad. and Isot.*).

[2] Olsson, Ingrid U., Karlén, Ingvar, Turnbull, A. H., and Prosser, N. J. D., *Arkiv Fysik*, 22, 237 (1962). Olsson, Ingrid U., and Karlén, Ingvar, contribution *SM*-33/1—to be published in *Proc. 1962 Symp. on Radioactive Dating* (at Athens, organized by I.A.E.A. and I.C.S.U.).

[3] Watt, D. E., Ramsden, D., and Wilson, H. W., *Intern. J. App. Rad. and Isot.*, 11, 68 (1961).

[4] Libby, W. F., *Radiocarbon Dating*, second ed. (Univ. Chicago Press, 1955).

'Scale Frequency' of the Exosphere

WHISTLER measurements of nose frequency (f_n) and time delay at this frequency (t_n) give a f_n, t_n distribution well fitted by a 'gyrofrequency' model of electron density in the exosphere[1]: one for which the electron density is everywhere proportional to the magnetic field strength or gyrofrequency (f_H). Since the electron density is directly proportional to the square of the plasma frequency (f_0) and uniquely determined by it we can express this model by the relation:

$$f_0^2 = f_a f_H$$

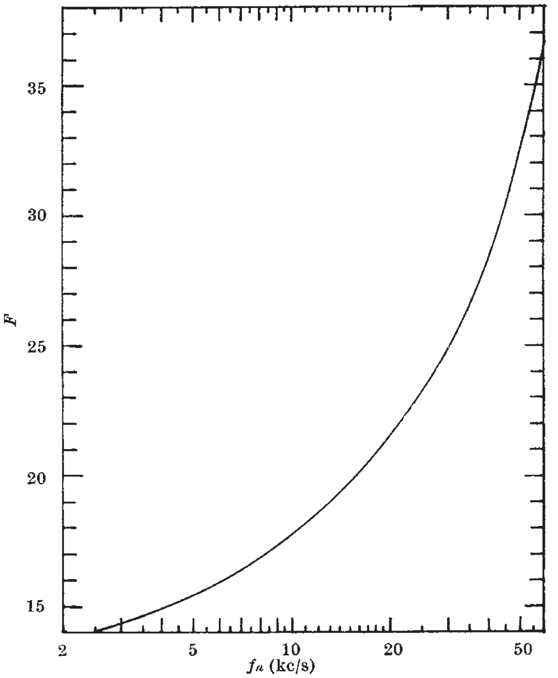

Fig. 1. The function F for calculation of scale frequency from nose frequency and nose delay time

The constant of proportionality, f_a, has the dimensions of frequency and so might be called the 'scale frequency' of the exosphere. It is typically around one megacycle per second (as deduced from Smith's work[1]).

To the extent that the gyrofrequency model fits the real exosphere the scale-frequency is constant. But the point I wish to make in this communication is that, regardless of this fit, the parameter, 'scale frequency', is a very useful one in exospheric studies. It is in the same form (frequency) as the other parameters (f_0, f_H, f) describing emission and propagation in the exosphere. The low-frequency dispersion $D_0 = f^{1/2}t$ becomes $D_0 = s f_a^{1/2}$ where s is the half-length of the field line in light-time units (light-seconds). For f_a constant along a field line the nose whistler integral can be solved analytically[1]. Since whistler data show that the scale frequency is at least quasi-constant then variations in space and time can be sensitively expressed by it. This would be particularly useful in discussing magnetic disturbance effects.

Scale frequencies are readily deduced from f_n, t_n data from nose whistlers. A recent extension of whistler analysis[2] makes it possible to obtain f_n and t_n from perhaps all well-defined whistlers even when the nose is not directly observable. In this work[2] it was shown that the nose frequency dispersion (D_n) is related to the low-frequency dispersion (D_0) as:

$$D_n = 1{\cdot}456\, D_0$$

Thus:

$$t_n f_n^{1/2} = 1{\cdot}456\, s f_a^{1/2}$$