valuable constraints on the possible density and physical state of the intergalactic gas.

Note added in proof. Since this letter was written some new ground-based observations of the low-frequency background have been published: Ellis, G. R. A., *Nature*, **204**, 171 (1964); Ellis, G. R. A., and Hamilton, P. A., *Nature*, **204**, 272 (1964). These observations appear to support the local explanation of the absorption. However, a final decision awaits confirmation by observations from above the ionosphere.

D. W. Sciama

Department of Applied Mathematics
and Theoretical Physics,
University of Cambridge.

[1] Smith, F. G., *Intern. Astro. Union Conf.* No. 23, Liège (1964).
[2] Ellis, G. R. A., Waterworth, M. D., and Bessell, M., *Nature*, **196**, 1079 (1962).
[3] Walsh, D., Haddock, F. T., and Schulte, H. F., *COSPAR*, Sixth Plenary Meeting, Warsaw, 1963 (see *Space Research IV: Proc. Fourth Intern. Space Sci. Symp.*, edit. by Muller, P., 935 (John Wiley, New York, 1964)).
[4] Hoyle, F., and Ellis, G. R. A., *Austral. J. Phys.*, **16**, 1 (1963).
[5] Compare also Lequeux, J., *Ann. d'Astro.*, **26**, 429 (1963).
[6] Sciama, D. W., *Quart. J. Roy. Astro. Soc.*, **5**, 196 (1964).
[7] Field, G. B., *Astrophys. J.*, **135**, 684 (1962).
[8] Goldstein, S. J., *Astrophys. J.*, **138**, 978 (1963).
[9] Davies, R. D., and Jennison, R. C., *Mon. Not. Roy. Astro. Soc.*, **128**, 123 (1964).
[10] Davies, R. D., *Mon. Not. Roy. Astro. Soc.*, **128**, 133 (1964).
[11] Pirani, F. A. E., *Proc. Roy. Soc.*, A, **228**, 455 (1955).

PHYSICS

Standard Date Periods with Declination Limits

A system of dividing the year into 16 periods, each defined by certain solar declination values having numerically equal positive and negative magnitudes, has been discussed by me in an earlier paper[1]. Research has been continued on the selection of the most suitable declination values and the corresponding dates by examination of ephemerides for the Sun during 1952–64 (ref. 2), resulting in slight modifications of the original selections. Such a system would have many advantages in solar engineering research, where bright Sun conditions are of predominant importance, the computation of solar angles of incidence on variously inclined surfaces being greatly facilitated by the limitation to the five standard numerical declination values shown in the fourth column of Table 1.

The ideal system for sub-division of the year would comply with the following conditions: (1) limiting declination values having numerically equal positive and negative magnitudes; (2) a uniform system of dates for all years in the cycle of four years between successive leap years; (3) the same number of days in each period.

The yearly cycle of the Sun's apparent motion is asymmetrical because of the eccentricity of the Earth's orbit and the inclination of the ecliptic, there being 186·4 days from the spring equinox through summer to the autumnal equinox and 178·8 days from the autumnal equinox through winter to the spring equinox. Hence conditions (1) and (3) are mutually incompatible and condition (3) is quite impossible to fulfil if condition (1) is retained. Conditions (1) and (2) can be closely approximated for non-leap years, but for strict correlation a different sequence of dates should be used for leap years, though this would constitute an undesirable complication of the system. It was decided that condition (2) should be the dominating one for all years, even though this involved deviations of a few minutes of angle on certain dates from the declination values set out in Table 1, which shows the proposed standard dates, limiting declination values and mean declinations for the 16 periods. Declination values are at local apparent noon and the dates are for the meridian of Greenwich (0° long.). No significant change is needed over the range ±3 h International Time Zones, but beyond this range there are a few modifications. The length of period 4*A* must be increased by one day in leap years.

Table 1. System of Dates for Standard Declination Periods

Period	Limiting dates	No. of days	Decln. limits	Mean decln.	No. of days	Limiting dates	Period
1*A*	Dec. 22 Jan. 13[2]	23	−23°27′ −21°30′	−22°47′	22	Dec. 21 Nov. 30[1]	1*B*
2*A*	Jan. 14[2] Feb. 4[1]	22	−21°30′ −16°15′	−19°05′	23	Nov. 29[1] Nov. 7[3]	2*B*
3*A*	Feb. 5[1] Feb. 26	22	−16°15′ − 8°45′	−12°34′	22	Nov. 6[3] Oct. 16[4]	3*B*
4*A*	Feb. 27 Mar. 20	22[5]	− 8°45′ 0	− 4°23′	23	Oct. 15[4] Sept. 23[3]	4*B*
5*A*	Mar. 21 Apr. 12[2]	23	0 8°45′	4°23′	23	Sept. 22[3] Aug. 31[3]	5*B*
6*A*	Apr. 13[2] May 5[2]	23	8°45′ 16°15′	12°34′	23	Aug. 30[3] Aug. 8[3]	6*B*
7*A*	May 6[2] May 28	23	16°15′ 21°30′	19°05′	23	Aug. 7[3] July 16	7*B*
8*A*	May 29 Jun. 21	24	21°30′ 23°27′	22°47′	24	July 15 Jun. 22	8*B*

The above dates are for International Time Zones +3 to −3 h (45°W.–45°E. long.). (1) Retard date by one day for Int. Time Zones +9 to +12 h (135°W.–180°W. long.). (2) Retard date by one day for Int. Time Zones +3 to +12 h (45°W.–180°W. long.). (3) Advance date by one day for Int. Time Zones −3 to −12 h (45°E.–180°E. long.). (4) Advance date by one day for Int. Time Zones −9 to −12 h (135°E.–180°E. long.). (5.) Add one day to period for leap years

The *A* and *B* periods of corresponding number may usually be combined for the purpose of collating data on solar energy utilization, especially as periods of bright sunshine are mainly concerned. This does not imply that the total sunshine hours are equal in the *A* and *B* periods and allowance must be made separately for the relative duration of bright Sun conditions. The system has been found satisfactory for evaluating research on solar engineering applications, and if more widely adopted would facilitate comparisons between different research work as well as simplifying any computation involved.

H. Heywood

Woolwich Polytechnic,
London, S.E.18.

[1] C.N.R.S. Coll. Intern., 23 (1958).
[2] *Star Almanac for Land Surveyors* (H.M.S.O.).

Propagation of Stress Waves in Liquids

The underlying assumption implicit in work concerned with the propagation of stress waves in liquids is that any pressure disturbance originating at some point in the liquid travels unchanged in form with a velocity $c = \sqrt{(dp/d\rho)}$, which is independent of the density. Such a wave is an 'acoustic' wave, and it is well known that this assumption is amply justified for the small variations of density and pressure usually developed by sound sources under water. But is it justified when the pressure at a point in a liquid rises suddenly by 200 atmospheres (say) due to the passage of a transient stress pulse? The purpose of this communication is to consider this question on the basis of the type of conditions prevailing in previous experiments described by me and other workers[1–3].

Consider unit mass of water at a temperature of 15° C. The initial pressure before the arrival of the stress wave is 1 atmosphere and we require to find the fractional decrease in volume occurring when the pressure rises rapidly by 200 atmospheres. Strictly speaking, we should treat the change as an adiabatic one; but since the adiabatic and isothermal bulk moduli for water differ by so little, we shall obtain a sufficiently good approximation if we assume that the change is isothermal and use the equation:

$$K = V_0 \frac{\Delta p}{\Delta V}$$

Here K, the bulk modulus, is taken to be $2{\cdot}13 \times 10^{10}$ dynes cm^{-2}; V_0 is the volume at 15° C, that is, 1 cm^3; Δp is 200 atmospheres and ΔV the decrease in volume of the unit mass under consideration. This gives us $\Delta V/V_0 = 9{\cdot}46 \times 10^{-3}$, that is, a decrease in volume of about 1 per cent. If ρ_0 and ρ are respectively the initial and final densities then we have, with sufficient accuracy,