FORUM

Time-Scales

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W. PALMER's note on Standard Time (this *Journal*, Vol. 25, page 535) may mislead some readers. He tends to confuse 'Time', as an abstract philosophical concept, with the measures of time, or time-scales, used in practice by astronomers, navigators, surveyors, physicists, electronic engineers and the general public. Such measures of time may be based on any recurrent phenomenon, whether uniform or not, ranging from the growth of coral to atomic transitions; and, for this reason, those professionally concerned use precise terminology to distinguish the many time-scales in current use. Unlike Mr. Palmer, they do not use 'Time' for a particular time-scale; and, for example, they restrict 'standard' to its generally understood application to the meridian to which the legal time of a country is referred. There are a number of factual errors arising from this confusion (e.g. G.H.A. Aries is equivalent to sidereal time) which need not be elaborated here.

It may interest readers to know that a recent experiment, by flying atomic clocks round the Earth eastwards and westwards and comparing the times indicated by them with identical clocks that remained stationary on Earth, has demonstrated beyond apparent doubt the truth of Einstein's theory of relativity in so far as it affects the 'proper time' kept by a clock. The travelling and stationary twins will not be the same age when they meet again! In fact corrections for this extremely small effect are applied to the times kept by atomic clocks before they are combined to give International Atomic Time.

Astronomers have a time-scale (Ephemeris Time) based on the law of gravitation; in practice it is determined from observations of the motion of the Moon. Analysis of observations since 1955, when an atomic time-scale became available for comparison, has recently shown a difference between (lunar) ephemeris time and atomic time, in that one is accelerated relative to the other. If this difference cannot be explained by other means, it could be explained cosmologically, the rate of acceleration indicating the age of the universe: the value found suggests an age of about 15×10^9 years, in reasonable accord with other estimates! But even these 'fundamental' time-scales, one based on the properties of the atom and the other on gravitation, must not be confused with 'Time'.