Mr. F. Courtney Harwood (Launderers' Research Association), Mr. S. H. Clarke (Fire Research, D.S.I.R.), the Hon. L. O. Russell (Institute of Management) and Sir Thomas Hutton (Productivity Council). The conference had shown how many resources are available for improving productivity and meeting its technical, its economic and its human problems. All these resources are not everywhere known or used. To overcome this there are two main national agencies. The British Productivity Council, with its decentralized regional organization and circuit system, endeavours to bring management and workers together in every main industrial area, making use of modern methods of presentation. The second agency is provided by the research associations and the Department of Scientific and Industrial Research with its stations. These bodies have valuable contacts with industry since they impinge directly on the particular industrial sectors of which they have expert knowledge. They have already done a great deal and are converted to the objects of the conference. Nevertheless, their structure, especially that of the research associations, permits them to do more; the value of the conference will depend upon whether it succeeded in establishing that interest in scientific and technological research should not limit the effort to convert industry as a whole to the principles which those attending the conference accepted.

X-RAY APPARATUS AND ASSOCIATED TECHNIQUES

EXHIBITION IN LONDON

As in previous years, an exhibition of X-ray apparatus was arranged in conjunction with the annual congress of the British Institute of Radiology, and was held at the Royal Horticultural Hall, London, during November 23–26. The majority of the exhibits were concerned with medical applications, both diagnostic and therapeutic, but industrial and scientific instruments were also represented.

Perhaps the most striking feature of modern electronic components and instruments is the way in which improvements in design and in materials have made possible reductions in size and in power consumption. This was well exemplified by much of the X-ray equipment on show. The increased use of oil-immersed components has resulted in compact single-unit power supplies for X-ray tubes, some of them incorporating series triode control valves which permit instantaneous high-tension switching as well as current and voltage stabilization. Another advance in this direction was represented by new oil-immersed high-tension rectifiers the filaments of which consist of thoriated tungsten with a power consumption less than one-third of that of pure tungsten filaments. Another interesting power supply includes a fly-wheel energy-storage generator which makes it possible to obtain a short-duration X-ray burst of very high intensity without drawing a heavy load from the mains supply.

X-ray tubes themselves have become more mobile; oil-insulated industrial tubes permit underwater radiography, and medical diagnostic and therapeutic tubes are mounted on cradles or above tilting tables which allow them and the patients to be moved automatically or with finger-tip control. Higher intensities are provided by the large range of rotating anode tubes. Another approach to the intensity problem in radiography is provided by the development of more-sensitive detecting devices. A new X-ray film is claimed to be 50 per cent faster than any previous type. Of even greater interest, perhaps, are the new image amplifiers, several examples of which were on show. In these tubes X-ray energy is first converted into light energy by a thin fluorescent screen, in contact with which is a photoelectric surface which, in turn, converts the light into electron emission. The electrons are accelerated by a high potential and focused on a final output screen. By these means the limit of brightness for threshold vision is reduced by a factor of 10 : 1, while the exposure time in fluorophotography is in the ratio of 200 : 1 as compared with the image produced on a normal fluoroscopic screen.

Artificial radioisotopes are becoming of ever-increasing importance both in therapy and in radiography. This fact was reflected in the many instruments on show for the handling and the detection and measurement of high-activity sources. The measuring instruments exhibited ranged from a simple 'nurse-proof' radiation monitor to fully automatic equipment capable of measuring the activities of up to 425 planchet-mounted samples to any desired degree of accuracy without any intervention from a human operator, the results being printed by the machine.

In X-ray therapy the deleterious effects of radiation on healthy tissue are now guarded against, so far as possible, by arrangements of ingenious geometry such as those employed in arc irradiation and in moving-beam methods. A new possible way of reducing radiation burns, which may be of great potential importance, is the discovery of the inhibitory effect of cortisone injections on acute X-ray damage to animal tissue. Discoveries like the last, together with apparatus as yet in the experimental stage, were demonstrated in a small scientific section at the exhibition. In general, the main commercial part of the exhibition demonstrated that the X-ray industry is quick in developing new ideas to a production stage.

U. W. Arndt

THE AGE OF THE UNIVERSE

The Philosophy of Science Group of the British Society for the History of Science last year offered a prize for "the best essay on: What is the logical and scientific status of the concept of the temporal origin and age of the universe?" Twenty-six essays were submitted, and a selection of six of these is published as the major portion of the November issue of the *British Journal for the Philosophy of Science*. The subject is considered from various points of view, the competitors having been asked to "clarify the logical, theoretical and observational aspects of the idea of assigning a quantitative age to the Universe". Naturally the essays vary in the distribution of emphasis between these aspects, and in those published the evidence most relied on ranges from the almost entirely logical to the equally one-sided observational kind. The value of the publication as a whole is thus greatly enhanced, and one receives the impression that the editors have made

a wise choice of contributions for the enlightenment of those who wish to obtain as comprehensive a view as possible of the whole problem.

The particular solutions arrived at, which are quite properly advanced with caution, differ considerably; but these are of less significance than the arguments that lead up to them. The essays should therefore be read in full if the greatest benefit is to be derived, but an indication of the conclusions may be of some interest. M. Scriven (Minnesota), from epistemological reasoning, concludes that "no verifiable claim can be made either that the Universe has a finite age or that it has not. We may still believe that there is a difference between these claims: but the difference is one that is not within the power of science to determine, nor will it ever be". J. T. Davies (London) provisionally accepts the age (about 4×10^9 years) given by linear extrapolation from the nebular recession hypothesis as being "the simplest interpretation of the observations and as being in excellent numerical accord with the age from independent investigations" of particular constituents of the universe. E. J. Öpik (Armagh) accepts the agreement (in general order of magnitude) of the ages given by various phenomena as suggesting an age not exceeding 6×10^9 years for the universe "in its present form and content". G. J. Whitrow (London) also lays stress on this agreement, which "strongly suggests that the universe has a finite age of some 4,000 million years". R. Schlegel (Michigan) prefers the view that the universe is "atemporal"—that is, the concept of time is inapplicable to it as a whole. He distinguishes this from the view that the age of the universe is infinite, for this would be a particular solution for a universe to which the time concept is applicable. B. Abramenko (Mannheim), though admitting that conclusions must be based on observational evidence which at present is inadequate to settle the matter finally, favours the view that time, like space, is curved, so that physical processes occur in cycles. There is then no such thing as the age of the universe as a whole, and the indications of age from the various phenomena relate to the length of one cycle in the infinite succession of cycles. Unlike most of the writers, however, he attaches more significance to the differences between these indications than to their agreement.

All the more prominent systems of cosmology—general relativity, kinematical relativity, the 'steady state' theory involving continuous creation—are given some attention, but it is noteworthy that none of the essayists writes specifically from the point of view of any of them; indeed, the objective character of the approach throughout is a praiseworthy feature of the collection. One point, however, would repay further elucidation. More than one writer is evidently under the impression that, in the 'steady state' theory, nebulæ are assumed continually to pass out of the region of possible observation, at a finite distance from the observer, through attaining and surpassing the velocity of light. Recent correspondence in *The Observatory* (**74**, 172; August 1954), however, suggests that this may be a misreading, notwithstanding that it is the apparent purport of the papers in which the theory was originally presented, and that in fact the theory assumes that the region observable in principle is infinite in extent, no nebula ever disappearing from it. It is very desirable that some clear statement on this point should be made by the authors of the theory, to prevent further misunderstanding.

ROYAL OBSERVATORY, CAPE OF GOOD HOPE

REPORT FOR 1953

THE report for 1953 of the Royal Observatory, Cape of Good Hope*, shows that an extensive programme of painting and repairs to the Observatory has been carried out, and dilapidations which accumulated during the war period have been practically overcome. Redecorations, externally and internally, have been effected in a number of buildings and at the time of writing the report only the new office buildings, a residence and a few other minor items required attention. In addition, electrical work has been carried out in some of the residences, a few extra trees have been planted, and it is hoped that a new hedge planted near the entrance gates will eventually provide some protection from the prevailing south-east wind.

The reversible transit circle has been in regular use and has required little special maintenance; observations were made with it on 155 days, 187 evenings and 113 mornings. The fitting of modern roller and thrust bearings to the declination axis of the Victoria telescope was completed in January, and the new cell made by Messrs. Cox, Hargreaves and Thomson for the 24-in. lens was then installed; this cell has resulted in a marked improvement in the performance of the lens. A number of alterations have been made in other ways, among which may be mentioned the replacement of the old windscreen by a new all-canvas screen which allows observations to be made within a few degrees of the horizon instead of 30° as with the previous arrangement. The telescope was used on fifty-seven nights for photoelectric observations, sixty-one nights for direct photography, and the astrometric camera that is mounted on it on forty-two nights. The astrographic telescope, which was in continuous service, was used on one hundred and sixty-five nights for photoelectric photometry, on five nights for direct photography and on forty-eight nights for photography with the photometric cameras mounted on it. This telescope, while still behaving fairly well in spite of its age, requires a thorough overhaul in its drive and clamping mechanism, and, in addition, the axles and bearings of the wheels carrying the dome are badly worn and will shortly need renewing.

The 7-in. telescope and the tower telescope have been used for observing occultations, and the former has also been used for visitors. The tower telescope is not in good condition as the old stand is unsteady, and the lens requires repolishing. The 6-in. telescope has been in regular use for observing long-period variable stars, and has also been used for visitors and for observing occultations. The photoheliograph has been used to take two photographs daily of the sun. The camera is in fair condition; but the stand is old, the polar axis unsteady and the clock drive unreliable. A few minor adjustments and alterations were necessary on the photometric cameras mounted on the astrographic telescope in November 1952, and the timing device was completed and brought into use. The astrometric (or wide-angle lens) camera which was dismounted from the astrographic telescope in 1952 was mounted on the Victorian telescope

* Report of Her Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the Year 1953. Pp. 11. (Cape of Good Hope: Royal Observatory, 1954.)