first all-British satellite; Britain was co-operating with several European countries in a scientific space research programme through the European Space Research Organization. The Royal Aircraft Establishment at Farnborough and the Signals Research Development Establishment at Christchurch, which were responsible for the general guidance of the study of the design of a communications satellite, had for some time been bouncing signals off the Moon to each other. He proposes that there should be no restriction on the dissemination within British industry of the information derived from the investigations. Two types of satellite communications system were at present under consideration. The first was the so-called medium orbit of about 7,500 nautical miles, which would call for a dozen or so satellites; the second was the so-called stationary or synchronous orbit requiring a much smaller number of satellites at a height of about 20,000 nautical miles, in which each satellite would remain above the same point on Earth. The effect of the explosion of the American so-called 'rainbow bomb', which might have a damaging effect on the solar cells and other satellite components for at least ten years, was being investigated before decision was made between the two systems. The debate also drew the suggestion that these developments should be made the responsibility of a single Ministry of Science and Technology and welcome for the idea that computing should be a main study at the new University of Essex.

THE NETHERLANDS REACTOR CENTRE

FOR the second time—the first was in June 1961—*Atomenergie in haar Toepassingen* (Atomic Energy and its Applications), the scientific and technical periodical published under the auspices of the Netherlands Reactor Centre (Reactor Centrum Nederland) has printed a special issue (4, No. 11; November 1962) in English. It contains seventeen articles dealing with the organization, buildings, reactors and research activities of the Reactor Centre. The Centre is situated at Petten on the North Sea coast, about 35 km north of the Amsterdam shipping canal. The reactors now operational are the low-flux reactor (*LFR*) of 10 kW maximum power and 10^{11} neutrons cm^{-2} sec^{-1} peak thermal flux, and the high-flux reactor (*HFR*) of 20 MW maximum power and 2×10^{14} neutrons cm^{-2} sec^{-1} peak thermal flux. A critical experiment reactor (*Krito*) of some watts maximum power is estimated to become critical in the early part of 1963. Since 1955, when the Reactor Centrum Nederland was established, the number of staff has increased steadily to 536 at June 1, 1962. 106 of these are graduates, and 351 scientific and technical personnel, with 93 administrative employees.

Separate articles deal with the descriptions of the construction, instrumentation and materials testing of the *HFR* reactor. The *LFR*, which was constructed by the Hawker Siddeley Nuclear Power Co., Ltd., and which first became critical during September 1960, is described by J. Coehoorn and J. H. B. Madsen. A brief account of the Netherlands development programme for a marine reactor is given by Prof. M. Bogaardt. The main interest of Reactor Centrum Nederland is at present in light-water-moderated reactors, and both *HFR* and *LFR* are of this type. The contract with Euratom for the marine reactor design is also for a light water reactor but of the pressurized type. It is in connexion with this contract that the critical facility (*Krito*) is being constructed at Petten in the newly built Fermi building, which also houses the *LFR* reactor. The facility consists of an aluminium tank (2·5 m diameter, 4·25 m height) in which the experimental core can be built up, together with pumps, piping, dump tank and control drive mechanisms, situated within a concrete enclosure 7·5 m wide, 11 m long and 12·5 m high with a wall thickness of 1 m. The first loading will consist of UO_2 pellets of 3·1 per cent and 3·8 per cent enrichment canned in aluminium tubes. The full core will contain about 40 boxes of 120 tubes to each box.

One of the joint projects of research being carried out by Norwegian "Institutt for Atomenergi" and Reactor Centrum Nederland is an investigation of plutonium ceramics, and at present work on plutonium-containing fuel is concentrated on the development of plutonium–uranium oxide fuels. Transplutonium research is discussed by Dr. W. Kraak and Dr. B. Verkerk, and activation analysis by Dr. H. A. Das.

S. WEINTROUB

HYGIENE IN MILK PRODUCTION, PROCESSING AND DISTRIBUTION

IN helping to meet the nutritional needs of an ever-expanding world population, milk has a most important part to play, but if milk is to be used efficiently and if waste of such a precious commodity is to be avoided, it must be produced, processed and distributed under the most hygienic conditions that science and good management can achieve. It is a matter for congratulation, therefore, that the World Health Organization, the Food and Agriculture Organization and the United Nations International Children's Emergency Fund have sponsored the production of a comprehensive and authoritative monograph* dealing not only with conditions in areas where dairying is well established but also with the entirely different picture that exists in the less-developed parts of the world where the climate is so often warmer and where the need for particularly stringent hygienic measures is especially great.

Thirty-seven experts from all parts of the world, most of them well known internationally throughout the dairy industry, have contributed by writing the 35 chapters and one of the three annexes of which the book consists.

The first chapter deals in a most comprehensive way with diseases that can be transmitted through milk, and includes sections on milk allergy, the possible presence of antibiotics, insecticides, preservatives and other chemicals in milk and other causes of unwholesome milk. Having established the problem involved and the risks that can nowadays be so readily avoided by sound hygiene, the book then provides a section on milk hygiene on the farm. This includes well-illustrated chapters on buildings and installations on dairy farms in both temperate and tropical climates. Then follow chapters on the

* World Health Organization. Monograph Series, No. 48: *Milk Hygiene. Hygiene in Milk Production, Processing and Distribution.* By M. Adbussalam *et al.* Pp. 782. (Geneva: World Health Organization; London: H.M.S.O., 1962.) 36 Sw. francs; 60*s.*; 12 dollars.

amount and nature of water supplies required on dairy farms and the all-important subject of pest control. The section on the farm ends with chapters on milk handling and on the cleaning and sterilization of milking equipment used in milk production.

Having dealt so thoroughly with production, the next large section of the book is concerned with the handling and processing of milk after it has left the farm. The subjects discussed include the clarifying, cooling and storage of milk, pasteurization and sterilization and the manufacture of evaporated and dried milks. Later chapters deal with the health and hygiene of dairy workers, and the section ends with valuable articles on the packaging and distribution of milk and milk products.

The special problems of such widely differing countries as India, Norway, Egypt and Kenya are discussed in a separate section by experts from these areas, and although most of the book naturally refers to cow's milk, one of the chapters here considers the composition and special problems associated with the milk of the mare, ewe, goat, camel, buffalo, reindeer and yak. The main part of the volume ends with chapters on administration and legislation and on educational and advisory services with special reference to countries that are in the process of developing their dairy industry.

Of the three annexes included in the book one reproduces the *Code of Principles concerning Milk and Milk Products* which was first published in 1960 and which was prepared by a committee of Government experts under the auspices of the Food and Agriculture Organization. The second annex defines and gives a brief description of several milk products with which many readers will not be familiar, such as, for example, 'dahi' of India, 'kefir' of the Caucasus and 'skyr' of Iceland. In the third annex a description is given of methods of pasteurization under bush conditions that are undergoing trial in Kenya.

The book has been prepared and edited with great care. It is clearly printed, well illustrated and is a pleasure to read. It makes in a single volume a unique contribution to the literature on milk hygiene covering, as it does, so many widely differing parts of the world. To those who are concerned with any form of dairy management or with teaching or advisory work in dairying, whether in developed or developing countries, this volume should prove to be a most valuable work of reference.

J. A. B. SMITH

LIGHT VARIATIONS IN THE SUPERLUMINOUS RADIO GALAXY 3C273

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SEVERAL radio sources among those known to have small angular diameters[1] have recently been identified at the California Institute of Technology[2,3] with star-like objects. On closer examination at least two of the objects, 3C48[4] and 3C273[5–7], appear to be abnormally luminous nuclei of distant, highly redshifted galaxies. On this interpretation 3C273 with $M_v = -26{\cdot}5$ becomes the most luminous object now known in the universe.

With the kind permission of the Director of the Harvard Observatory, and with finder charts provided by Dr. Matthews, of the California Institute of Technology, we have investigated the photographic history of 3C48, 147, 196, 273 and 286 using Harvard's valuable historical plate file reaching back well into the nineteenth century. On each plate showing an image of one of the objects, the brightness was estimated by eye in the standard fashion in terms of suitable comparison stars. Being fainter than 17th magnitude, 3C 147, 196 and 286 each yielded detectable images on only about half a dozen of the nearly half-million plates in the collection, and no positive evidence for variation greater than several tenths of a magnitude was found. The earliest of these objects to be isolated, 3C48, is a magnitude brighter; hence in 1961 we were able to estimate it on 75 plates, again without finding significant variation greater than 0·3 mag.[8]. However, the most recently identified of the five, 3C273, at $m_{pg} = 12{\cdot}5$ mag. is sufficiently bright to be visible on a significant fraction of the thousands of plates on its region. While work is continuing on the complete collection, we report results based on the 600 measures so far reduced. These suffice to give convincing proof of variability and to show provisionally its character. The earliest useful plates date from 1887; for the period 1893–1953, during which Harvard maintained regular patrols, only two years lack observations in the material reported here.

Conditions for photographic photometry are uncommonly favourable in the case of 3C273. For many of the available exposures its brightness falls in the linear portion of the characteristic curve; moreover, closely adjacent to this object are three field stars one of which has a brightness equal to the magnitude of 3C273, the other two are respectively 0·2 mag. brighter and fainter. Accordingly, despite the use of plates from 17 different telescopes, it has proved possible to make eye estimates of magnitude with mean errors of an individual estimate averaging less than $\pm 0{\cdot}1$ mag. Since the heavy dots in the light curve of Fig. 1 represent annual means of some 5–50 measures, the internal probable error of each annual mean is normally of the order of, or smaller than, the diameter of the dots (0·06 mag.) in Fig. 1. We concede the probability of a systematic error arising from the colour index of 3C273 which is bluer by 0·5 mag. than the mean of the comparison stars. This implies dependence of the results on the redward limit of sensitivity of the ordinary photographic plates. However, even under extreme assumptions it seems unlikely that such errors will reach 0·1 mag.; neither do the observed variations have the plateau-shift character which such errors should produce.

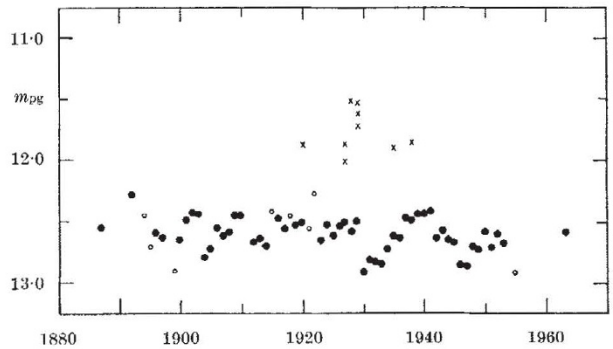

Fig. 1. Mean light curve of 3C273 for the years 1887–1963. Circles are annual means; black circles, include five or more individual observations; white circles, four or less. The *x*'s refer to strong individual observations more than 0·5 mag. brighter than the annual means (these apparent flashes were not included in the annual means)