THE NEW RADIO ASTRONOMY CENTRE OF THE UNIVERSITY OF SYDNEY

By PROF. H. MESSEL

THE Chatterton Astronomy Department of the School of Physics, and the School of Electrical Engineering, have established a Radio Astronomy Centre in the University of Sydney.

Radio astronomy is concerned with observations of the heavens at radio wave-lengths rather than with light waves. It is a relatively new and vigorously growing branch of one of the oldest of the sciences, and Australia has taken a leading part in its development. Almost all the Australian work, so far, has been carried out by the radio astronomy group in the Radiophysics Division of the Commonwealth Scientific and Industrial Research Organization.

Recently, however, several members of this group have joined the staff of the University of Sydney, and, in addition, several outstanding English radio astronomers have already joined, or will soon join, them. Most of these are in the Chatterton Astronomy Department of the School of Physics under Prof. Harry Messel. One group, led by Dr. B. Y. Mills, who was previously with the Commonwealth Scientific and Industrial Research Organization, will engage immediately in radio astronomy work. Another, in which Dr. R. Q. Twiss of the School of Physics and Prof. Hanbury Brown of the University of Manchester will join forces, will work with the giant stellar interferometer in the optical field of astronomy.

Radio astronomy, however, is the meeting point of astronomy, physics and all the most advanced techniques of electronics and electrical engineering. The appointment of a group of leading radio astronomers, including Dr. B. Y. Mills, to the Chatterton Astronomy Department and the recent appointment of Prof. W. N. Christiansen, formerly of the Commonwealth Scientific and Industrial Research Organization radio astronomy group, to the chair of electrical engineering at the University of Sydney, has made possible the establishment of the new Radio Astronomy Centre. The Centre will mean the pooling of resources, intellectual and material, of the Schools of Physics and Electrical Engineering for an attack on some of the major fundamental problems of radio astronomy. The basic interest in the School of Electrical Engineering in solid-state devices and low-noise receivers will contribute a great deal to this joint action.

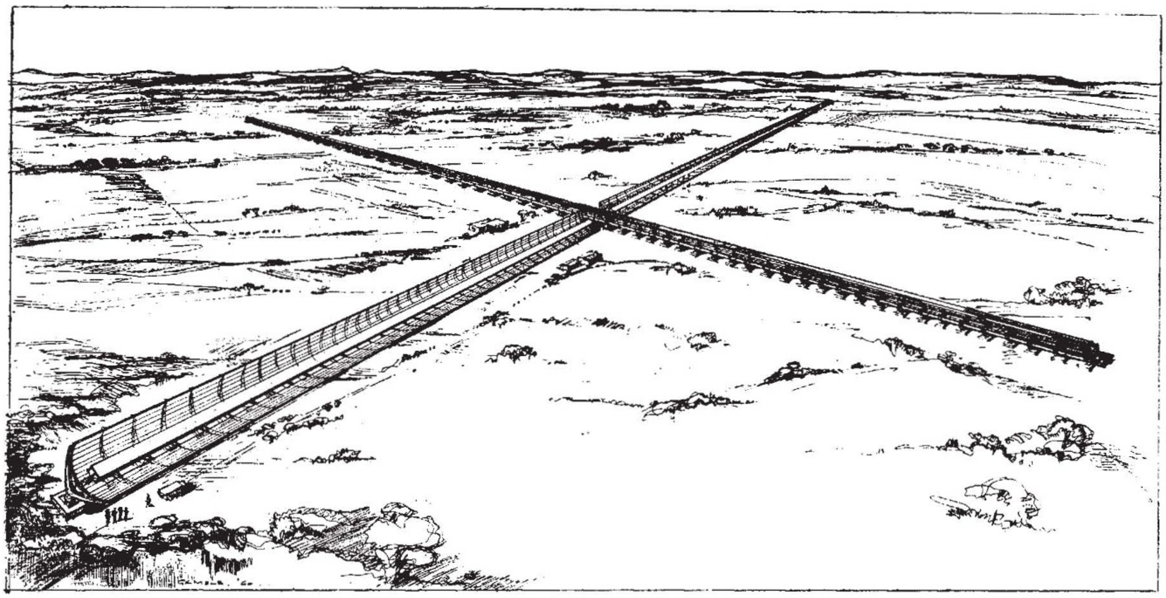

Fig. 1. Artist's sketch of the giant Mills cross for the University of Sydney Radio Astronomy Centre

One of the first problems to be considered by the Radio Astronomy Centre is that on which Dr. Mills has been engaged for some years: the detailed observations of sources of radio emission, both in our own Galaxy and in the very distant regions of space. Such observations are very important for a study of the physics of the rare gaseous medium, lying around and between the stars, which probably holds the key to the problem of the formation and evolution of galaxies such as our own, the Milky Way system. These observations are of particular importance to the School of Physics, which is already established as a leading centre of cosmic-ray research, because it has been shown that there is a very close connexion between cosmic rays and the cosmic radio emissions observed at wave-lengths of 1 m. or longer. It is hoped also that a study of the weakest radio-sources will yield valuable information about the distribution and state of matter in the most distant regions of the universe and perhaps help to answer the age-old question as to its origin.

For the new studies a very large radio telescope will be needed, far too large to be built in a completely steerable form, such as the large paraboloid being constructed by the Commonwealth Scientific and Industrial Research Organization at Parkes. The radio telescope needed for this work must have dimensions of about one mile, and the most suitable form for this is a cross-like structure invented by Dr. Mills and called a Mills cross. The cost of a radio telescope of this type and size will be about £300,000.

The Chatterton Astronomy Department, supported by the Nuclear Research Foundation, has set aside £100,000 for the first stage of this telescope. The rest of the cost to complete the instrument to its full size must be raised elsewhere by the Schools of Physics and Electrical Engineering of the University. During the next year, when the first stage of the telescope is being designed and construction commenced by Dr. Mills and his collaborators, Prof. Christiansen will be in Holland engaged in a design study for a similar instrument for a Benelux research foundation. Because of the different conditions it is probable that the details of the two instruments will be very different. This close international collaboration is typical of many astronomical projects and should be of great benefit to astronomy in both countries.

Although the design of the Sydney radio telescope has not been completed, the broad specifications are already decided (Fig. 1). It is intended to operate at two different wave-lengths, near 75 cm. and near 3 m. The shorter wave-length is the basic one, and will give the higher sensitivity and resolution; the beam-width will be less than 3 min. of arc with the planned size of 1 mile. The longer wave-length will be used to obtain spectral information, particularly of optical emission nebulæ for which observations in the neighbourhood of this wave-length are most important.

The arms of the cross will be in the form of cylindrical parabolas with 'line' feeds for the two wave-lengths at their foci. It will be possible to direct the instrument in the meridian plane, partly by mechanical and partly by electrical means, rotation of the Earth bringing all parts of the sky, within the coverage of the instrument, into view. Emphasis is being placed on rapid alteration of the setting of the radio telescope so that many selected objects can be studied in a single night's observation; at the same time a number of simultaneous records at closely spaced elevations produces the analogue of a photograph taken with an optical telescope. Because of the vast amount of data which will be produced by the instrument, the principal output will be in digital form on paper tape, and for analysis will be fed directly into *Silliac*, the electronic computer of the School of Physics.

This instrument will combine very well with the 210-ft. steerable radio telescope of the Division of Radiophysics, which is designed primarily for operation at shorter wave-lengths, down to 10 cm., including the *H*-line wave-length of 21 cm. The conjunction of these two very powerful instruments in studies of the southern skies, particularly of the central regions of the Milky Way and the closest of the external galaxies, the Clouds of Magellan, is an exciting prospect for Australian radio astronomers.

The joint effort of the Schools of Physics and Electrical Engineering in this ambitious undertaking is without parallel in the University of Sydney, or indeed in any Australian university, and may help substantially in setting a pattern for the more effective introduction of advanced research into the universities of Australia.

THE INTERNATIONAL GEOPHYSICAL YEAR

A SYMPOSIUM on the "International Geophysical Year", arranged by Section A (Mathematics and Physics) of the British Association, was held in Cardiff on September 1.

Dr. R. Stoneley opened the symposium with a reminder that the idea of international co-operation in scientific matters is by no means a modern one. Sir Graham Sutton has pointed out that in 1861 the American meteorologist Commander F. M. Maury, in an article in the *British Association Notices and Abstracts*, strongly advocated international co-operation in the scientific exploration of the Antarctic. However, the suggestion was not followed up, and it was not until 1882–83 that the First International Polar Year marked the commencement of scientific collaboration in polar research: observations were made in arctic regions of auroræ, geomagnetic and meteorological phenomena. Fifty years later, 1932–33, the Second International Polar Year included as new features the observation of weather conditions above ground-level by means of radio-balloons, and the investigation of the ionosphere by radio.

It was too much to expect scientists to wait until 1982 for another Polar Year, and in 1950, Louis V. Berkner and Sydney Chapman suggested to the Mixed Commission on the Ionosphere that the Third International Polar Year be held only 25 years after the second, with the advantage that 1957–58 would coincide with the expected sunspot maximum. This project was recommended by that Commission to the three parent Unions (Union Géodésique et Géophysique Internationale, International Astronomical Union, Union Radio Scientifique Internationale) and was approved in 1951 by the International Council of Scientific Unions, which appointed a special committee, to be known later as the Comité Spécial de l'Année Géophysique Internationale, with Prof. S. Chapman as president; the name of the project was changed to 'International Geophysical Year', embracing the whole Earth, and not merely the polar regions. The duration of the International Geophysical Year was extended to the eighteen months July 1, 1957–December 31, 1958. By the commencement of the Year the number of nations participating had grown to 67.

The scientific activity was divided among 14 'disciplines': (1) World Days and Communications; (2) Meteorology; (3) Geomagnetism; (4) Aurora and Airglow; (5) Ionosphere; (6) Solar Activity; (7) Cosmic Rays; (8) Longitudes and Latitudes;