SCIENCE

Radiophysics in Australia

The Radiophysics Laboratory in Sydney is a division of the Commonwealth Scientific and Industrial Research Organization, one of the main federal government agencies in Australia responsible for research and development in the fields of both primary and secondary industries. It had its origin in 1949 as a wartime radar research establishment but has since become a leading center for more fundamental research in radio and for the peacetime application of radar techniques to new fields. The laboratory is perhaps better known for its recent work in radio astronomy and radar meteorology, but it is also concerned with the development of new methods of navigation and of electronic computing devices of the digital type, the investigation of the upper atmosphere, and some research on the lower ionosphere.

Jansky's discovery (1932) of radio radiation from extra-terrestrial sources received new emphasis during World War II, when periods of high noise level on search radars as they scanned across the sun were found to have occurred when abnormally large sunspot groups were visible. Conclusive evidence that high-intensity radiation does originate in active areas on the sun, and that these are usually associated with sunspots, was obtained at the Radiophysics Laboratory in 1945. The novel techniques used—in which a single antenna mounted on a cliff overlooking the open sea, together with its mirror image, constitute an interferometer for observing radio sources as they rise above the horizon—have also been instrumental in discovering many of the known "radio stars," that in the constellation Taurus being the first to be identified with a known astronomical object (the Crab Nebula). The laboratory's current program covers almost the entire field of radio astronomy. Of particular interest in the solar field are the methods evolved for locating active areas on the sun, tracing their movement, and determining the polarization of the radiation from them; for observing the spectra of solar disturbances over the frequency range 40–240 mc/s in a fraction of a second; and for studying the distribution of radiation over the sun's disk. Early successes in the discovery of discrete sources are being followed up by measurements of their angular extent—which involves separations of some miles between the component antennae of the interferometer—and by observations of their frequency spectra. Evidence is being obtained that the discrete sources are largely, if not entirely, "radio nebulae." One exciting new line of work is a study of the 1420 mc/s line emitted by "cold" hydrogen, its profile and the Doppler shifts involved, its distribution in space, and the additional light these throw on the structure of our galaxy.

No less comprehensive is the laboratory's work on rain and cloud physics. Despite its early successes as a "rainmaker"—the first artificially produced rainstorm in which rain was conclusively shown to have reached the ground occurred near Sydney early in 1947—the laboratory has concentrated on obtaining a thorough understanding of the physical processes involved in the formation of clouds and rain. Theoretical work, backed by experimental verification, has been completed on the scattering of radio waves by meteorological particles; and, as a result of an active flying program in specially instrumented aircraft, the occurrence of substantial rainfall from nonfreezing clouds and the importance of coalescence as an alternative process in the growth of droplets to raindrop size have been amply documented. Artificial rainmaking is being investigated under controlled field conditions; the action of dry ice on supercooled clouds, for example, and the conditions under which its use is likely to be successful are now well understood.

In this brief outline many investigations in progress at the Radiophysics Laboratory have, of necessity, been omitted.

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