NEWS AND VIEWS

Very Long Baseline Interferometry

HIGH angular resolution observations have made an important contribution to radio astronomy in recent years. Specialized techniques have been developed to combat the relatively poor inherent resolution of the single radio telescope, and the two-element interferometer introduced into optical astronomy by Michelson in 1920 has been taken over into radio astronomy with such success that the resolution is higher at radio than at optical wavelengths in spite of the difference of a factor $\sim 10^5$ in wavelength. Even Hanbury Brown and Twiss's improvement on Michelson's angular resolution to 0.0005 arc s has been superseded by radio developments.

These very long baseline (VLB) radio interferometers which now span the continents and the oceans of the Earth present novel technical problems. Whereas the earliest short baseline interferometers measured coherence between the signals received in the telescopes using cables and radio links, the VLB approach has found a solution to the coherence problem by using two entirely independent receivers. The method involves the construction of receivers with very accurate frequency control; this is now possible with atomic frequency sources such as the hydrogen maser or rubidium standards. These provide the necessary phase stability for measuring coherence and at the same time they act as high precision clocks (accurate to better than a microsecond) which give the required synchronization of the tape recordings of the astronomical signals measured at each end of the baseline.

VLB interferometers have been operated between large telescopes in Australia, Canada, Sweden, Britain, the United States, and the Soviet Union. The longest baseline used so far was between the 22-m radio telescope of the Crimean Astrophysical Observatory at Simeiz, USSR, and the 37-m radio telescope of the Haystack Observatory at Westford, Massachusetts, a distance of 7,350 km (*Soviet Astr.*, **16**, 379; 1972). At the operating wavelength of 1.35 cm the resolution was 0.0002 arc s with a baseline of 550×10^6 wavelengths.

On page 18 of this issue of *Nature*, Legg *et al.* report VLB observations between the 45-m radio telescope of the Algonquin Radio Observatory, Ontario, Canada, and the 25-m radio telescope at Chilbolton, England, operated by the Radio and Space Research Station. At the observing wavelength of 3 cm the 5,265 km baseline corresponds to 187×10^6 wavelengths. Legg *et al.* report observations of 3C84, the radio source associated with the 13.3 mag galaxy NGC1275; it is a Seyfert galaxy with an eruptive nucleus. At radio wavelengths this galaxy has three components, one 4 arc min in diameter comparable with the optical object, one ~ 10 arc s diameter and the one studied here which is found to be contained within 0.01 arc s. Detailed analysis of their observations suggests that this nuclear component may consist of four separate sources each about 0.001 arc s in diameter spread 0.006 arc s along a north–south line. Similar compact components are found in many extragalactic sources, including both radio galaxies and quasars. Kellermann and Pauliny-Toth (*Astrophys. J. Lett.*, **155**, L71; 1969) state that more than half of all sources observed at centimetre wavelengths are opaque radio sources with positive spectral indices. Such sources are, like the nuclear component of 3C84, extremely compact objects with high brightness temperatures in the range 10^{11} to 10^{12} K.

The interesting new result found by Legg *et al.* is that the 3-cm brightness temperature of the 3C84 components is 3×10^{11} K. This is close to the upper limit of brightness temperature allowed (10^{12} K) in a radio source; above this temperature inverse Compton scattering causes catastrophic energy loss. The magnetic fields in these components of 3C84 are estimated to be 10^{-2} to 10^{-1} gauss, among the highest values found in a synchrotron radio source. R. D. D.

T-Cell Function and Experimental Arthritis

THE experimental models of arthritis which at present are used to elucidate the pathogenetic mechanisms of rheumatoid arthritis are those which set up opportunities for immune reactions and their sequelae to occur in the joints of prepared animals. In the case of adjuvant arthritis—inducible in rats by remote injection of water-in-oil emulsion incorporating killed mycobacteria—it has been, at least tentatively, suggested that the latter or their fragments constitute the antigen which, conveyed by histiocytes to the synovial membrane, there interacts with circulating specifically-sensitized T lymphocytes to produce the inflammatory changes of the arthritis.

The experimental disease is certainly transferable to untreated syngeneic recipient rats by thoracic duct cells from donors which have been relatively recently sensitized, and it is also reported that administration of anti-rat lymphocyte serum during immunization prevents the arthritis (Currey and Ziff, *Lancet*, ii, 889; 1966), so that cell-mediated immunity seems to be important in its production especially as, in contrast to rheumatoid arthritis, local immunoglobulin synthesis by the inflamed synovium is not a feature (Cook and Jasin, *Arth. Rheum.*, **15**, 327; 1972). Nevertheless, depletion of T cells produced by neonatal thymectomy does not confer protection against arthritis developing on subsequent standard challenge.

Lennon and Byrd (see page 38 of this issue of *Nature*) have now adduced new evidence that although neonatal thymectomy on the one hand protects rats receiving basic myelin protein in an immunization schedule otherwise appropriate to induce auto-immune encephalomyelitis against developing the latter, on the other it induces an undue proneness to what looks like adjuvant arthritis, with histologically typical mononuclear cell synovial infiltrates. What may be relevant here, however, as Lennon and Byrd point out, is the fact that the worst arthritis was seen in the rats with the lowest pre-immunization blood lymphocyte counts and the least