NEWS AND VIEWS

New York Conference on Pulsars

May 21

NOT long ago it was the quasar, and now it is the pulsar, the radio properties of which burst on us without any corresponding optical information. At this conference there was a wealth of information about the structure of the radio pulses, many ideas on their generation, on the scintillation phenomena which so evidently modulate their strength, and on the nature of the accurate periodicity of the pulses, but there was still very little about the possible identification of any of the four known pulsars with visible objects.

The one new piece of optical information fell as a bombshell at the conference at the Goddard Institute of Space Studies; it was reported both from Kitt Peak and Lick Observatories that the light from Ryle's star, provisionally identified with *CP* 1919, was varying by about 4 per cent with a period twice the interval between the radio pulses. If this is true, it makes the identification more certain and the theories more difficult, since there is no evidence at all for the differences one might then expect between alternate radio pulses.

The confusion between various observations was worsened by the dramatic arrival of Dr Cudaback from Lick Observatory, carrying batches of data showing that the light output of *CP* 1919 varied by more than 15 per cent with a wide variety of periods, not locked accurately to the radio period but including the double period and its harmonics. This behaviour is clearly not the same as the radio behaviour, and at this early stage it could not be taken into account in the theoretical discussions.

The radio evidence confirmed and enlarged the picture which has emerged from recent papers in *Nature*. New observations at Arecibo and Greenbank have shown that the polarization of radio pulses is typically elliptical rather than plane, and that it varies over the whole range from circular to plane. An extra pulse has been found in Jodrell Bank recordings of *CP* 0950; this pulse occurs 100 ms earlier than the main pulse, and contains 1·5 per cent of the energy of the main pulse. Observations of the radio spectrum have been made down to a wavelength of 13 cm for all four sources by the California Institute of Technology, and down to 11 cm for two sources by Jodrell Bank. The spectrum falls steeply for *CP* 0834 and *CP* 1919, and the radio emission mechanism must explain this very rapid cutoff.

The scintillations of these radio sources, giving the variations shown in Jodrell Bank recordings from a wavelength of 2 m to 30 cm, have the characteristics of focusing at the short wavelengths and a more random character at long wavelengths. Further, there is fine frequency structure in the spectrum which is troublesome for further observation of the Faraday effect in the galactic magnetic field, but which is now clearly attributable to scintillation. Professor F. G. Smith showed that the scintillation occurs in a physically thin shell of ionized gas round the star, with radius perhaps 10^{10} km with irregularities 10^4 km across containing an electron density of about 10^3 cm^{-3}.

The very accurate time-keeping properties of the pulsars suggest that they are either massive oscillating stars or binary systems. A single star would be a white dwarf, oscillating in an overtone mode, and driven by nuclear burning. Binary systems are subject to enormous gravitational forces, and they will be unstable if the orbital period is made short enough. Any single star rotating at the observed pulse period would only be stable if it were as small as a neutron star, but J. P. Ostriker showed that there is a wide range of white dwarf models which rotate fast enough to distort them into ellipsoids. Suggested emission mechanisms varied from a permanent flare, emitting like a lighthouse, to versions of shock waves converting mechanical energy into radiation as they encounter a magnetic field. The shape of the individual spikes and the pulse envelopes fit well with a source distributed over the surface of a white dwarf, according to calculations by B. H. Bland of Manchester.

The conference was prepared to accept interpretations based on white dwarfs, but there is still room for many questions on pulsation theory and the emission mechanism. The observational question about the optical emission also remains open; it may be settled very soon, since the whole of the astronomical world is so excited about the possibility of light pulses that many telescopes will be used on the pulsars during the next few nights.

F. G. SMITH

Renal Transplantation

A REPORT in the current issue of the *British Medical Journal* describes the progress of 49 patients who have received renal transplants at Addenbrooke's Hospital, Cambridge. Compared with early experience of this surgical technique, the results are much improved—the longest period of survival since the operation is 2·5 years.

The report, which was written by 12 medical workers (including Professor R. Y. Calne, who recently performed the liver transplant), describes 54 consecutive transplants—51 kidneys coming from cadavers and 3 from parental living donors. Briefly, patients were admitted to a special transplantation and dialysis unit on the top floor of the hospital, and tissue typing was carried out. Immediately after removal, the kidneys were immersed in normal saline at 4° C, the renal artery was cannulated in most cases, and the kidneys were perfused with Ringer's solution at 4° C.

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