RADIO OBSERVATIONS OF PLANETARY NEBULAE

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I am to report on a rather extensive series of observations of planetary nebulae, using the Mark-II radio telescope at Jodrell Bank. The method of observation adopted involves comparing the signal received from a beam centered on the nebula with two beam areas horizontally displaced to either side of it. If the source is not too far South, the confusion effects can be reduced by making observations at different hour angles. A second source of error, particularly in the earlier results, arises from the fact that the positions adopted for some nebulae were not as accurate as had been assumed. The anomalously low 6 cm flux for *IC* 418 in particular is now believed to be due to this cause, and can be disregarded.

Observations of 21 sources at 21 cm, 65 sources at 11 cm, and 40 sources at 6 cm have already been published (Davies *et al*, *Mon. Not. R. astr. Soc.*, **135**, 1967, 139). Observations of 76 sources at 4-cm wavelength were completed in August this year, and preliminary values are now available. In addition about 12 sources have been observed at 21 cm and 73 cm using the Mark-I and Mark-II telescopes as an interferometer. The nebulae were not resolved by the instrument in most cases, but it is expected that the confusion will be greatly reduced. The results of these observations have not yet been analysed. From the results available, 35 planetary nebulae have been found to be optically thin, and the fluxes observed agree well with those obtained from the Hβ radiation, after correction for extinction.

The nebulae NGC 1501, 4634, 6307, 6543, and 6884 appear to show optically thick spectra, although in no case is this certain, since all the sources are weak and may be subject to confusion.

The nebulae NGC 6572, 6790, 7027, and IC 418, show the transition from optically thick to thin, at wavelengths of approximately 10, 6, 10 and 15 cm respectively.

Three nebulae, VV 285, NGC 6445 and 6833 appear to have non-thermal spectra, but this may be affected by confusion.

The source NGC 6857, for which Terzian reported a flux of 1·2 flux units at 70 cm, is the brightest observed planetary nebula at 4 cm, having a flux of 10·6 flux units.

Twenty-three of the planetary nebulae observed at 4 cm were undetected. Two Wolf-Rayet stars, HD 193793 and HD 16523 were detected at 11 cm. Pressure of observing time has prevented further observations of these or other Wolf-Rayet stars.

Osterbrock and O'Dell (eds.), Planetary Nebulae, 106–107.

DISCUSSION

Thompson: The flux density of NGC 6857 as measured by Colvin and myself at 10-cm wavelength is $6{\cdot}4 \pm 0{\cdot}5$ flux units. The position of this nebula coincides with the brightness peak in the broad thermal source NRAO 621, and some diffuse nebulosity can be seen on the Palomar Schmidt plates. Some fraction of the measured radio emission may thus result from a confusing thermal source.

Terzian: NGC 6857 shows no radio signal at 195 MHz, perhaps because it is just seen in absorption.

Aller: The optical spectrum of NGC 6833 is that of a typical moderate excitation object. It has a small angular size. I would not expect it to be unusual, certainly not a non-thermal source.

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