## LETTERS TO THE EDITOR

## PHYSICAL SCIENCES

## **Three New Pulsars**

PULSAR surveys carried out at the Molonglo Radio Observatory during February and March, 1969, have resulted in the discovery of three new pulsars. They have been designated MP 0450, MP 1642 and MP 1818. The last two were found in areas of the sky which had not previously been searched for pulsars using the Molonglo radio telescope. The position of MP 0450, however, had been searched twice before during the pulsar survey programme, but the pulsar was not detected presumably because of long term variations of its pulse amplitude.

The physical parameters of the three pulsars are given in Table 1. MP 1642 has a small ratio of pulse width to period of 1·3 per cent compared with the average of about 4 per cent<sup>1</sup>. Only three or four other pulsars have pulse width to period ratios as small as this. In other respects, the values of the parameters of these pulsars are well within the ranges of values covered by other pulsars<sup>1</sup>. Using the dispersing layer model proposed by Mills<sup>1</sup> in which the electron density at a point z away from the galactic plane is given by

$$n = \frac{n_0}{1 + (z/a)}$$

with  $n_0 = 0.1 \text{ cm}^{-3}$  and a = 100 pc, the dispersion measure and latitude of MP 1818 place it well within the layer at a distance of about 700 pc from the Sun. The same model indicates that MP 0450 and MP 1642 are in the outer regions of the dispersing layer at distances from the Sun of about 1 kpc and 2 kpc respectively.

Table 1. PHYSICAL PROPERTIES OF THE PULSARS

		MP 0450	$MP \ 1642$	MP 1818
	$\delta + 2^{\circ}$	22 s	27 s	16 s
a1938	δ	04 h 50 m 22 s	16 h 42 m 25 s	18 h 18 m 14 s
		$\pm 2 s$	$\pm 1 s$	$\pm 1 s$
	$\delta - 2^{\circ}$	22 s	23 s	12 s
S1950		$-18^{\circ} \pm 1^{\circ}$	$-3^{\circ} \pm 2^{\circ}$	$-5^{\circ} \pm 2^{\circ}$
1		217°	14°	25°
b		- 34°	$26^{\circ}$	5°
P(s)		$0.548 \pm 0.005$	$0.388 \pm 0.005$	$0.597 \pm 0.005$
$W_{\rm p}$ (ms)		~ 20	~ 5	$\sim 20$
2408 (MHZ S-1)		$\sim 360$	$\sim 250$	$\sim 120$
$\int n dl (cm^{-3} pc)$		$25 \pm 10$	$33 \pm 5$	$70 \pm 10$
$U_{\rm D}$ ( $\times 10^{-26}$ J m <sup>-2</sup> Hz <sup>-1</sup> )		~ 0.1	~ 0.1	$\sim 0.1$

The technique used in the Molonglo pulsar programme has been described before<sup>2</sup>, and has been used consistently except in the discovery of the first two Molonglo pulsars<sup>3</sup> and also some restricted use of a two channel dispersion remover<sup>4</sup>. As a result, twenty pulsars have now been discovered at Molonglo and it seems appropriate to consider the extent to which the search is complete in the area of sky observable with the instrument ( $\delta = +20^{\circ}$  to  $-90^{\circ}$ ).

At the present time about 33 per cent of this area of sky has been searched more than once. The sensitivity is a function of pulsar period and dispersion<sup>5</sup> and it is reasonable to expect that we have found most of the pulsars in this area with flux densities, periods and dispersion measures falling well within the sensitivity limits of the system. An unknown number of very crratic pulsars may have been missed, however, for transit drifts at Molonglo give only a few seconds' observation at each point. Even in extensively searched regions few points have been observed for a total time exceeding one minute. A further 41 per cent of the observable sky has been searched only once and it is almost certain that there are still several pulsars in these areas which are within the sensitivity limits of the search but have not been found because they are not active all the time.

The remaining 26 per cent of the available sky which has not been observed at all includes most of the sky south of declination  $-70^{\circ}$  and several other smaller areas. Nearly all the unsearched sky is at high galactic latitudes. On the basis of discoveries already made at Molonglo it seems likely that the continuation of the present search will reveal several more strong pulsars.

We have noted many suspected pulsars on the chart records. These are very near the signal to noise limit of the system and are very difficult to confirm. It is therefore likely that a significant increase in sensitivity would lead to the discovery of many more pulsars. At Molonglo there is little scope at present for a general increase in sensitivity but some improvement could be obtained for restricted ranges of period and dispersion.

We thank Professor B. Y. Mills for his continuing interest in this work, which is supported by the Australian Research Grants Committee, University of Sydney Research Grants Committee, the Science Foundation for Physics within the University of Sydney and the US National Science Foundation. A. E. V. is in receipt of a Commonwealth Postgraduate Studentship.

Note added in proof. The pulsar PSR 1642-03 (MP 1642) was announced by G. R. Huguenin and J. H. Taylor on March 5, 1969 (IAU Circular No. 2135).

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Received April 28, 1969.

- <sup>1</sup> Mills, B. Y., Proc. Astron. Soc. Austral., 1, 176 (1969).
- <sup>2</sup> Large, M. I., Vaughan, A. E., and Wielebinski, R., Nature, **220**, 753 (1968). <sup>3</sup> Turtle, A. J., and Vaughan, A. E., Nature, **219**, 689 (1968).
- <sup>4</sup> Large, M. I., Vaughan, A. E., and Wielebinski, R., Astrophys. Lett. 3, 123 (1969).
- <sup>5</sup> Vaughan, A. E., and Large, M. I., Proc. Astron. Soc. Austral., 1, 220 (1969).

## Unsuccessful Pulsar Search at 1,400 MHz

A PULSAR search at 1,400 MHz was carried out in March 1969 using the Nançay transit telescope. A third of the galactic plane was scanned between plus and minus two degrees in galactic latitude. No pulsars were discovered.

The aim of the survey was to search for pulsars with spectral maxima at high frequencies (CP 0328, for example), and for pulsars of very high dispersion. Plotting the distribution of known pulsars in the sky, Large *et al.*<sup>1</sup> found a zone of avoidance along the galactic plane and a concentration some degrees to the south. They suggested that a thin layer of ionized hydrogen in this plane produces very high dispersion. Individual pulses from pulsars situated in such a layer would not have been resolved by the low frequency surveys but, because the pulse transit time in a given bandwidth is proportional to v<sup>3</sup>, the pulses can be resolved at 1,400 MHz with a large bandwidth.

The receiver had a bandwidth of 5 MHz and a time constant of 10 ms. After removing the slowly varying components, the output of the receiver was recorded for visual inspection and digitized by an on-line computer for tests. These tests were performed every 5 s on the nearest 20 s of data and searched for periodicities between peaks of twice the r.m.s. noise. Records with a 10 ms constant show a peak to peak noise fluctuation equivalent to a