

## NEW OBSERVATIONS OF HI ABSORPTION FOR PULSARS

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The second Molongo pulsar survey (Manchester et al., 1978) provides a large sample of pulsars in the southern sky. It is of interest to obtain non-dispersion-dependent distances for as many of these pulsars as possible. Since most of these pulsars are relatively weak, a system of high sensitivity is required. In this paper we report on preliminary observations made at Parkes during June 1980 with such a system.

A dual-channel receiver system sampling orthogonal linear polarizations was used. Each channel consisted of a two-stage cryogenically cooled (20 K) FET preamplifier followed by a band-limiting filter (BW 70 MHz), a room-temperature FET amplifier, a mixer and intermediate frequency amplifiers. A  $2 \times 32$  channel filterbank with channel bandwidth of 33 kHz was used to provide spectral resolution. The system was calibrated using observations of Hydra A [ $S(1420 \text{ MHz}) = 43.5 \text{ Jy}$ ] and taking  $S/T_A = 1.6 \text{ Jy K}^{-1}$  for the ratio of flux density to antenna temperature. The system noise was 40 K in one channel and 50 K in the other. Brightness temperature profiles were computed assuming  $T_B/T_A = 1.2$ .

The on-line program measured both absorption and emission profiles, the latter using frequency switching. In off-line processing, absorption integrations of 10–20 minutes duration were averaged with a weight proportional to the square of the mean pulse intensity during the integration to form a final profile. No sloping or curved baselines were subtracted.

So far, good observations have been obtained for seven pulsars; these are summarized in Table 1. Emission and absorption profiles are shown for six of these pulsars in Fig. 1. Notes on individual sources are as follows.

PSR 0959–54: Absorption extends to the tangential point at negative velocities and there is no significant absorption at positive velocities. The velocity gradient is small in this direction so only an upper limit can be placed on the distance.

PSR 1054-62: Again, absorption extends to the tangential point indicating a kinematic distance  $d \sim 4$  kpc. Possible features exist at  $\sim +50$  km s<sup>-1</sup> and at  $\sim +100$  km s<sup>-1</sup>. The  $+50$  km s<sup>-1</sup> feature corresponds to  $d \sim 11$  kpc and a mean electron density  $\langle n_e \rangle \sim 0.033$  cm<sup>-3</sup>.

PSR 1154-62: Absorption is observed at negative velocities out to the tangential point ( $\sim -50$  km s<sup>-1</sup>) corresponding to  $d \sim 5$  kpc and  $\langle n_e \rangle \sim 0.08$  cm<sup>-3</sup>. The weak feature observed at positive velocities by Ables and Manchester (1976) is not seen in the present observations.

PSR 1356-60: Clear absorption is seen at negative velocities to the tangential point, but none at positive velocities.

PSR 1557-50: In observations by Ables and Manchester (1976) the  $-80$  km s<sup>-1</sup> feature was weak ( $\sim 2.5 \sigma$ ) despite an integration time over four times that used in the present observations.

PSR 1558-50: An absorption feature with  $I/I_0 \sim 0.4$  is seen at  $\sim -20$  km s<sup>-1</sup>. A possibly significant feature is observed at  $\sim -80$  km s<sup>-1</sup> corresponding to  $d \sim 6$  kpc and  $\langle n_e \rangle \sim 0.03$  cm<sup>-3</sup>.

PSR 1845-01: Absorption is detected at small positive velocities and possibly at  $\sim +100$  km s<sup>-1</sup> and  $\sim -25$  km s<sup>-1</sup>. The negative velocity corresponds to a very large distance ( $\sim 20$  kpc) and a low electron density ( $\sim 0.008$  cm<sup>-3</sup>). Higher electron densities have been observed for other pulsars in this part of the galactic plane (Weisberg et al., 1979, 1980).

Table 1. H-LINE ABSORPTION OBSERVATIONS

PSR	$\ell$ ( $^{\circ}$ )	$b$ ( $^{\circ}$ )	INTGN TIME (m)	$\tau_{\max}$	$v_{\max}$ (km s <sup>-1</sup> )	$d$ (kpc)	DM (cm <sup>-3</sup> pc)	$\langle n_e \rangle$ (cm <sup>-3</sup> )
0959-54	280.2	+0.1	67	1.7	-15	<6	131	>0.02
1054-62	290.3	-3.0	91	1.0	-20	$4 \pm 2$	322	$0.11 \pm 0.50$
1154-62	296.7	-0.2	120	$\sim 1.5$	-50	$5 \pm 2$	324	$0.08 \pm 0.03$
1356-60	311.2	+1.1	85	1.6	-70	$9 \pm 3$	294	$0.036 \pm 0.012$
1557-50	330.7	+1.6	102	0.5	-100	$12 \pm 5$	270	$0.027 \pm 0.011$
1558-50	330.7	+1.3	86	$\sim 1.0$	-25	$2.0 \pm 0.5$	169	$0.090 \pm 0.025$
1845-01	31.3	0.0	82	1.1	-40	$20 \pm 2$	163	$0.008 \pm 0.001$

The observations reported here occupied less than two days of telescope time. Clearly further observations are required to resolve ambiguities in the interpretations of these observations and to obtain observations on other pulsars.

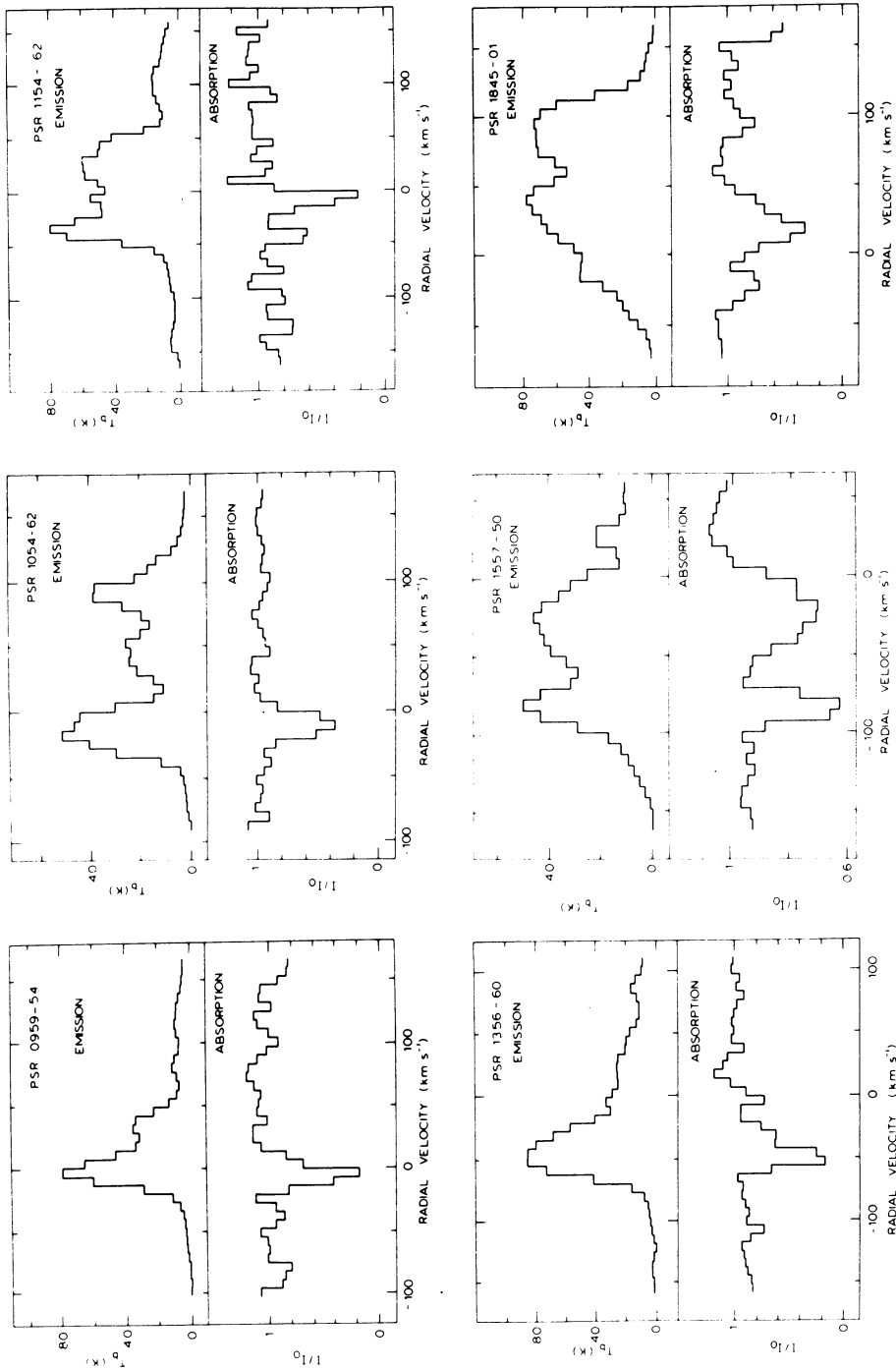


FIG 1. HI emission (top) and absorption (bottom) profiles for six pulsars. For the absorption profiles the ordinate is the ratio of the observed pulse intensity to the mean pulse intensity off the hydrogen line.

## REFERENCES

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