

POLARIZATION IN PULSAR RADIO EMISSION

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Polarimetric observations of over 300 pulsars have been carried out between 21 December 1988 and 22 January 1990 at 606, 610, 925, and 1408 MHz using the Lovell Telescope at Jodrell Bank. Many of these pulsars have no previously published polarization profiles and will be published shortly (Gould and Lyne 1990). This large data set along with previously published data from various sources, has been used to test the correlation found by Radhakrishnan and Rankin (1990) between sense reversing circular polarization signatures and the accompanying sense of rotation of the linear polarization position angle.

Sense-reversing circular signatures

Radhakrishnan and Rankin found that transitions of circular polarization from left hand (positive) to right hand (negative) accompanied clockwise (negative) rotations of the linear polarization position angle and *vice versa*. From a list of 22 pulsars, 20 were found to follow the above correlation. Many of these pulsars were observed only once or at only one frequency. Some of these pulsars also had slightly uncertain circular signatures or uncertain linear polarization angle swings.

The pulsars presented in table 1 and figure 1 are those for which the circular and linear polarization signatures persist over more than one observation and at more than one frequency. Out of 24 pulsars 14 follow the proposed correlation and 10 do not.

Why do these results differ from those of Radhakrishnan and Rankin? Firstly, we find PSR 2003-08 has a counterclockwise rotation of the position angle, whereas Radhakrishnan and Rankin have given a clockwise rotation. Also PSR's 1451-68 and 1933+16 were not included in their list even though they were presented in Rankin's paper I (Rankin 1983a). Single pulse observations confirm the position-angle swings of PSR 1933+16 and 0329+54, both of which suffer from orthogonally polarized radiation.

Another interesting pulsar included in table 1 is PSR 1702-19. This pulsar is famous for its large amounts of predominantly right hand (negative) circular polarization. As is obvious from the profiles presented here in figure 1, the main pulse regularly undergoes a sense reversal of its circular polarization signature.

Data for most of the pulsars used in the analysis of Radhakrishnan and Rankin are presented here. Pulsars for which there is only one observation or one frequency and/or which have uncertain circular or linear signatures. Inclusion of those pulsars with good polarization data at just one frequency would result in the addition of five pulsars into the first two columns of table 1 and four pulsars into the latter two columns.

Table 1

+/- cw	ref	-/+ ccw	ref	+/- ccw	ref	-/+ cw	ref
0844-35	4	0559-05	1	0149-16	1	0329+54	1
1237+15	1	0826-34	2,4	0834+06	1	1451-68	3,6
1508+55	1	1700-32	4,5	1055-52	6	1702-19m	1
1600-27	1	2306+55	1	1730-22	1	1933+16	1,7
1737+13	1,8			2003-08	4	1039-19	1
1821+05	1						
1857-26	1						
1859+03	1						
1907+03	1,8						
2111+46	1						

References: 1. Jodrell Bank (this paper), 2. Biggs *et al.* (1985), 3. Hamilton *et al.* (1977), 4. Lyne (private communication), 5. Manchester *et al.* (1980), 6. McCulloch *et al.* (1978), 7. Rankin (1983a), 8. Rankin *et al.* (1989)

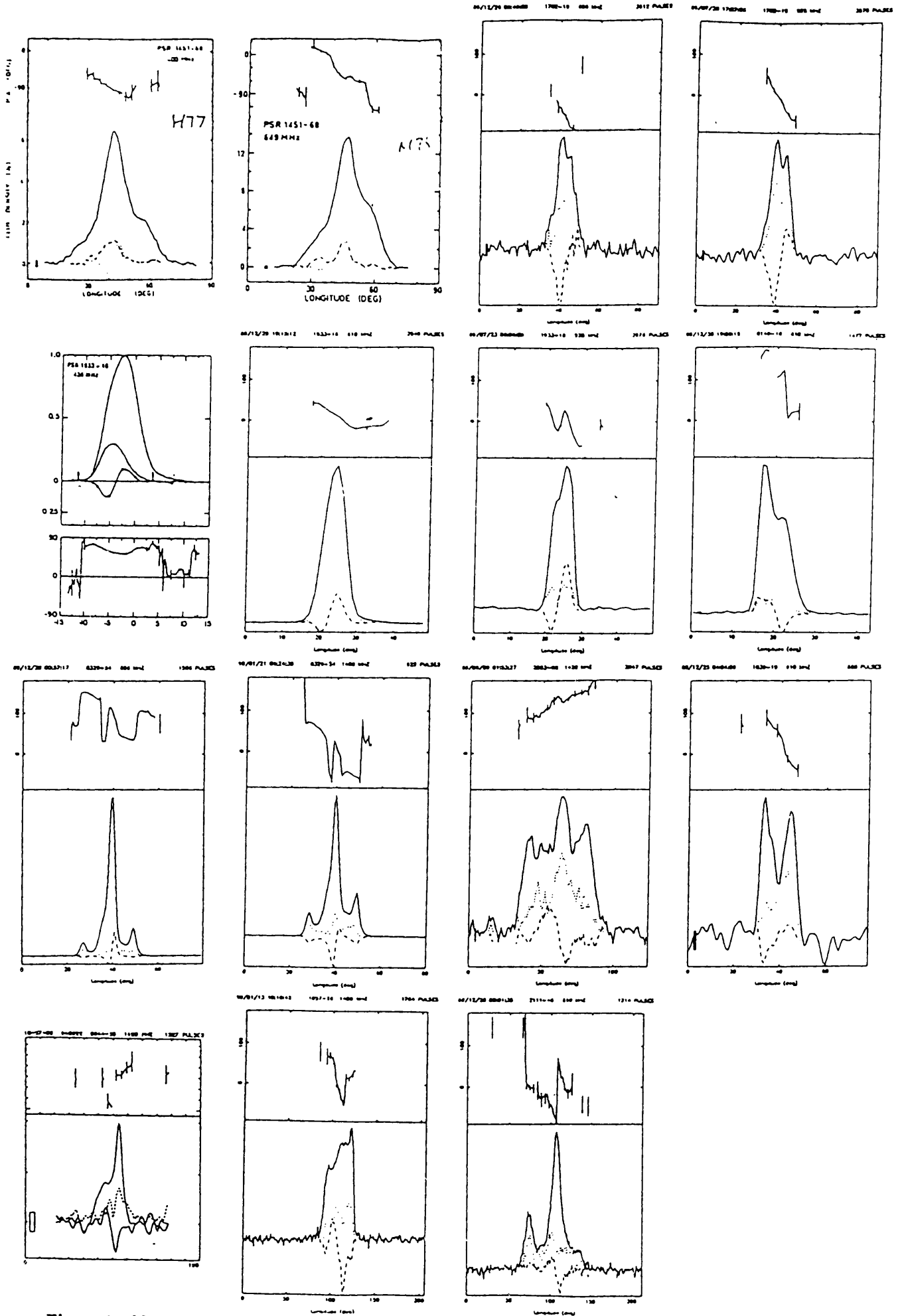


Figure 1 Mean pulse profiles and polarization parameters for pulsars with sense-reversing circular signatures.

PSR 2303+46

Polarimetric observations of this binary pulsar between December 21, 1988 and January 1, 1990 were also carried out at Jodrell Bank using the Lovell Telescope at around 608 MHz. Three of the resulting profiles are presented below (see figure 2). The profiles were obtained by the summation of several consecutive three-minute integrations.

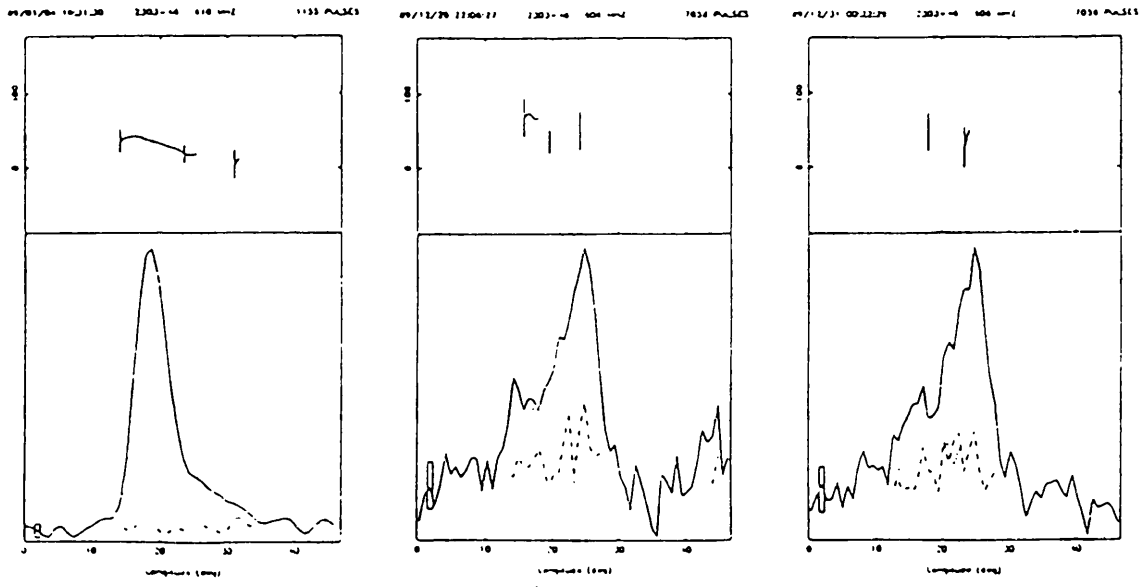


Figure 2 Mean pulse profiles and polarization parameters for PSR 2303+46, 1155, 7056, and 7056 pulses, respectively

The first profile in figure 2 is of the highest quality, the best known for this pulsar. It shows very little circular polarization and a shallow monotonic swing of the linear position angle.

The most intriguing difference between the first profile and the latter two is the position of the second component. It appears in the trailing edge of the first profile, whereas in the latter two it is shown to be on the leading edge. The integrated profile of this pulsar thus seems to be unstable.

The summation of 1155 consecutive pulses (about 20 minutes observation) produced the first profile, whereas 7056 pulses (about 2 hours observation) produced the latter two profiles. The second component must then spend most of its time on the leading edge.

An analysis of all the three-minute integrations during any particular 2-hr observation shows (very unclearly) the second component wandering from the leading to the trailing edge and back again with a period of around 50 minutes. Such a periodicity (if real) would not seem to be the result of the binary orbit which has a period of 12.34 days (Taylor and Dewey 1988). This second component may be due to a separate region of emission to the main pulse.