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An unusual pulsar – PSR 0826 – 34

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Summary. Of the 155 pulsars discovered in the Second Molonglo Pulsar Survey, PSR 0826 – 34 is notable for its unusual profile and exceptional sporadicity.

1 Observations

The long-period pulsar PSR 0826 – 34 discovered in the Second Molonglo Pulsar Survey (Manchester *et al.* 1978) has several unusual characteristics deserving particular attention. Suspicion that a pulsar could exist at this position was first aroused in 1971 during the Molonglo Radio Source Surveys (Vaughan & Large 1972; Mills 1977), but repeated observations failed to confirm its existence.

During the search phase of the Second Molongo Pulsar Survey the pulsar was again spasmodically detected, and its existence was finally confirmed in a single transit-scan using the Molonglo radiotelescope east–west arm on 1977 October 9, when individual pulses were seen with a signal/noise ratio greater than 10. A more accurate measurement of the pulsar declination (given in Table 1) was obtained by recognizing an intermittent response of strength about 1 Jy, recorded by the Molonglo Cross on 1971 May 6, as being attributable to this pulsar.

Subsequent observations using this position were made with the CSIRO 64-m radiotelescope at Parkes, NSW (also at 408 MHz), and the remaining parameters of Table 1, as well as the integrated pulse profile of Fig. 1, were obtained from measurements made there on 1977 October 20 and 1978 April 14.

2 Discussion

The integrated pulse profile of Fig. 1 is similar to that of some other long-period pulsars (e.g. 0525 + 21, 1237 + 25, Manchester & Taylor 1977), but is unusual in two respects. First, the

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Table 1. Parameters of PSR 0826 − 34.

Right ascension (1950.0)	$08^h\ 26^m\ 20^s \pm 2^s$
Declination (1950.0)	$-34°\ 07'\ 30'' \pm 60''$
Heliocentric period	$1.84189180 \pm 0.00000003$ s
Dispersion measure	52 ± 5 pc cm^{-3}
Integrated flux density at 408 MHz, active	$\simeq 0.40$ Jy
Integrated flux density at 408 MHz, inactive	$\lesssim 0.40$ mJy
Pulse half-maximum width	150° longitude
Pulse equivalent width	0.64 s
Fraction of time that pulsar is active	$\simeq 20$ per cent

fractional pulse-width is greater than that of any other reported pulsar, about 150° of longitude. More striking, however, is the gradually increasing emission from the end of one pulse to the beginning of the next. This was consistently observed in both the integrated profile and individual pulses. Like many other pulsars, the smooth long-term average profile is due to several short-lived, sharper features blended together. The weak but distinct interpulse centred at longitude 110° in Fig. 1 was intermittently quite strong in short-interval averages.

The most noticeable property of this pulsar is its frequent 'nulling' – ceasing all detectable emission for at least 70 per cent of the time. During one such long 'off' period, an upper limit to the average pulse intensity was placed at 0.1 per cent of the average 'active' intensity. The time-scale of the nulls ranges from a few periods to at least 15 000 periods. The relative pulse intensity observed on 1978 April 14, and averaged over 100-s intervals, is shown in Fig. 2; it is clear from the data that the pulsar switches sharply on or off in 10 s or less.

The nulling property has been reported previously for several other pulsars (Backer 1970; Ritchings 1976), and it was suggested by Ritchings (1976) that it may be associated with the final termination of pulsar radio emission. If so, PSR 0826 – 34, which has longer and more frequent nulls than any other reported pulsar, could well be approaching the end of its active life.

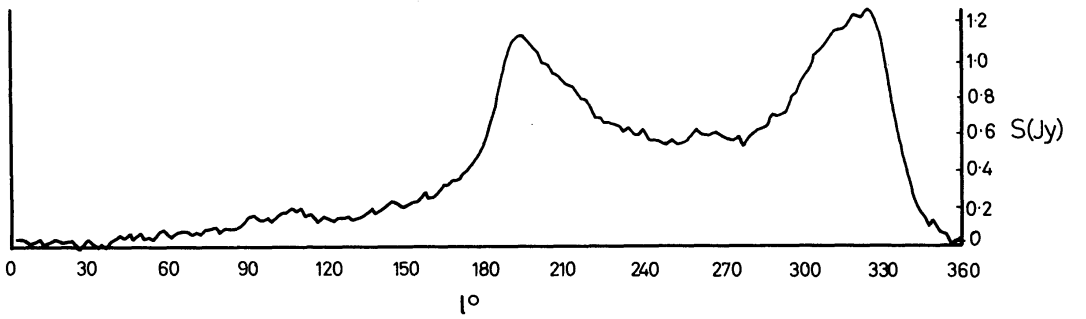

Figure 1. Integrated pulse profile of PSR 0826 – 34 at 408 MHz.

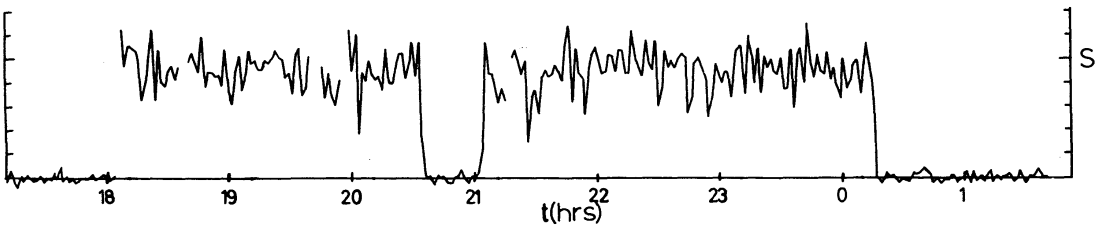

Figure 2. Relative pulse strengths and nulling, observed 1978 April 14.

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