

A MASSIVE GLITCH IN PSR 0355+54

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ABSTRACT. Pulse timing observations at Jodrell Bank have shown that the relatively old pulsar PSR 0355+54 has suffered two glitches in the last 18 months, the second glitch being larger than any previously observed in any pulsar.

PSR 0355+54 has a characteristic age of 0.6 My and until recently has showed a very steady slow-down with a low level of timing noise (e.g. Cordes and Downs 1985). Since 1980 the pulsar has been included in a series of timing observations at Jodrell Bank and these have revealed two glitches.

The first glitch was estimated as occurring within 7 days of 1985 Jan 14. The fractional change in period amounted to $\Delta P/P = -5.5E-9$. Jumps of this magnitude or greater have been observed in about 5 other pulsars.

The second glitch was 1000 times greater than this with $\Delta P/P = -4.4E-6$ and occurred some time between observations on 1986 Jan 03 and 1986 Mar 15. Both glitches were accompanied by increases in the period derivative, having $\Delta \dot{P}/\dot{P}$ values of 0.2% and about 10% respectively.

The size of the second glitch is greater even than any of the large glitches observed in the Vela pulsar, both in the value of $\Delta P/P$ and of $\Delta \dot{P}/\dot{P}$. The most striking implication of this event is that about 10% of the moment of inertia of the star became decoupled from the solid crust at the time of the glitch. This implies that at least this fraction of the mass of the star is superfluid (Pines and Alpar 1985). The first post-glitch observations also suggest that the value of \dot{P} is recovering rapidly towards its pre-glitch value on a time-scale of about 40 days. However, so far only 0.5 percent of the period decrease has been recovered. There may be further recovery on much longer time-scales than is revealed in the two months' post-glitch data presently available.

REFERENCES

- Cordes, J.M. and Downs, G.S., 1985, *Astrophys. J. Suppl.*, 59, 343.
Pines, D. and Alpar, M.A., 1985. *Nature*, 316, 27.