Slow and normal glitches in PSR B1822−09

T. V. Shabanova*

Pushchino Radio Astronomy Observatory

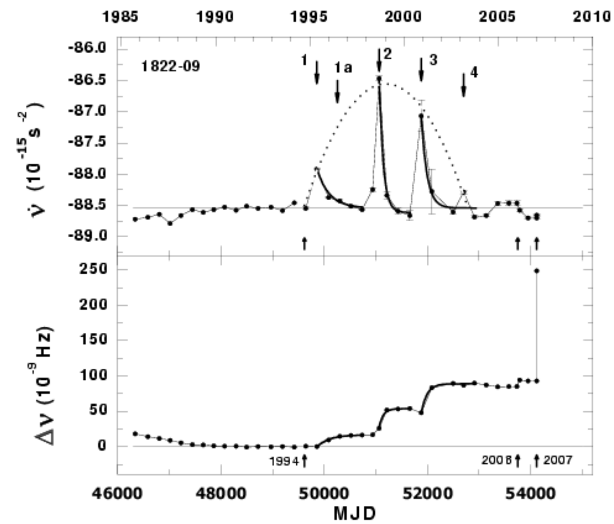

Figure 1: Signatures of five slow and three normal glitches. Arrows pointing upwards indicate the normal glitches.

The glitching behaviour of the pulsar B1822−09 (J1825−0935) has been investigated at the Pushchino Observatory since 1991. The pulsar exhibits two classes of glitches in its spin rate – normal glitches with a short rise time and slow glitches with a long rise time [1, 2]. Signatures of these glitches are shown in Fig. 1. A series of five slow glitches, that occurred over the 9-yr time interval, from 1995 to 2004, is well seen in the center of this plot. A charateristic feature of the slow glitches is a gradual exponential increase in the spin frequency ν over some hundreds of days. The corresponding changes in the frequency derivative $\Delta\dot{\nu}$ are responsible for the steepness of the front in the frequency residuals $\Delta\nu$. The existence of the envelope for the peaks of $\Delta\dot{\nu}$ indicates that all slow glitches are the components of one process which took place during 9 years, in 1995–2004. No clear frequency relaxation after a slow glitch is observed. Slow glitches have a certain recurrence interval inside a series which can be estimated to be $\sim$ 1000 days.

The largest normal glitch occurred in January 15, 2007 and was characterized by a fractional increase in the spin frequency of $\Delta\nu/\nu = 1.2 \times 10^{-7}$. As is seen in the rightmost side of the plot, the size of the 2007 glitch is $\sim$ 1.7 times greater than the total effect from all the previous seven glitches. The existence of different types of glitches in the spin rate of one pulsar provides a useful way to study the pulsar glitch mechanisms and the internal structure of a neutron star. It is possible that slow and normal glitches in PSR B1822−09 are triggered by two different mechanisms. Apparently, the most attractive model for the explanation for the origin of slow and normal glitches in this pulsar is a solid quark star model [3].

References

[1] T. V. Shabanova. A&A, 337, 723 (1998)
[2] T. V. Shabanova. ApSS, 308, 591 (2007)
[3] C. Peng, R. X. Xu. MNRAS, 384, 1034 (2008)

*E-mail: tvsh@prao.ru