Title

Predicting the Starquakes in PSR J0537–6910

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Abstract

We report on more than 7 yr of monitoring of PSR J0537-6910, the 16 ms pulsar in the LMC, using data acquired with *RXTE*. During this campaign the pulsar experienced 23 sudden increases in frequency ("glitches") amounting to a total gain of over 6 ppm of rotation frequency superposed on its gradual spin-down of = -2×10^{-10} Hz s^{-1}. The time interval from one glitch to the next obeys a strong linear correlation to the amplitude of the first glitch, with a mean slope of about 400 days ppm^{-1} (6.5 days μHz^{-1}), such that these intervals can be predicted to within a few days, an accuracy that has never before been seen in any other pulsar. There appears to be an upper limit of ~40 μHz for the size of glitches in *all* pulsars, with the 1999 April glitch of PSR J0537-6910 the largest so far. The change of its spin-down across the glitches, Δ, appears to have the same hard lower limit, -1.5×10^{-13} Hz s^{-1}, as that observed in all other pulsars. The spin-down continues to increase in the long term, = -10^{-21} Hz s^{-2}, and thus the timing age of PSR J0537-6910 ($-0.5v^{-1}$) continues to decrease at a rate of nearly 1 yr every year, consistent with movement of its magnetic moment away from its rotational axis by 1 rad every 10,000 yr, or about 1 m yr^{-1}. PSR J0537-6910 was likely to have been born as a nearly aligned rotator spinning at 75-80 Hz, with a || considerably smaller than its current value of 2×10^{-10} Hz s^{-1}. Its pulse profile consists of a single pulse that is found to be flat at its peak for at least 0.02 cycles.

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Comments

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