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Repeated, Delayed Torque Instabilities Following Flux Enhancement in the Magnetar 1E 1048.1 5937

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1E 1048.1-5937 is one of the most active magnetars, having exhibited three long-term flux flares, as well as several SGR-like bursts, pulse profile changes, and timing anomalies in 16 years of previous monitoring. This pulsar has also displayed behavior not seen in any other magnetar: on the order of 100 days after the start of two of these flux flares, the spin-down rate underwent a period of greatly increased variability for the approximately two years. These bizarre episodes, in which the spin-down rate changed abruptly by a factor of as much as 10, are a significant puzzle in magnetar astrophysics and, if repeatable, suggest the slow build-up of outer magnetospheric twisting as suggested by Beloborodov (2009). Here we report a fourth flux flare in 1E 1048.1-5937 as observed in X-ray timing observations obtained using the Swift X-ray Telescope in December 2011. We show that again roughly 100 days following the flare, the pulsar's spin-down rate began showing large variations, with the source presently being in this state. This strongly suggests that such flare/torque change delays are repeatable in this source. Why such delayed spin-down variations are seen thus far uniquely in 1E 1048.1-5937 remains puzzling.

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