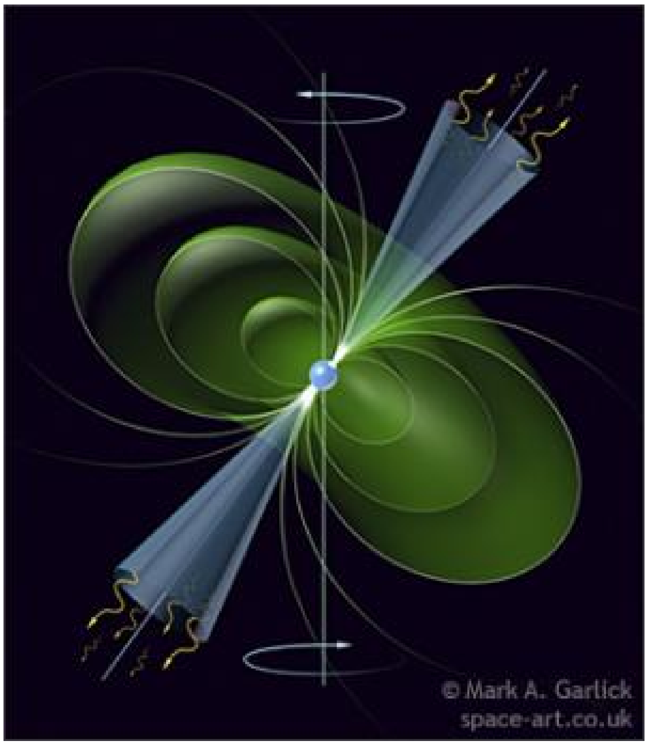
A glitch in pulsar J1718-3718

June 29 2011, By Jon Voisey



Pulsar diagram Credit: Mark Garlick

Pulsars are noted as being some of the universe's best clocks. Their highly magnetized nature gives rise to beams of high energy radiation that sweep out across the universe. If these beams pass Earth, they can rival atomic clocks in their precision. So precise are these timings, that the first extrasolar planet was discovered through the effects it had on this heartbeat. But in September of 2007, pulsar J1718-3719 appears to have had a seizure.

These disjunctions aren't unprecedented. While not exactly frequent, such "glitches" have been noted previously in other pulsars and magnetars. These glitches are often displayed as a sudden change in the period of the pulsar suddenly drops and then slowly relaxes back to the pre-glitch value at a characteristic rate dependent on the previous value as well as how large the jump was. Behavior like this has been seen in other pulsars including PSR B2334+61 and PSR 1048-5397.

The size of a glitch is measured as a ratio of the change in speed due to the glitch as compared to that of the pre-glitch speed. For past glitches, these have generally been changes that are around a hundredth of a percent. While this may not sound like a large change, the stars on which they act are exceptionally dense neutron stars. As such, even a small change in rotational energy means a large amount of energy involved.

Previously, the largest known glitch was 20.5 x 10^{-6} for PSR B2334+61. The new glitch in PSR J1718-3718 beats this record with a frequency change of 33.25 x 10^{-6}. Aside from being a record setter, this new glitch does not appear to be following the trend of returning to previous values. The changed period persisted for the 700 days astronomers at the Australia Telescope National Facility observed it. Pulsars tend to have a slow braking applied to them due to a difference between their rotational axes and their magnetic ones. This too generally returns to a standard value for a given pulsar following a glitch, but PSR J1718-3718 defied expectations here as well, having a persistently higher braking effect which has continued to increase.

Currently, astronomers know precious little about the effects which may cause these glitches. There is no evidence to suggest that the phenomenon is something external to the body itself. Instead, astronomers suspect that there are occasional alignments of the stars internal superfluid core which rotates more quickly, with the star's crust that cause the two to occasionally lock together. Models of neutron stars have had some success at reproducing this odd behavior, but none have suggested an event like PSR J1718-3718. Instead, the authors of the recent study suggest that this may have been caused by a fracturing of the crust of the neutron star or some yet unknown internal reaction. The possibilities currently are not well constrained but studying future events like these will help astronomers refine their models.

Source: [Universe Today]

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