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Using millisecond pulsars to calibrate XMM/Newton onboard clock

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The XMM-Newton space telescope is capable of 30-microsecond time resolution but its onboard clock drifts, for example due to changes in temperature. Current calibration documentation only provides an upper limit on the clock drift of 10^-8, but observations of X-ray millisecond pulsars (MSPs) suggest that it should be more stable.

Using kilo-second XMM-Newton observations of MSPs taken with the EPIC pn-camera in fast timing mode in addition to radio timing measurements from the ATNF pulsar catalog for J1939+2134 (641.9 Hz), J0437-4715 (173.6 Hz), J0218+4232 (430.4 Hz) and J0534+2200 (29.9 Hz), we analyzed the pulse shape for each object with the aim to detect the broadening in the profile produced for a linear clock drift through the use of the statistical H-test plus minimization methods. Our results suggest that the clock is much more stable than what was previously claimed in the literature.

A well-established clock stability would permit to derive physical quantities with a properly understood accuracy and perform interesting measurements in accreting X-ray millisecond pulsars (e.g. spin-down rate), transients, among others.

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