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X-RAY ROTATIONAL MODULATION IN VXR45

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VXR45 is a young very fast rotator star (RA (J2000) = 8^h42^m14^s.8, Dec (J2000) = –52° 56' 01", $V=10.70$, $B - V=0.81$, photometric period = 0.223 days (Patten & Simon, 1996)), member of IC2391 open cluster. The observation has been performed in November 20, 2001 with EPIC/PN on XMM-Newton satellite and covers, almost continuously, two photometric periods of VXR45. We extracted photon counts from a circular region centered on the VXR45 and selected in order to include $\sim 80\%$ of the source photons (Ghizzardi, 2001; Saxon, 2002), corresponding to a radius of 37". The total number of photon counts in the 0.3-7.8 keV band amounts to 7431; the local background has been determined from a source-free region near VXR45 for a total of 506 counts.

Fig. 1 shows the light-curve of VXR45 obtained in the 0.3-7.8 keV band (top) and that of the corresponding background (bottom). The X-ray rotational modulation, with a period very similar to the photometric one, is clearly evident. Note that other short-term variability not due to rotational modulation may also be present in the light-curve.

Fig. 2 shows the X-ray light-curve folded with the photometric rotational period. Phase-related variability is clearly evident; the amplitude of the variations in the X-ray light-curve is $\sim 30\%$ of the average count-rate.

We find, for the first time, unambiguous evidence of rotational modulation of X-ray stellar coronal emission in a very fast rotating star in the “supersaturated” regime.

The detection of X-ray rotational modulation implies the presence of not uniformly distributed active regions on the star. Furthermore we do not find evidence of spectral changes as function of the phase, consistently with the hypothesis that the modulation we observe is mainly due to a coverage effect, and that at all times the emission is largely due to the same mixture of emitting structures, probably composed by active regions hosting several flares.

References:

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Ghizzardi, S., 2001, “EPIC-MCT-TN-011”, Tech. rep., EPIC Milano Calibration Team
Saxon, R. D., 2002, “XMM-CCF-REL-116”, Tech. rep., XMM-SOC

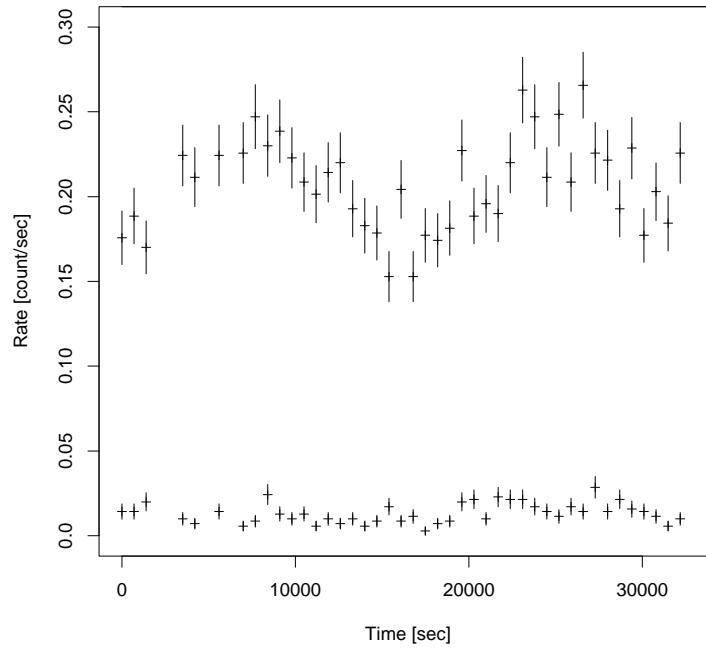


Figure 1. X-ray light-curve of VXR45 (top) and background (bottom) as seen with EPIC/PN in the 0.3-7.8 keV band, time bins are 700 sec long. The photometric rotational period of ~ 19.3 ksec is well visible.

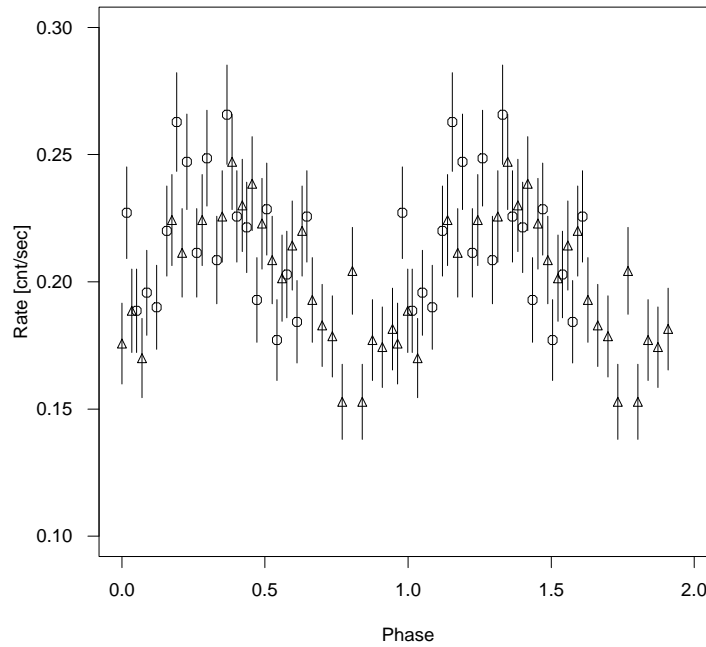


Figure 2. Folding of the X-ray data with the rotational period versus photometric period phase. Circles are points observed at $t < 0.223$ days (the photometric period) and triangles those observed at $t > 0.223$ days.