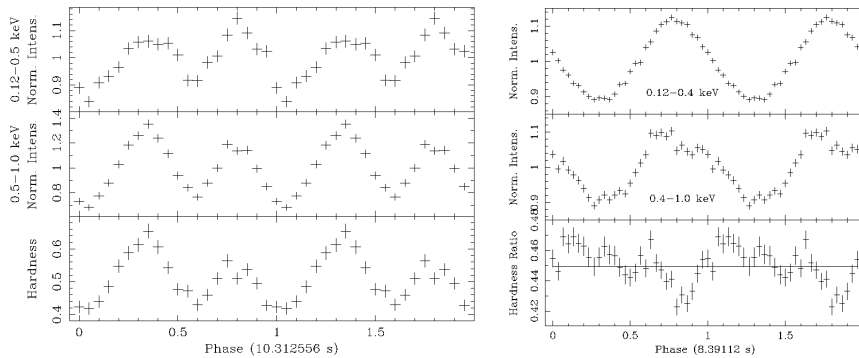


**XMM-Newton observations revealed broad absorption lines in the X-ray spectra of at least three radio-quiet isolated neutron stars. If interpreted as proton cyclotron resonance absorption the line center energies indicate magnetic field strengths in the range of  $10^{13-14}$  G.**

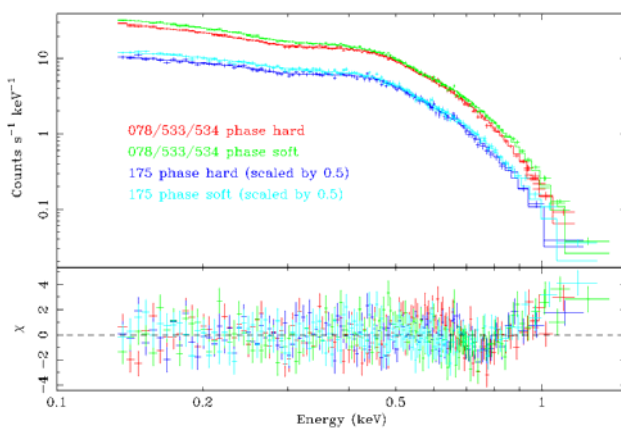
Presently seven thermally emitting isolated neutron stars are known. Their X-ray spectra are characterized by soft blackbody-like emission ( $kT \sim 45 - 120$  eV) without indication for harder, non-thermal components. These stars apparently show no radio emission and no association with supernova remnants. Four of them exhibit pulsations in their X-ray flux with periods in the range of 3.45 s to 11.37 s. XMM-Newton observations revealed broad absorption lines in the X-ray spectra of at least three of the stars. From the two pulsars RX J0720.4–3125 and RBS1223 variations of the depth of the line with pulse phase are observed.

The XMM-Newton spectra of RBS1223, RX J0720.4–3125 and RX J1605.3+3249 show deviations from a Planckian energy distribution which can be modeled by a broad Gaussian-shaped absorption line. The first two neutron stars are pulsars with 10.31 s and 8.39 s spin period and show spectral variations with pulse phase (Figure 1).



**Fig. 1** *Folded light curves in soft and hard energy bands together with hardness ratio (the ratio of count rates in the hard and soft band) of the pulsars RBS1223 (left) and RX J0720.4–3125 (right).*

Pulse-phase spectroscopy for RX J0720.4–3125 shows that a large fraction of the spectral variations can be attributed to changes in the equivalent width of the absorption line (Figure 2). The observed dependence of temperature and equivalent width on pulse phase may be due to the change in the viewing geometry of the inclined magnetic rotator.



**Fig. 2** *Phase-resolved EPIC-pn spectra of RX J0720.4–3125 from phases of high and low hardness ratios. The upper pair of spectra shows the combined data from 3 thin filter observations, the lower pair corresponds to the medium filter observation. The upper and lower spectra in each pair are extracted from the phases of low and high hardness ratio. The spectra demonstrate that spectral variations mainly originate below 0.5 keV where they can be described by changes in the depth of the absorption line (by a factor of  $\sim 2$ ). In contrast temperature variations, determined by the spectrum above 0.5 keV are small (2 – 3 eV).*

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