THE XMM-NEWTON LOOK AT MKN 841

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ABSTRACT

Mkn 841 has been observed during 3 different periods (January 2001, January 2005 and July 2005) by XMM-Newton for a total cumulated exposure time of ∼108 ks. In January 2001, the iron line in this source was rapidly variable, the variability being interpreted either by a change in line flux (Petrucci et al., 2002) or by a change in line width (Longinotti et al., 2004). Here we present preliminary results of the whole XMM-Newton data concerning this source, focusing on the line complex and the broad-band continuum.

Key words: LaTeX; ESA; X-rays; Galaxies: Mkn 841.

1. THE DATA

Mkn 841 has been observed 5 times by XMM-Newton. The date and exposure time of the different observations are summarized below: We have divided the observation

Obs.	Date	Duration (ks)	3-10 keV Flux (10^{-11} erg.s^{-1}.cm^{-2})
1	13 Jan. 2001	8.5	1.05
2	13 Jan. 2001	10.9	1.17
3	14 Jan. 2001	13.3	1.24
4	16 Jan. 2005	46.0	0.85
5	17 Jul. 2005	29.1	0.95

done in Jan. 2005 in 3 sub-observations of ∼ 15 ks so that we have 7 spectra with about the same exposure.

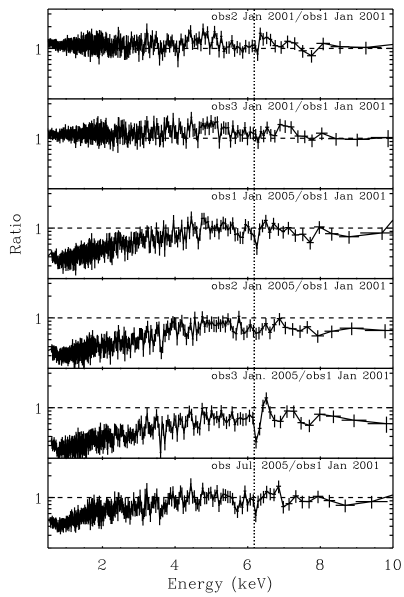

Figure 1. Ratios of the different PN spectra to the first XMM observation. The dashed line indicates the 6.4 keV position in source frame.

2. FLUX CONTINUUM VARIABILITY

During each observation, the flux smoothly varies, with a maximum amplitude (between min and max) of ∼40% in Jan 2005. From January 2001 to July 2005, the flux of the source has decreased by a factor 3. We have reported in Fig. 1 the ratios of the different PN observations to the first XMM pointing of Jan 13th. We clearly see strong spectral variability between January 2001 and the others, especially below 5 keV and around 6.4 keV.

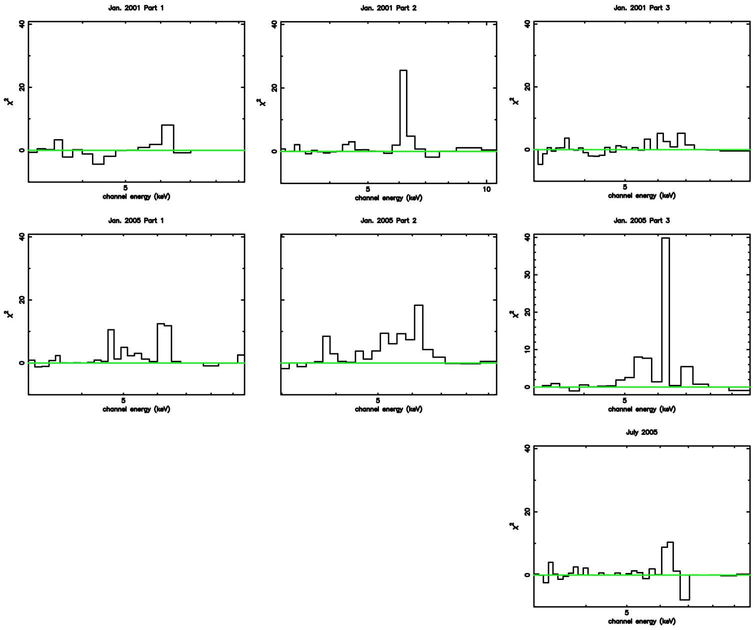

Figure 2. χ^2 distributions when fitting the different observations with a power law between 3 and 10 keV but excluding the data between 4 and 7 keV.

3. LINE VARIABILITY

We have plotted in Fig. 2 the contribution to the χ^2 distributions (positive and negative values of χ^2 correspond to positive and negative residuals of the best fit) when fitting the different observations with a power law between 3 and 10 keV but excluding the data between 4 and 7 keV. Data have been rebinned to reach a significance of at least 15 σ per bin. The line complex variability is clearly visible especially on short ($\sim$10-15 ks) time scale.

4. PCA ANALYSIS

We use a principal component analysis (PCA) to seek for variability patterns. As shown in Fig 3, most of the variability (>99% for the broad band continuum and >80% for the iron line complex) is explained by the two first components. The first one (PC 1) consists in a variability mode dominated by flux variations in the soft energy range. It seems also to explain part of the line wings variability. The second PCA component (PC 2) can be described roughly as a pivoting of the spectrum around 1-2 keV. It should be noticed that most of the (neutral) line core variability is also explained by this component.

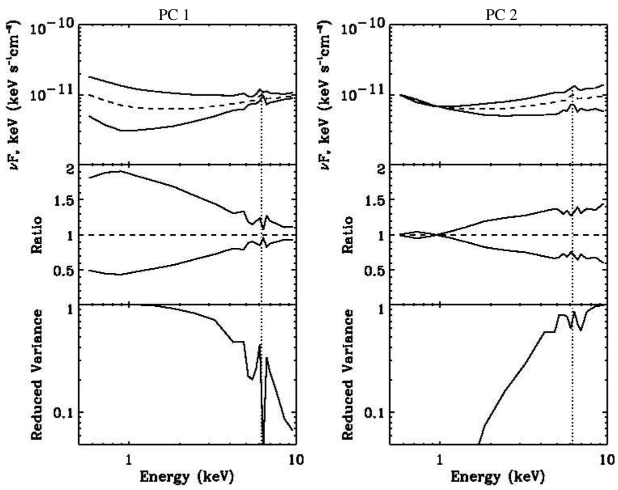

Figure 3. The 2 first principal components of variability. The upper panels illustrate the effects of each component on the shape and normalisation of the spectrum: time average spectrum (dashed line) and spectra obtained for the maximum and minimum observed values of the normalisation parameter. The middle panels show the ratio of the maximum and minimum spectra to the average one. The bottom panels show the contribution of each component to the total variance as a function of energy.

REFERENCES

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