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The quasar 3C 273 observed by XMM–Newton and RXTE

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Abstract. *XMM–Newton* has observed the quasar 3C 273 several times between 2000 June and 2003 January. Two simultaneous observations using NASA's Rossi X–ray Timing Explorer (PCA) enables the comparison of the high energy part (2.5–10 keV) of the EPIC spectra with an independent instrument. The spectral parameters are in good agreement between the two satellites. RXTE fluxes are about 30% higher than the *XMM* EPIC fluxes. The variability of the high energy component (>2.5 keV) is presented. The high energy component is well described by a single power law model with indices between 1.60-1.79. The individual observations show no evidence for either a narrow or a broad iron line.

1. Introduction

The radio-loud quasar 3C 273 is one of the nearest quasars. This makes it a favorite object to study over all wavelengths (Courvoisier 1998). Since its first X–ray detection (Friedman & Byram 1967), the quasar 3C 273 is a popular target of every X–ray satellite mission. Over a wide range of X–ray energies the continuum spectrum is well described by a single power law model. The spectrum is known to show a soft excess at low energies (Turner et al. 1985; Staubert 1992). Previous observations indicate either a narrow (Grandi et al. 1997), broad (Yaqoob & Serlemitos 2000), or the absence of an Fe–line (Haardt et al. 1998).

We present results from *XMM* EPIC observations done in small window mode and correlated RXTE observations. For RXTE PCA only PCU2 was available.

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2. The Spectra above 2.5 keV

Above ∼2 keV the X-ray spectrum of 3C 273 can be described by a single power law including galactic N_H = $1.8\cdot10^{20}$ cm^{-2} (Dickey & Lockman 1990). To determine the photon index we fitted all observations in the range 2.5–10.0 keV for EPIC and 2.5–21.0 keV for PCA. This range is selected because it corresponds to the lowest energies available for RXTE and to avoid the gold edge caused by the *XMM* telescope mirrors at about 2.1 keV.

The spectral shapes measured by RXTE PCA and *XMM* EPIC PN/MOS2 are in good agreement. In the analyzed sample of observations the power law indices vary in the range of Γ=1.60–1.79 significantly. The observations from 2000 June until 2002 January show harder spectra than the observations from July 2002 until 2003 January. The fluxes vary significantly in the range of $6.2–9.5\times10^{-11}$ erg/cm$^2 s$.

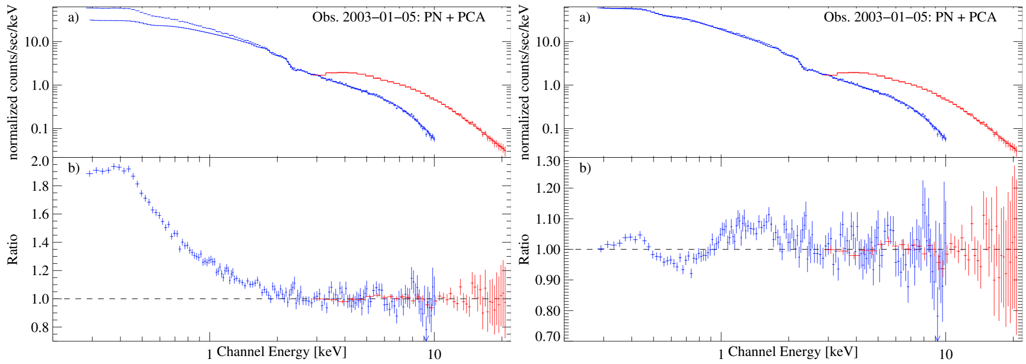

Fig. 1. Example of PN and PCA spectra. Left panel: The spectra are fitted above 2.5 keV with a single power law model ($\Gamma = 1.74 \pm 0.03$). The plot is extended to lower energies to visualize the soft excess. Right panel: Additional disk blackbody component ($T_{in} = 0.166 \pm 0.003$) is added to the previously fixed power law.

3. The Fe–line

There is no significant detection of an Fe–line, neither in PN nor in MOS for all observations. We investigated upper limits for a possible hidden line by adding a redshifted Gaussian line into the 2.5–10 keV power law fits. For the narrow line model the equivalent width does not exceed 52 eV for PN and 101 eV for MOS ($3\,\sigma$ upper limits).

4. Soft excess

All spectra show a soft excess that extends up to ~2 keV. The flux inside the soft X–ray band (0.3–2.0 keV) varies by more than 50% independently from the power law component seen at higher energies. The spectral shape of the soft excess shows no significant variability. A second power law component as well as a disk blackbody could characterize the soft excess. Both models still show systematic residuals. Fig.1 shows an example of a disk blackbody + power law fit including a fixed galactic absorption of $N_H = 1.8{\cdot}10^{20}$ cm^{-2}.

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