Spectral Variability of 3C 273 at soft X-rays

R.Staubert, T.J.-L.Courvoisier, H.Fink, M.-H.Ulrich, H.Brunner, S.Friedrich, K.Otterbein

ABSTRACT.
We report on the results of three observations of 3C 273 by ROSAT (Staubert et al. 1993).

OBSERVATIONS AND RESULTS

	Pointed observation #)	Survey &)	Pointed observation
date	18 June 1990	18-21 Dec. 1990	14-15 Dec. 1991
integr. time / source cts	916 s / 7377	497 s / 2801	6243 s / ~50000
spectral fits (0.08-2.4 keV) with single power law:			
a) N_H variable:			
N_H [10^{20} cm^{-2}]	(1.67 +- 0.26) *)	(1.27 +- 0.36) *)	(1.56 +- 0.11) *)
photon index	1.78 +- 0.10 *)	2.05 +- 0.17 *)	1.89 +- 0.05 *)
χ^2_{red} (dof)	1.27 (29)	1.0 (42)	2.18 (26)
b) N_H fixed to galactic value of 1.8 10^{20} cm^{-2}:			
photon index	1.84 +- 0.05 *)	2.29 +- 0.08 *)	1.98 +- 0.014 *)
χ^2_{red} (dof)	1.27 (30)	1.26 (43)	2.89 (27)

#) contemporaneous with observations by IUE, &) contemporaneous with observations by IUE and Ginga, *) all uncertainties are 90% joint confidence limits

CONCLUSIONS. Soft X-ray spectra (0.1-2.4 keV) of 3C 273 have been measured by ROSAT in June '90, in Dec. '90 (contemporaneous with Ginga and IUE) during the All Sky Survey and in Dec. '91 (Staubert et al. 1991, Staubert 1992). Marginally acceptable spectral fits are found for a single power law model with the column density fixed to the galactic value N_H = 1.8 10^{20} cm^{-2} for the June '90 and the Dec. '90 data. A single power law fit is not acceptable for the Dec. '91 data. If N_H is a free parameter the best fit values are lower than the galactic value, particularly so for the observation of Dec. '91. This is indicative of a soft excess. Under the assumption of a single power law model, there are significant variations in power law index from one observation to the next, demonstrating spectral variability on time scales 5 to 12 month. The power law spectra found by ROSAT are significantly steeper than those observed in the 2-10 keV range (with an average photon index of about 1.47 and a spread from 1.41 to 1.54; Turner et al. 1990). This again indicates the existence of a 'soft excess' component. The simultaneous ROSAT and Ginga observations of Dec. '90 clearly show two spectral components. A double power law fit reproduces the standard hard component and establishes an additional soft component with a photon index of 3.5 (Staubert 1992). For the June '90 and Dec. '91 observations no simultaneous hard X-ray measurements are available. However, a double power law model yields an acceptable fit to the Dec. '91 data with photon indices of 1.54 for the hard component and 2.27 for the soft component. Since the ROSAT energy range (0.1-2.4 keV) is rather small for double power law fits, the parameter space for such fits has been explored for all three ROSAT observations, stepping through a grid of parameters (I_0 /α) which define the underlying hard component: a) the spectral variability of the soft component is evident (under all reasonable assumptions for the hard component); b) for the Dec. '90 data the combined ROSAT/Ginga spectrum provides a calibration: fitting the ROSAT data alone (with a double power law) underestimates the steepness of the soft component.

References

Staubert et al. 1991, Proc. *"Testing the AGN Paradigm"*, Maryland, Oct. 1991, p. 366
Staubert 1992, Proc. *"X-Ray Emission from AGN and the Cosmic X-ray Background"*, Garching, Nov. 1991, MPE Rep. 235, p. 42
Turner et al. 1990, MNRAS 244, 310
Staubert et al. 1993, in preparation, to be submitted to A&A

T. J.-L. Courvoisier and A. Blecha: Multi-Wavelength Continuum Emission of AGN, 382.