

ROSAT X-ray Observations of Pair Mrk474/NGC 5682

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Abstract. Like radio and optical observations of AGN/Galaxy pairs (e.g. Carilli, C & van Gorkom, J. 1992, *ApJ*, 399, 373), X-ray observations of the pairs can reveal absorption at high energy band, and also, possible galactic gaseous X-ray emissions that are very useful in constructing halo models. ROSAT/PSPC X-ray spectra of 4 AGNs in the well-known pairs 3C232/NGC 3067, 3C275.1/NGC 4651, 3C309.1/NGC 5832 and Mrk474/NGC 5682 are reported here. Especially, we have detected an extragalactic HI of NGC 5682 in the Mrk474 spectrum.

Key words: AGN/Galaxy pairs, AGN X-ray spectrum, extragalactic HI

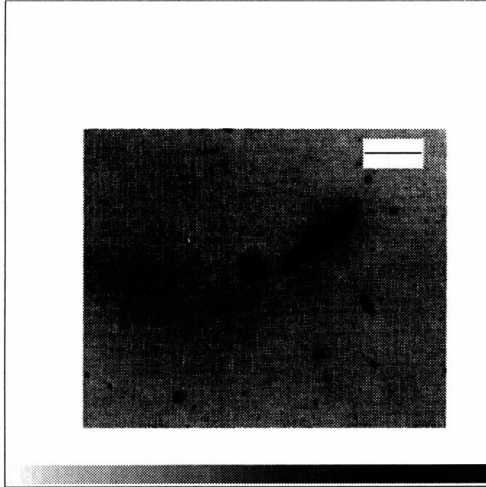
1 Observations

X-ray spectra of the AGNs are fitted by power law of $f(E)dE = A(\frac{E}{1\text{keV}})^{-\Gamma}dE$ plus a neutral hydrogen absorption using χ^2 method. The resulting column densities N_{HI} are consistent with absorptions in our galaxy in all AGNs except for Mrk474, partly because the 3 3CR QSOs do not have enough counts (≤ 300) for good spectral calculation. Mrk474 that has ~ 10830 total counts can be fitted by $N_{HI} = 3.61 \pm 0.23 \times 10^{20} \text{ cm}^{-2}$ (comparing to the Galactic $N_{HI} = 2.01 \times 10^{20} \text{ cm}^{-2}$) and photon index $\Gamma = -2.31 \pm 0.06$. Note that the power law fitting has systematic positive residuals below 0.5 keV, another blackbody component is then added that results in even larger an HI of $5.5 \pm 1.0 \times 10^{20} \text{ cm}^{-2}$. Therefore, an extragalactic absorption of $N_H = 1.3 \sim 4.5 \times 10^{20} \text{ cm}^{-2}$ is evidenced.

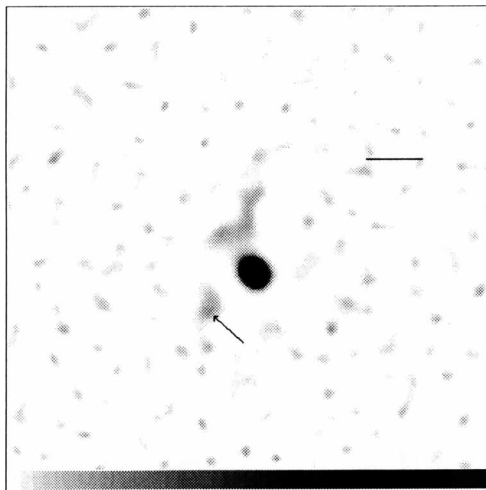
An optical image of the pair is in Fig.1a, the bar gives the angular scale of 1 arc minute (Arp, H., Baldwin, J.A. & Wampler, E.J. 1975, *ApJ*, 198, L3). Fig. 1b shows a deconvolved ROSAT X-ray image. The X-ray center is coincident with M474. The nearby galaxy NGC5682 has an average $N_H = 9.2 \times 10^{20} \text{ cm}^{-2}$ within the linear diameter 13.8 kpc (Bottinelli, L., et al. 1984, *A&AS*, 56, 381). Assuming the HI radial density drops as $\sim r^{-2}$, we estimate that at the M474 impact distance 13 kpc it is about 3 times smaller than the average: $3.1 \times 10^{20} \text{ cm}^{-2}$, which is very close to that derived from the ROSAT X-ray spectrum.

However, the X-ray configuration of the pair shows interesting structures to be studied carefully. In Fig.1b, the emission consists of at least four component: the nucleus (M474), two sources at $(-48'', -40'')$ and $(82'', -61'')$ relative to M474 (the first one is identified as an optical source, marked by the arrow), and a **diffuse emission** at $50''$ NE from M474 that may in turn be a composition of 3 or more point sources. No optical counterpart can be identified to such a diffuse feature.

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Fig_1a - Mrk474/NGC5682:optical



Fig_1b - Mrk474/NGC5682:deconvolution