SOFT X-RAY PROPERTIES OF A COMPLETE SAMPLE OF RADIO SOURCES

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Abstract. We investigate the X–ray properties of a complete sample of 88 radio sources derived from the Wall & Peacock 2–Jy sample. We find that L_x correlates well with core radio luminosity for all object classes, whereas the $L_x - L_{total}$ is probably introduced by sample selection effects. Further, evidence for an anisotropic X–ray component in broad line radio galaxies is reported. A full description of the results will be given elsewhere (Siebert et al. 1996).

1. Introduction

It is essential for our understanding of the connection between the X-ray emission of radio-loud AGN and their emission from other wavebands to study complete samples of both quasars and radio galaxies with comprehensive information on the radio and the optical properties of these sources. Here we briefly summarize our findings on the soft X-ray properties of such a sample, consisting of 88 radio sources (68 galaxies, 18 quasars, 2 BL Lacs), selected from the Wall & Peacock 2–Jy sample.

2. Data analysis and results

The X-ray properties have been determined using the ROSAT All-Sky Survey (RASS) and (34) pointed PSPC observations extracted from the public

R. Ekers et al. (eds.), Extragalactic Radio Sources, 263–264.

archive. A source is considered to be detected in X-rays when the significance is greater than 3σ. In case of a non-detection the 2σ upper limit to the X-ray flux is calculated. In total 59 sources are detected (both BL Lacs, all but one (PKS 1151-34) quasar and about 60% of the galaxies). Comparing the RASS and the pointed PSPC observations for 29 sources we find evidence for variability greater than a factor of two in 6 sources (the quasars PKS 0403-13, 3C 279 and PKS 1510-08, the BL Lacs PKS 0521-36 and AP LIB and the radio galaxy 3C 88). The most extreme behaviour is shown by AP LIB, with a decrease in intensity by at least a factor of 20 between the two observations ($\sim$ 3 years). Furthermore, 16 sources show extended X-ray emission, which is either due to an associated cluster of galaxies or the proximity of the source.

2.1. LUMINOSITY DISTRIBUTIONS

From the luminosity distributions for the various radio-morphological subclasses we conclude that FR I radio galaxies are in general less luminous than FR II type sources. None of the compact steep spectrum sources is detected which is most likely due the relatively high redshifts of these sources. Broad line radio galaxies generally exhibit higher X-ray luminosities and a higher detection rate than weak or narrow line radio galaxies. This indicates an anisotropic X-ray emission component and fits nicely into unification schemes for high power radio-loud AGN.

2.2. CORRELATION ANALYSIS

The correlation of L_x with total radio luminosity turns out to be insignificant for all object classes once the effects of the strong L_T - L_c correlation and the redshift bias are properly accounted for via a partial correlation analysis (Akritas & Siebert 1996). On the other hand, the correlation of L_x with core radio luminosity remains significant. The regression slope of the $L_x - L_c$ correlation for quasars is remarkably flat (0.30 ± 0.14), but is consistent with previous findings. Whereas we find an excellent correlation of L_x with optical luminosity for the quasars, the corresponding correlation for galaxies is insignificant. Again the regression slope ($0.84 \pm 0{,}16$) is consistent with various previous studies. There is a highly significant correlation of L_x with [OIII]λ5007 line luminosity for quasars with a regression slope close to unity. Although the correlation for the FR IIs alone is not significant, we note a smooth transition from quasars to FR II radio galaxies. FR I radio galaxies exhibit a completely different behaviour with typically 1 – 2 orders of magnitude lower emission line luminosities, indicating fundamental differences between FR I and FR II type objects.

References

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