A study of radio-quiet quasars detected with ROSAT

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We have compiled a database of 857 X-ray detected radio-quiet quasars using ROSAT data of both the *All-Sky Survey* and pointed observations based on the 6th Véron-Cetty–Véron quasar catalogue. Combined with the sample of 574 radio-loud quasars (Brinkmann, Yuan, & Siebert 1997), this is the largest compilation of X-ray detected quasars up to now, with a large number (> 100) of objects at high redshifts ($z > 2$). For a large fraction of the objects the soft X-ray spectral properties are obtained with improved accuracy, a large fraction of $\sim 70\%$ of the objects was detected in X-rays for the first time. Some of the main results for radio-quiet quasars (Yuan, Brinkmann, & Siebert 1997) are:

• Radio-quiet quasars have steeper X-ray spectra ($\Gamma = 2.57 \pm 0.05$, 1 σ error, for $z < 0.5$ objects) than radio-loud objects ($\Gamma \sim 2.2$); this spectral difference persists to high redshifts ($z > 2.5$). The figure on the left side shows the contours of 90% confidence level of the mean and standard deviation of the intrinsic distributions (Gaussian) of the X-ray power law indices Γ, for radio-quiet (RQ) and radio-loud flat- (FS) and steep-spectrum (SS) quasars.

• We confirm a spectral flattening with z for radio-loud and radio-quiet objects at $z < 2$; beyond $z > 2$, we found that the spectral slopes are independent of z. These results are consistent with a composite X-ray spectral model involving an additional steep soft X-ray component.

• The luminosity correlation of quasars between optical and X-ray is confirmed to be an intrinsic property of the quasar population. The figure on the right shows a plot of the X-ray loudness α_{ox} versus optical luminosity for a magnitude-limited subsample ($B < 18.5$); the bars indicate the mean α_{ox} obtained by taking into account the upper limits for non-detected objects. The data show an increase of α_{ox} with optical luminosity. However, we have shown by means of Monte Carlo simulations (Yuan, Siebert, & Brinkmann 1997) that such a correlation between the quasars' X-ray loudness and optical luminosity can emerge even for intrinsically constant luminosity ratios and that the apparent dependence is caused by the dispersion in the luminosities. A linear relationship between the X-ray and optical luminosities is thus consistent with current observations.

References:

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