QUASAR CONTRIBUTION TO THE X-RAY BACKGROUND

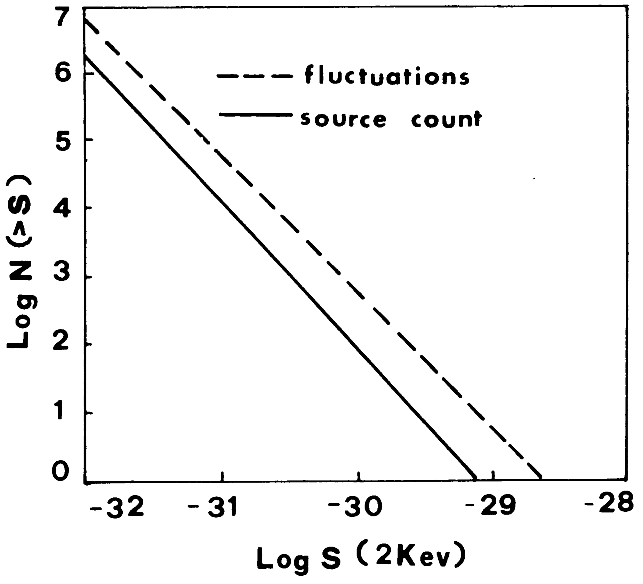
Ajit Kembhavi and A.C. Fabian
Institute of Astronomy,
Madingley Road,
Cambridge CB3 OHA, England

Recent observations by the Einstein Observatory have shown that a majority of known quasars are powerful X-ray emitters. The 107 objects observed as of Feb. 1980 (Zamorani et al. 1980) have X-ray, optical and radio luminosities scattered over a wide range. Until a large enough X-ray selected sample of quasars becomes available, it is necessary to study statistical correlations in the available sample, so that some insight into X-ray production may be obtained, and the contribution of quasars to the X-ray background estimated.

In an attempt to find correlations, Zamorani et al. (1980) have divided the sample into radio-loud and radio-quiet. A quasar in their scheme is defined to be radio loud if it shows positive radio emission and if $\alpha_{RO} > 0.35$, where $\alpha_{RO} = -\log (L_{OP}/L_R)/\log(\nu_{OP}/\nu_R)$. Such a definition of radio loudness however introduces a selection effect: suppose there is a correlation between X-ray and optical luminosities so that $L_X = kL_{OP} + b$, with k and b approximately constant. Then in selecting members of the radio loud class, all quasars below the line $L_R = (a/k)(L_X - b)$ in the $L_R - L_X$ plane are rejected, where the constant a depends upon the value of α_{RO} used to distinguish between loud and quiet. This distorts any correlation present. The selection effect does not materially affect results for the present sample. It may be avoided by defining as radio-loud all quasars with radio flux greater than some limiting value (see Smith and Wright 1979). Zamorani et al. (1980) also report a correlation between α_{RO} and $\alpha_{OX} = -\log (L_X/L_O)/\log (\nu_X/\nu_O)$. Such a correlation could be spurious, because $\log (L_R/L_O)$ and $\log (L_X/L_O)$ will show a correlation even if L_R and L_X are <u>not</u> correlated, and L_O is chosen at random from a fixed range.

As a preliminary step in a detailed analysis of the X-ray data we have estimated the contribution of quasars to the X-ray background by convolving the observed distribution of α_{OX} with the source counts of optically selected quasars given by Braccesi et al. (1980). The contribution to the α_{OX} distribution for the 28 sources with 3σ upper limits on L_X(2 keV) is obtained by assuming that the distribution of

G. Setti, G. Spada, and A. W. Wolfendale (eds.), Origin of Cosmic Rays, 273–274.



L_X is a single-sided Gaussian. The sample is split up into radio-loud and radioquiet groups, and each group is divided into subgroups with redshift $Z \lesssim 1$ and $Z > 1$. The subgroups are all averaged over after assuming that 10% of all quasars are radio-loud and that 75% of all quasars are at $Z > 1$. We find that $\log N (> S) = - 63.0 - 2.16 \log S_X$. The slope is the same as that of the Braccesi counts, and it can be estimated that at the limiting flux of the Einstein deep survey ($\sim 5.2 \times 10^{-32}$ erg sec^{-1} cm^{-2} Hz^{-1} at 2 keV), there should be ~ 11 source (sq. deg.)$^{-1}$ and that the contribution to the background should be $\sim 10\%$.

It has been pointed out by Fabian and Rees (1978) that evolved sources contribute fluctuations of amplitude $\lesssim 1\%$ in the Uhuru $5^o \times 5^o$ field of view. We find that for the present sample this implies $\log N(S) \lesssim - 2 \log S - 57.27$. The X-ray source counts are close to but consistent with this fluctuation limit. We are investigating how strong the constraints set by the fluctuations are, and the dependence of these on the average quasar spectral index (see also Cavaliere et al. 1980).

References

Braccesi, A., Zitelli, V., Bonoli, F., and Formiggini, L.: 1980, Astron. Astrophys., 85, pp 80-92.

Cavaliere, A., Danese, L., De Zotti, G., and Franceschini, A.: 1980, Preprint.

Fabian, A.C., and Rees, M.J.: 1978, MNRAS, 185, pp 109-122.

Smith, M.C., and Wright, A.E.: 1979, Anglo-Australian Observatory, Preprint.

Zamorani, G. et al.: 1980, Preprint.

https://doi.org/10.1017/S0074180900074726 Published online by Cambridge University Press