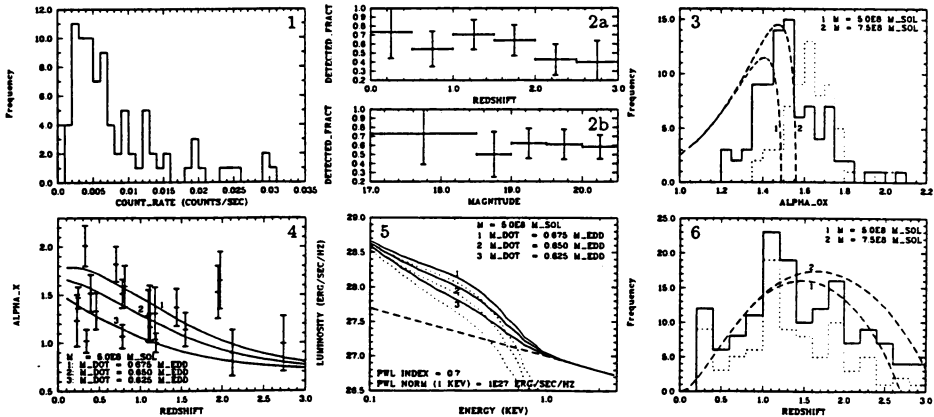


ROSAT OBSERVATIONS OF AN OPTICAL QUASAR SURVEY FIELD

H. BRUNNER, T. DÖRRER, P. FRIEDRICH, G. LAMER, R. STAUBERT
Astronomy Institute, University of Tübingen, Germany

Abstract. Deep ($T \sim 35$ ksec) pointed ROSAT observations of a $2.2^\circ \times 2.2^\circ$ optical quasar survey field (149 quasars; $m_{lim} = 20.5$; Crampton *et al.*, 1989) have yielded a detection rate (3σ) of $\sim 60\%$ (86 quasars; limiting sensitivity $\sim 5 \cdot 10^{-15}$ erg cm^{-2} s^{-1} keV $^{-1}$ at 1 keV). See Fig. 1 for the distribution of the ROSAT PSPC source count rates and Fig. 2a, b for the fraction of quasars detected in X-rays as a function of redshift and optical magnitude. 46 quasars were bright enough to perform spectral power law fits. The mean energy power law index drops from ~ 1.4 at $z = 0$ to ~ 0.9 at $z > 2$ (Fig. 4; only the 20 brightest sources are plotted). This is interpreted as being due to a break in the spectrum between a soft, thermal accretion disk and a hard power law component, occurring at a source frame energy around 1 keV (Fig. 5). Mean accretion disk model parameters are derived ($\dot{M} = 5 \cdot 10^8 M_\odot$, $M = 0.65 M_{Edd}$, $\alpha_{visc} = 0.5$), using an optically thin α -accretion disk model (Dörrer *et al.*, 1992 and references therein). Model predictions for the decline of the X-ray spectral index with redshift are plotted in Fig. 4. The α_{ox} distribution (Fig. 3; dotted line: X-ray upper limits) and the optical number-redshift relation (Fig. 6; dotted line: X-ray number-redshift relation) is modeled using the accretion disk parameters as determined from the X-ray spectral data and assuming a constant comoving volume density ($H_0 = 100$ km/s Mpc, $q_0 = 0.5$) and statistical orientation of the inclination angles of the model source population.



References

- Crampton, D., Cowley, A. P. and Hartwick, F. D. A.: 1989, *Ap.J.* **345**, 59
 Dörrer, T., Friedrich, P., Brunner, H., Staubert, R. et al.: 1992, *X-ray emission from active galactic nuclei and the cosmic X-ray background*, eds. Brinkmann and Trümper, *MPE report* **235**, 130