

84.02

Spatially-Resolved Optical Images of High-Redshift QSO's

T.M. Heckman, M. Lehnert (JHU, STScI, UMD), W. van Breugel (IGPP), and G.K. Miley (Leiden)

We will present the results of a program of deep optical imaging of 17 high redshift ( $z = 2$  to  $3$ ) radio-loud QSO's. These data represent the first detection of spatially resolved structure around such high redshift QSO's at other than radio wavelengths.

In 15 cases, the Ly $\alpha$  emission is spatially resolved, with a typical size of 100 kpc. The luminosity of the resolved component is  $\approx 10^{44}$  erg/sec ( $\approx 10\%$  of the total Ly $\alpha$  luminosity). The gas bears an obvious morphological relationship to the radio source in some cases. However, in other cases, the gas has a complex, filamentary morphology that is not reflected in the radio source. The sizes and estimated masses of these gaseous nebulae agree with theoretical expectations for gas-rich young galaxies still in the process of formation.

For 4 QSO's the UV continuum is also spatially resolved on scales of tens-of-kpc. This may be starlight from the QSO host galaxy, scattered QSO light, or a foreground galaxy acting as a gravitational lens. There are also several possible examples of Ly $\alpha$  companion galaxies (faint, semi-stellar sources of Ly $\alpha$  and UV continuum). These may be similar to the object associated with the high- $z$  QSO PKS1614+051 studied by Djorgovski et al and Hu and Cowie.

Finally, (LaPalma weather permitting), we hope to present preliminary results of a program of long-slit optical spectroscopy of the "fuzz" and the possible companions.

84.04

Soft X-ray/XUV Excesses in Einstein Quasar Spectra.

B. J. Wilkes, M.S. Elvis, J. McDowell (CfA) J-L. Masnou (Meudon) and K.A. Arnaud (GSFC).

We study the soft X-ray excesses above a simple power-law spectrum for a signal-to-noise limited sub-sample of 14 quasars observed with the *Einstein* IPC. Detailed analysis of the IPC data, combined with MPC where possible, and use of the more accurate, 21' beam, Galactic  $N_H$  measurements (Elvis, Lockman and Wilkes 1989), allow us to determine the presence and estimate the strength of any excess and also to improve constraints on the spectral slope at higher X-ray energies. We find a significant excess above a simple power law ( $\lesssim 0.3$  keV) for 9 of the 14 quasars, with strengths of the excess  $\sim 6-31 \mu\text{Jy}$  and energy indices  $\sim 2-4$ . Excesses are present in both radio-loud and radio-quiet quasars and the detection rate is consistent with that found for radio-quiet Seyfert 1 galaxies (Turner and Pounds 1989). We infer that soft excesses are common in all kinds of AGN over a wide range of luminosity and, at least for the quasars, generally occur at  $\lesssim 0.3$  keV. Two quasars for which we have more than one observation: 3C273 and PG 1426+015; show variable strengths in their excess. The power law slopes above 0.3 keV are consistent with those reported in Wilkes and Elvis (1987) for all the objects confirming their relation between this slope and the radio-loudness of the quasar. We will present these results along with far infra-red to X-ray energy distributions for these objects and discuss the results of a search for relations between the soft excess strength and other continuum properties.

Elvis, M., Lockman, F. J. and Wilkes, B. J. 1989 *A.J.* 97, 777  
Turner, T. J. and Pounds, K. A. 1989 *M.N.R.A.S. in press*  
Wilkes, B. J. and Elvis, M. 1987 *Ap.J.* 323,243

84.03

Exosat X-ray Spectra of Quasars

R.F. Mushotzky (NASA/GSFC)

During its lifetime the Exosat Observatory obtained 0.1-10 keV x-ray spectra of  $\sim 18$  quasars for which the error in the power law index was less than  $\pm 0.35$ . All of these sources had an intensity  $\geq 4 \times 10^{-12}$  ergs/cm<sup>2</sup>-sec in the 2-10 keV band and have quality flag of 3 or better pulse height spectrum. We have analyzed these data using the Exosat data base. Of these objects 14 had errors in spectral index  $\alpha$  of  $\leq 0.20$ .

We find that a single power law model with absorption greater than or equal to the galactic value is a good fit to 8 of these sources. For the remaining 6 we have fit them with a model of a black body + a power law which always provides an acceptable fit. Our sample spans a range in 2-10 keV luminosity of  $43.8 < \log L < 46.4$  and has  $z_{\text{max}} = 0.8$ .

We find excellent agreement with the Ginga results of M. Turner et al (1989). When single power law models are fit to the data we find a strong correlation of the Exosat power law index with the Einstein IPC values of Wilkes and Elvis, however when the more complex model is considered this correlation disappears. We find no correlation of  $\alpha$  with luminosity or redshift and  $\langle \alpha \rangle = 0.76 \pm 0.20$  consistent with the value for Seyfert galaxies found by Turner and Pounds (1989) from Exosat data. The value of  $kT_{\text{BB}}$  is usually  $< 0.1$  keV. In individual objects (IIIZW2, Mkn 205) we find good agreement with the IPC+MPC results of Urry, Edelson, Mushotzky and Arnaud (1989).

84.05

Ultraviolet and X-ray energy distributions of IPC Quasars

J. McDowell, B. J. Wilkes, M.S. Elvis (CfA)

Although quasars emit roughly equal amounts of energy per decade over at least five decades of frequency, most studies of quasars concentrate on their properties in only one energy range. This has severely limited our ability to address fundamental questions such as the nature of the central energy source. As part of a synoptic study of quasar continuum properties, we have obtained radio to x-ray continuum energy distributions of 33 quasars with Einstein IPC soft x-ray spectra (Wilkes and Elvis 1987).

These distributions reveal that, while the generally accepted picture of a mixture of power-law-like and 'bump' components is correct, there is a surprising variety in the detailed shapes and relative strengths of these components. We show that large ( $>$  factor 10) variations in the strength of the ultraviolet continuum 'blue bump' occur from object to object (McDowell et al 1989). The source of the 'blue bump' radiation is believed to be a thermal accretion disk fuelling the central black hole. The variations in bump strength may then reflect either physical differences in the accretion mode or differences in viewing angle. Multiple epoch IUE observations, now included in our database, allow a study of the time variability of the bump strength in individual objects and confirm that this is not the cause of the dispersion in the sample bump strengths. Color-color diagrams derived from the energy distributions are used to search for relations between bump strength and other continuum properties. A correlation between 'x-ray loudness' and the strength of the ultraviolet bump is examined in detail.

Wilkes, B. J. and Elvis, M. 1987 *Ap.J.* 323,243  
McDowell, J. C., et al, 1989 *Ap.J.* 345, L13

SATURDAY