03.02

## The Relation between Radio and X-ray Emission in Quasars.

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The soft X-ray spectra of quasars are re-examined, making two-component fits to ensure no contamination by the soft ($\lesssim$0.6 keV) excess (Masnou *et al.* 1990). We confirm the difference in IPC X-ray slopes for radio-loud and -quiet objects reported by Wilkes and Elvis (1987). The reflection component seen in radio-quiet Seyfert galaxies by ***Ginga*** (Pounds 1990), indicates an input power law slope of $\sim$ 1.0, in good agreement with the lower energy IPC slopes for radio-quiet quasars. Thus the apparent discrepancy between IPC and higher energy quasar X-ray slopes is removed. A synchrotron self-Compton, radio-linked component ($\alpha_E \sim$ 0.5) dominates the X-ray emission in radio-loud quasars.
A combination of the ***Einstein*** radio-loud quasar sample, radio-loud quasars observed by ***Ginga*** and ***Einstein*** observations of broad line radio galaxies is used to study the relation between X-ray slope, radio core dominance (Shastri 1990) and luminosity. Interpretation in terms of the fraction of beamed X-ray and radio emission in each type of quasar is discussed. The relation of FeII with radio and X-ray emission is also investigated.

Masnou, J-L, Wilkes, B. J., Elvis, M., Arnaud, K. A. and McDowell, J. C. 1990 in preparation

Pounds, K. A. 1990 in Proceedings of the 23rd ESLAB Symposium ed. Nick White [ESA Publications Division], **2**, 753

Shastri, P. 1990 ***MNRAS*** submitted

Wilkes, B. J. and Elvis, M. 1987 ***ApJ*** **323**, 243

03.03

## The Continuum Energy Distribution of the Bright QSO H1821+643

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We report on the first UV observations of the bright QSO H1821+643. With $V$ = 14.2 and $z$ = 0.297, H1821+643 is the second brightest object in the sky at $z$ > 0.1. The IUE data are combined with new optical spectroscopy, and existing infrared and X-ray data, to reveal a strong optical/UV "big bump", which continues past the Lyman limit in the rest frame of the QSO. A possible turnover at the high frequency side of the UV continuum constrains fits of a thin accretion disk model to a large black hole mass ($M \simeq 3 \times 10^9\,M_\odot$) and a high accretion rate ($\dot{M} \simeq 18\,M_\odot$ yr$^{-1}$), but a small outer radius ($R_{\rm out} \simeq 27\,R_{\rm Sch}$). The latter can be interpreted in the two-temperature accretion flow model, which is also consistent with the observed UV and X-ray variability. Because of its location only 3° from the ecliptic pole, H1821+643 will be an important object for simultaneous UV and soft X-ray monitoring to test for a common origin of the UV bump and soft X-ray excess.

03.04

## Multifrequency Study of the QSO PKS 0558–504: A Steep X-Ray Continuum Independent of the UV, Optical, and near-IR Components

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The QSO PKS 0558–504 (V ~ 15) was observed during 1989 Nov. with Ginga, IUE, and the 1.5 m at CTIO. Continuum measurements between Ly α and the I-band are virtually identical to previous results (1983–1987), showing a particularly strong "blue bump". However, the average x-ray flux (2-10 keV) is lower by a factor of 2.3, compared with EXOSAT observations obtained during 1984. Neither the UV continuum nor the I magnitude is disturbed by more than a few % during the later epoch, implying that the hard x-ray emission is distinct from either the blue bump or the IR power-law component.

Both x-ray measurements show an unusually steep spectrum, with a power-law energy index, $\alpha \geq 1$. Ginga extends the coverage of this steep spectrum to ~15 keV. Thus PKS 0558-504 appears to be a high-energy prototype, significantly steeper than the typical AGN which have $\alpha = 0.7$ at energies above 2 keV. Other radio-loud QSOs that deviate from the normal x-ray spectrum have been observed to be "flat", with $\alpha \sim 0.5$. During the Ginga (fainter) observations there is evidence of a soft x-ray excess below 2 keV, which may signify the high-energy (Compton?) tail of the blue bump (massive accretion disk?).

03.05

## A Multi-Frequency Variability Study of Markarian 335

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We present preliminary results from an ongoing multi-frequency monitoring campaign of the bright, Seyfert 1 galactic nucleus, Markarian 335. Nearly uniform sampling at nominal 30 day intervals has been obtained quasi-simultaneously at optical, near infrared, and ultraviolet wavelength bands. We present a compilation of the data, including binned continuum fluxes, emission line parameters, and light curves. Wavelength dependent variability is seen at the 20-30% level, and symmetric coverage of a significant "flare" event was obtained. We offer interpretation of the variability in terms of optically thick accretion disk models. The inferred blackhole masses and accretion rates are discussed. A correlation analysis between continuum and emission line variability parameters is also presented.

03.06

## Using AGN Colors as Diagnostics for Accretion Disks

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In an effort to determine whether accretion disk plus power law models adequately describe the optical/UV spectra of AGN, we have plotted, on color-color diagrams, the synthetic colors derived from such models along with those computed from a sample of radio to X-ray quasar continua (McDowell et al 1991). We believe that this technique, in contrast to the detailed model fitting of individual objects which characterizes much of the previous work in this area, allows one to more easily assess the general properties of quasar spectra. The color-color diagrams provide a framework on which to simultaneously examine the entire sets of data and models, and thus clearly illustrate the effects of the various model parameters on the computed energy distributions. Here we present two color-color diagrams that we find useful: IR(infrared)-V(visible) vs. V-UV(ultraviolet) and V-UV vs. UV-SX(soft X-ray). IR-V measures the strength of the 'blue bump', V-UV reflects the 'sharpness' of the turnover towards higher energies, and UV-SX measures the strength of the soft X-ray excess.

The synthetic colors were computed from continua generated using a relativistic, orientation dependent model for an accretion disk surrounding a Kerr black hole. On the color-color diagrams, the distribution of these colors suggests that a single parameter, $S'$, is capable of describing all disk models. $S'$ depends on the assumed inclination angle, $\theta$, and an 'accretion parameter', $S$, which is proportional to $\log(M^2/\dot{M})$, according to the equation, $S' \approx S + \xi(cos(\theta) - 1)$ where $\xi \sim 2 - 3$. For face-on disk models, $S'$ equals $S$.

On both diagrams, the locus of pure disk models does not satisfactorily describe the distribution of the data, but it does define a boundary to the sample. Mixing the disk models with another component, as we demonstrate using a single power law, can, however, reproduce these data.

McDowell, J. C. *et al*, 1991 this meeting.