Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 4 — January 1997	Editor: Anthony Holloway (ajh@ast.man.ac.uk)

From the Editor

Thanks to those of you who have sent in abstracts this month. I have added some details on the IAU symposium on the central regions of galaxies. If anyone has a conference or meeting they would like to publicise, let me know.

The deadline for the next issue will be 25th February. Please use the template for abstract submissions, available from me by e-mail or on the web page.

Cheers, Ant.

Abstracts of recently accepted papers

On the soft X-ray spectra of γ-loud blazars

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ROSAT observations of a large sample of bright γ–ray (E > 100 MeV) blazars are presented. Results of a detailed spectral analysis in the soft $\sim$ 0.1–2.0 keV energy range are discussed in relation to the overall energy distribution with particular emphasis on the relation between X–ray and γ–ray properties. A significant anti–correlation between X–ray and γ–ray spectral shapes of flat radio spectrum quasars (FSRQ) and BL Lacs has been discovered. A different shape in the overall energy distributions from radio to γ–ray energies between FSRQ and BL Lacs is also implied by the correlation of their broad–band spectral indices α_{ro} and $\alpha_{x\gamma}$. Both the above correlations can be explained if both the IR to UV emission and the hard X–ray to γ–ray emission originate from the same electron population, via, respectively, the synchrotron process and the inverse Compton mechanism. We suggest that a key parameter for understanding the overall energy distributions of both classes of objects is the energy at which the synchrotron emission peaks in a $\nu - \nu F(\nu)$ representation.

To appear in Astrophysical Journal, May 10, 1997 issue, Vol. 480

E-mail contact: comastri@astbo3.bo.astro.it, Postscript files of figures, tables and text available at
http://www.bo.astro.it/bap/BAPhome.html/bap96-42-*.ps or via anonymous ftp at boas3.bo.astro.it/bap/files/bap96-42-*.ps

X-ray transmission in cold matter, nonrelativistic corrections for Compton scattering

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Obscuration by cold matter is frequently observed in a variety of X-ray sources. With the improved sensitivity and energy resolution of the new generation of X-ray detectors, such as those aboard *ASCA*, it may not always be possible to neglect electron scattering for column densities much greater than $\sim 10^{23}$ cm^{-2}. We derive simple, approximate analytic expressions for a spherical geometry which enable the transmitted flux to be corrected for nonrelativistic Compton scattering. The method allows the use of arbitrary element abundances, photoelectric absorption cross-sections and input spectra and is computationally fast enough for use in a spectral fitting code. The approximations can be used for column densities up to $\sim 5 \times 10^{24}$ cm^{-2}. The maximum observed energy for which the approximations are valid depends on the column density and is ~ 18.5 keV for $N_H = 10^{23}$ cm^{-2} and ~ 10 keV for $N_H = 5 \times 10^{24}$ cm^{-2}. The model provides a significantly improved description of the transmitted spectrum compared to the usual model in which only attenuation due to the absorption opacity is considered and scattering is neglected altogether. The latter leads to errors in the transmitted spectrum which can exceed an order of magnitude, especially around the Fe-K edge.

To appear in ApJ in April 10, 1997 issue

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The extended narrow line region in Mkn79. II. Modelling.

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We present photoionization modelling of the Extended Narrow Line Region (ENLR) in Mkn79 based on long-slit spectra presented in our previous paper (Nazarova et al. 1996). The ENLR has been modelled with two gas components: a system of high density clouds embedded in a low density gas envelope. The ENLR line fluxes have been calculated allowing for attenuation of the nuclear ionizing continuum as a function of distance from the centre. The diffuse continuum emission from the low density gas is also included as an important secondary source of ionization. We show that this multi-component gas model can successfully reproduce the observed line fluxes and line ratios in the ENLR of Mkn79 assuming a central source luminosity of $6.6\times10^{52} photons\ s^{-1}$, consistent with the dereddened nuclear luminosity. The predicted reflected continuum from the ENLR gas is also in agreement with the observed extended blue continuum emission.

To appear in A&A

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Discovery of rapid variability of the iron K line profile in the Seyfert galaxy NGC 7314

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We present evidence of rapid variability of the shape of the Fe-K line in the narrow-line Seyfert galaxy NGC 7314. The time-averaged line profile is strongly peaked near 6.4 keV and extends to ~ 5 keV and ~ 7 keV on the red and blue sides respectively. The X-ray continuum varies by a factor of 2 on a timescale of hundreds of seconds and it appears that emission in the red wing of the Fe-K line below ~ 6 keV responds to these variations on timescales of less than $\sim 3 \times 10^4$ s. The response becomes slower and slower towards the line peak near ~ 6.4 keV. The line broadening is unlikely to be due to scattering in material *fully* enclosing both continuum and line-emitting regions as it would not then be possible for the continuum to vary faster than any part of the Fe-K line. Doppler and gravitational broadening (corresponding to a FWHM of $\sim 8 \times 10^4$ km s^{-1}) are likely to dominate. We show that the line-emitting region cannot lie completely outside of $r = 4.1 \times 10^{15}$ cm from the continuum source. This implies a a strong upper limit on the putative black-hole mass of $4.7 \times 10^9\ M_\odot$ is for a Schwarzschild metric and $2.3 \times 10^{10}\ M_\odot$ for a maximally rotating Kerr metric. If the Fe-K line originates entirely in an accretion disk, the disk cannot be highly ionized and has inclination $> 33°$. The equivalent width of the line is model-dependent, most likely to be in the range $\sim 300 - 460$ eV but could formally be as small as ~ 130 eV. An obvious interpretation of the less-variable narrow core of the iron line is that it originates in distant cold matter such as a molecular torus. In this case low and high disk inclinations are preferred for ionized and neutral disks respectively.

Recently appeared in ApJ

E-mail contact: yaqoob@lheavx.gsfc.nasa.gov, paper available on-line at http://www.aas.org/ApJ/v470n1/5386/5386.html

Interpretation of the emission line spectra of Seyfert 2 galaxies by multi-component photoionization models

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We present multi-component photoionization models allowing for *local* density inhomogeneities in the NLR to interpret the emission line spectra of Seyfert 2 galaxies. This approach leads to a successful match of a large set of line intensities from the UV to the NIR. In particular, the hitherto elusive NIR features [SIII]$\lambda9062 + \lambda9531$ as well as high-ionization lines like [FeVII]$\lambda6087$ are consistently fitted. The predictions of CIII]$\lambda1909$ and CIV$\lambda1549$ are considerably improved.

From the detailed analysis of single-component photoionization models we derive the minimal radial extent of the NLR and the necessary span in density. Furthermore, we determine constraints on suggestions made about the role of matter-bounded clouds, and on proposed explanations for large [OIII]$\lambda4363/\lambda5007$ ratios (the so-called 'temperature problem'), and assess the usability of some emission-line ratios as indicators of the ionization parameter. We find that a *systematic* variation of the cloud column densities in a population of matter-bounded clouds is inconsistent with the trends and correlations exhibited by the emission lines in the diagnostic diagrams. Concerning the temperature problem, the only possibility that leads to an overall consistency with the strengths of all other observed emission lines is subsolar metal abundances (as compared to e.g. the presence of dust, the existence of a high-density component, or matter-bounded clouds).

In addition, the consequences of the presence of (Galactic-ISM-like) dust internal to the clouds were investigated. These models alleviate the [OIII]-ratio problem but did not lead to overall consistent fits. The most conspicuous fallacy lies in the extreme underprediction of Fe-lines, which is mainly due to the strong depletion of the Fe abundance.

In our final model series, the NLR is composed of a mixture of metal-depleted ($\sim 0.5 \times$ solar) clouds with a radius-independent range in densities (10^2 to 10^5 cm^{-3}) distributed over a range of distances from the nucleus (galactocentric radii from at least $\sim 10^{20}$ cm to $10^{21.5}$ cm, for $Q_{\rm tot} = 10^{54}$ s^{-1}). In order to encompass the observed range of each line intensity relative to Hβ, it turns out to be necessary to vary the spectral energy distribution incident on the clouds, qualitatively confirming the findings of Ho et al. (1993). We found a successful continuum sequence by adding an increasing contribution of a hot black body ($T \approx 200\,000$ K) to a steep powerlaw ($\alpha_{\rm uv-x} \approx -2$). These continua imply that low and high-excitation objects differ in the strength but not in the basic shape of the EUV bump.

Accepted by Astronomy & Astrophysics

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ROSAT observations of warm absorbers in AGN

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We study the properties of warm absorbers in several active galaxies (AGN) and present new candidates, using ROSAT X-ray observations. Several aspects of the characteristics of warm absorbers are discussed, constraints on the density and location of the ionized material are provided; the impact of the presence of the warm gas on other observable spectral regions is investigated, particularly with respect to the possibility of a warm-absorber origin of one of the known high-ionization emission-line region in AGN; the possibility of dust mixed with the warm material is critically assessed; and the thermal stability of the ionized gas is examined. Based on the properties of known warm absorbers, we then address the question of where else ionized absorbers might play a role in determining the traits of a class of objects or individual peculiar objects. In this context, the possibility to produce the steep soft X-ray spectra of narrow-line Seyfert-1 galaxies by warm absorption is explored, as compared to the alternative of an accretion-produced soft excess. The potentiality of explaining the strong spectral variability in RX J0134-42 and the drastic flux variability in NGC 5905 via warm absorption is scrutinized.

Contribution to the EARA workshop on accretion disks (MPA Garching, Oct. 1996), to appear in Lecture Notes in Physics, eds E. Meier-Hofmeister, H. Spruit

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Long-term variability of AGN

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For more than ten years, we have been obtaining spectra of selected Seyfert galaxies in order to study their long-term variations. We use variability analysis as a tool to determine the physical properties of the BLR in AGN, such as size, structure, and kinematics.

The concept that nuclear activity in Seyfert galaxies and quasars is triggered by gravitational interactions with the environment of AGN has received much observational and theoretical support. Our galaxies show disturbed morphologies and tidal arms as signatures of former gravitational interaction.

Strong variations were found in the spectra during the whole period of observations. Due to the moderate sampling rate of our observations, crosscorrelation techniques are suitable only to estimate upper limits. We infered upper limits for the outer radius of the broad emission-line region comparable to other objects of the same luminosity.

To appear in *IAU Colloq. 159, Emission Lines in Active Galaxies: New Methods and Techniques*, ed. B. M. Peterson, F.-Z. Cheng, A. S. Wilson (ASP)

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The QSO evolution derived from the HBQS and other complete QSO survey

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An Homogeneous Bright QSO Survey (HBQS) has been carried out in the framework of an ESO Key programme. 327 QSOs (with $M_B < -23$ and $0.3 < z < 2.2$) have been selected over an area of 555 deg^2 in the magnitude range $15 < B < 18.75$. For magnitudes brighter than $B = 16.4$ the QSO surface density turns out to be a factor 2.2 higher than what measured by the PG survey, corresponding to a surface density of $0.013^{+.007}_{-.005}$ deg^{-2}. If the data from the Edinburgh QSO Survey are included, an overdensity of a factor 2.7 is observed, corresponding to a surface density of 0.016 ± 0.005 deg^{-2}. In order to derive the QSO optical luminosity function we used Monte Carlo simulations that take into account of the selection criteria, photometric errors and QSO spectral slope distribution. We have combined our data with the Edinburgh QSO Survey, the Large Bright QSO Survey, Durham/AAT survey, ESO/AAT faint survey and the (ZM)^{2}B survey.

The luminosity function can be represented with a Pure Luminosity Evolution, $L(z) \propto (1+z)^k$, of a two power-law both for $q_0 = 0.5$ and $q_0 = 0.1$. For $q_0 = 0.5$ the k evolution parameter is $k = 3.26 \pm 0.07$, slower than the previous Boyle's (1992) estimate $k = 3.45$. A flatter slope $\beta = -3.72 \pm 0.13$ of the bright part of the luminosity function is also required. If a spread in the QSO spectral slope of $\sigma_\gamma = 0.3$ and 0.5 is taken into account, the k parameter drops to 3.2 and 3.0 respectively. The observed overdensity of bright QSOs is concentrated at redshifts lower than 0.6. It results that in the range $0.3 < z < 0.6$ the luminosity function is flatter than observed at higher redshifts. In this redshift range, for $M_B < -25$, 32 QSOs are observed instead of 19 expected from our best-fit PLE model. This feature requires a luminosity dependent luminosity evolution in order to adequately represent the data in the whole $0.3 < z < 2.2$ redshift interval. The observed overdensity of low redshift bright QSOs could be originated by the contribution of a slower evolving population of radio-loud QSOs.

Accepted by Astron. J. (April 1997 issue)

E-mail contact: lafranca@astrpd.pd.astro.it, preprint astro-ph/9612181 available at http://babbage.sissa.it/list/astro-ph/9612

AGN Watch Continuum Monitoring of and Radio-quiet and Radio-loud AGN

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The International AGN Watch has monitored a number of radio-quiet and radio-loud Active Galactic Nuclei – the most luminous objects in the universe. We present a review of the main observational results from the continuum monitoring campaigns, concentrating on those which aim to quantify the simultaneous ultraviolet to X-ray variability characteristics. These data provide strong constraints on the proposed continuum emission mechanisms. The AGN Watch campaigns have made extensive use of a wide variety of both ground- and space-based multi-waveband observational facilities, and we stress that long-term simultaneous access to the entire electromagnetic spectrum is essential.

Accepted by Advances in Space Research (Proceedings of Cospar 96)

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Comparison of different models for the UV-X emission of AGN

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After briefly recalling some important observational results concerning the UV and X–ray spectrum of AGN, we discuss the radiation mechanisms which are involved and describe different models proposed to account for them. We schematize these models in a simple way, and compute the emitted spectra, insisting on their main characteristics and on their differences.

Proceedings of the 3rd workshop on accretion disks, Munich, October 1996, Lecture Notes in Physics, Springer Verlag edts E. Meyer and H. Spruit

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Meetings

IAU Symposium No. 184
THE CENTRAL REGIONS OF THE GALAXY AND GALAXIES

1997 Aug 18-22, Kyoto Japan

Purpose of the symposium

To understand the general characteristics of dynamics, mass and ISM distributions, evolution, activities including outflow/inflow, shocks, and star formation, in the central regions of the Galaxy and galaxies. Highlights also on black holes and related activity.

WWW: http://www.tenmon.or.jp/iau97
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