Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 57 — December 2001	Editor: Rob Beswick (rb@ast.man.ac.uk)

Abstracts - Thesis Abstracts - Jobs - Meetings

From the Editor

The Active Galaxies Newsletter is produced monthly. The deadline for contributions is the last friday of the month. The Latex macros for submitting abstracts and dissertation abstracts are appended to each issue of the newsletter and are also available on the web page.
Rob Beswick

Abstracts of recently accepted papers

The Chandra Deep Field North Survey. X. X-ray Emission from Very Red Objects

D.M. Alexander, C. Vignali, F.E. Bauer, W.N. Brandt, A.E. Hornschemeier, G.P. Garmire and D.P. Schneider

Department of Astronomy & Astrophysics, 525 Davey Laboratory, The Pennsylvania State University, University Park, PA 16802

The multi-wavelength properties of Very Red Objects (VROs; $I - K \geq 4$) are largely unknown as many of these sources are optically faint ($I \geq 24$) and undetected at most wavelengths. Here we provide constraints on the X-ray (0.5–8.0 keV) properties of VROs using the 1 Ms *Chandra* exposure of an $8.4' \times 8.4'$ region within the Hawaii Flanking-Field area containing the Hubble Deep Field North (HDF-N). We find that VROs detected in the hard band (2.0–8.0 keV) have flat X-ray spectral slopes ($\Gamma \approx 0.9$) and X-ray properties consistent with those expected from luminous obscured AGN. The fraction of such sources in the $K \leq 20.1$ VRO population is 14^{+11}_{-7}%. Conversely, the average X-ray spectral slope of VROs detected in the soft band (0.5–2.0 keV) but not in the hard band is comparatively steep ($\Gamma > 1.4$), and the X-ray emission from these sources is consistent with that expected from less energetic processes (i.e., star formation, low-luminosity AGN activity, normal elliptical galaxy emission); star-formation and low-luminosity AGN activity scenarios are favored in those sources with irregular optical morphologies. Stacking analyses of the X-ray emission from VROs not individually detected at X-ray energies yield significant detections ($\geq$99% confidence level) in the soft band and the full band (0.5–8.0 keV). We find this X-ray emission is produced predominantly by the optically brightest VROs. The simplest explanation of this result is that we have detected the average X-ray emission from non-active VROs with low X-ray-to-optical flux ratios [$\log(\frac{f_X}{f_I}) \approx -2$]; this is consistent with that expected if the majority of these VROs are $\approx M_I^*$ elliptical galaxies. A number of VROs are also detected with mid-infrared (15 μm) and radio emission, and we provide constraints on the nature of this emission.

Accepted by Astronomical Journal

E-mail contact: davo@astro.psu.edu,
preprint available also as astro-ph/0111397

Spectroscopic and Variability Surveys for AGN in the Groth Survey Strip

Vicki Sarajedini[1]

[1] University of Florida, Gainesville, FL 32611

Preliminary results are presented for a spectroscopic survey of the Groth Survey Strip (GSS), a 40 by 3.5 arcminute region of the sky imaged with HST, for which several hundred galaxy spectra have been obtained as part of the DEEP project (http://deep.ucolick.org). At least 6 broad-line AGNs (primarily Seyfert 1s) have been detected as well as several narrow-line Seyfert 2 candidates. The Seyfert galaxies detected in our survey have integrated absolute magnitudes extending to $M_B\sim$-17.5, probing fainter magnitudes and higher redshifts than existing optical spectroscopic surveys. We also discuss a variability study of the GSS using the original HST images from 1994 and new images obtained in 2001. The high resolution obtained with HST allows us to isolate and measure variable galactic nuclei too faint to be detected from the ground, reaching nuclear magnitudes of $M_B\sim$-16 in galaxies to z$\sim$0.8. The combination of these techniques provides a powerful probe of the population of low-luminosity AGNs at moderate redshifts.

To appear in IAU Colloq. 184, AGN Surveys, ed. R.F. Green, E. Ye. Khachikian, & D.B. Sanders (San Francisco: ASP)

E-mail contact: vicki@astro.ufl.edu

X-ray Spectroscopy of QSOs with Broad Ultraviolet Absorption Lines

S. C. Gallagher, W. N. Brandt, G. Chartas, & G. P. Garmire[1]

[1] Astronomy & Astrophysics, 525 Davey Laboratory, Penn State, University Park, PA 16802, USA

For the population of QSOs with broad ultraviolet absorption lines, we are just beginning to accumulate X-ray observations with enough counts for spectral analysis at CCD resolution. From a sample of eight QSOs [including four Broad Absorption Line (BAL) QSOs and three mini-BAL QSOs] with *ASCA* or *Chandra* spectra with more than 200 counts, general patterns are emerging. Their power-law X-ray continua are typical of normal QSOs with $\Gamma \approx 2.0$, and the signatures of a significant column density [$N_{\rm H} \approx (0.1–4) \times 10^{23}\,{\rm cm}^{-2}$] of intrinsic, absorbing gas are clear. Correcting the X-ray spectra for intrinsic absorption recovers a normal ultraviolet-to-X-ray flux ratio, indicating that the spectral energy distributions of this population are not inherently anomalous. In addition, a large fraction of our sample shows significant evidence for complexity in the absorption. The subset of BAL QSOs with broad Mg II absorption apparently suffers from Compton-thick absorption completely obscuring the direct continuum in the 2–10 keV X-ray band, complicating any measurement of their intrinsic X-ray spectral shapes.

Accepted by Ap. J.

E-mail contact: gallsc@astro.psu.edu,
preprint available at http://xxx.lanl.gov/abs/astro-ph/0110579

Near-infrared micro-variability of radio-loud quasars

Matthew Whiting[1], **Alicia Oshlack**[1], **Rachel Webster**[1]

[1] Astrophysics group, School of Physics, University of Melbourne, Victoria 3010, Australia

We observed three AGN from the Parkes Half-Jansky Flat-spectrum Sample at near-infrared (NIR) wavelengths to search for micro-variability. In one source, the blue quasar PKS 2243-123, good evidence for NIR micro-variability was found. In the other two sources, PKS 2240-260 and PKS 2233-148, both BL Lacertae objects, no such evidence of variability was detected. We discuss the implications of these observations for the various mechanisms that have been proposed for micro-variability.

Accepted by P.A.S.A

E-mail contact: mwhiting@physics.unimelb.edu.au,
preprint available at http://arXiv.org/abs/astro-ph/0111171

Disclosing the true nature of the Sy 2 galaxy NGC 3281: one more Compton-thick source

C. Vignali* and A. Comastri

Osservatorio Astronomico di Bologna, Via Ranzani 1, 40137 Bologna, Italy
* Present address: Department of Astronomy & Astrophysics, 525 Davey Laboratory, The Pennsylvania State University, University Park, PA 16802, USA

We present the *BeppoSAX* broad-band X–ray spectrum of the Seyfert 2 galaxy NGC 3281. The source high-energy spectrum is characterized by the nuclear transmitted component, with an absorbing column density of $\approx 2{\times}10^{24}$ cm^{-2}, while the MECS spectrum is reflection-dominated, with a prominent (EW$\approx$0.5–1.2 keV) iron Kα emission line. The source is detected at only the 5σ significance level in the LECS band, because of the strong obscuration which hampers at low energies the direct view of the active nucleus harbored in NGC 3281. *BeppoSAX* results are consistent with the scenario where NGC 3281 is inclined more than 60° with respect to the line-of-sight. Combining the N_H value obtained from the present X–ray analysis with the A_V measurement, a N_H/A_V about 50 times the Galactic value is derived.

Accepted by Astronomy & Astrophysics

E-mail contact: chris@astro.psu.edu,
preprint available also as astro-ph/0111056

The Spectral Energy Distribution of the Seyfert galaxy Ton S180

T. J. Turner[1,2], P. Romano[3], S. B. Kraemer[4,5], I. M. George[1,2], T. Yaqoob[1,6], D. M. Crenshaw[7], J. Storm[8], D. Alloin[9], D. Lazzaro[10], L. Da Silva[10], J. D. Pritchard[9], G. Kriss[6,11], W. Zheng[6], S. Mathur[3], J. Wang[6], P. Dobbie[12], N. R. Collins[4,5,13]

[1] Joint Center for Astrophysics, Physics Dept., University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250
[2] Laboratory for High Energy Astrophysics, Code 662, NASA/GSFC, Greenbelt, MD 20771
[3] Department of Astronomy, The Ohio State University, 140 West Avenue, Columbus, OH 43210
[4] Laboratory for Astronomy and Solar Phyiscs, Code 661, NASA/GSFC, Greenbelt, MD 20771
[5] Institute for Astrophysics and Computational Sciences, The Catholic University of America Washington, DC 20064
[6] Center for Astrophysical Sciences, Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD 21218
[7] Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303
[8] AIP, An der Sternwarte 16, D-14482 Potsdam, Germany
[9] European Southern Observatory, Casilla 19001, Santiago, Chile
[1]0 Observatorio Nacional, Departamento de Astronomia, Rua Gen. Jose Cristino, 77, 20921-400, Rio de Janeiro, Brazil Observatorio Nacional, Rio de Janeiro, Brazil
[1]1 Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218
[1]2 Astronomy Group, Leicester University, Leicester LE1 7RH, UK
[1]3 Science Systems and Applications, Inc., 5900 Princess Garden Parkway Suite 300, Lanham, MD 20706

We present spectral results from a multi-satellite, broad-band campaign on the Narrow-line Seyfert 1 galaxy Ton S180 performed at the end of 1999. We discuss the spectral-energy distribution of the source, combining simultaneous *Chandra*, *ASCA* and *EUVE* data with contemporaneous *FUSE*, *HST*, and ground-based optical and infra-red data. The resulting SED shows that most of the energy is emitted in the 10 – 100 eV regime, which must be dominated by the primary energy source. No spectral turnover is evident in the UV regime. This, the strong soft X-ray emission, and the overall shape of the SED indicate that emission from the accretion disk peaks between 15 and 100 eV. High resolution *FUSE* spectra showing UV absorption due to O VI and the lack of detectable X-ray absorption in the *Chandra* spectrum demonstrate the presence of a low column density of highly ionized gas along our line-of-sight.

The highly-ionized state of the circumnuclear gas is most likely linked to the high luminosity and steep spectrum of the active nucleus. Given the strong ionizing flux in Ton S180, it is possible that the clouds within a few tens of light days of the central source are too highly ionized to produce much line emission. Thus the narrow width of the emission lines in Ton S180 is due to the emission arising from large radii.

Accepted by Astrophysical Journal

E-mail contact: turner@lucretia.gsfc.nasa.gov,
preprint available as astro-ph/0111514

The Detection of Circumnuclear X-ray Emission from the Seyfert Galaxy NGC 3516

I. M. George[1,2], T. J. Turner[1,2], H. Netzer[3], S. B. Kraemer[4,5], J. Ruiz[4,5], D. Chelouche[3], D. M. Crenshaw[6], T. Yaqoob[2,7], K. Nandra[2,8], R. F. Mushotzky[2]

[1] Joint Center for Astrophysics, Department of Physics, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250 [2] Laboratory for High Energy Astrophysics, Code 662, NASA/Goddard Space Flight Center, Greenbelt, MD 20771 [3] School of Physics and Astronomy and the Wise Observatory, The Beverly and Raymond Sackler Faculty of Exact Sciences, Tel Aviv University, Tel Aviv 69978, Israel. [4] Laboratory for Astronomy and Solar Physics, Code 681, NASA/Goddard Space Flight Center, Greenbelt, MD 20771 [5] Institute for Astrophysics and Computational Sciences, The Catholic University of America, Washington D.C. 20064 [6] Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303 [7] Department of Physics & Astronomy, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218 [8] Universities Space Research Association

We present the first high-resolution, X-ray image of the circumnuclear regions of the Seyfert 1 galaxy NGC 3516, using the *Chandra X-ray Observatory* (*CXO*). All three of the *CXO* observations reported were performed with one of the two grating assemblies in place, and here we restrict our analysis to undispersed photons (i.e. those detected in the zeroth-order). A previously-unknown X-ray source is detected ∼6 arcsec ($1.1 h_{75}^{-1}$ kpc) NNE of the nucleus (position angle ∼29 degrees) which we designate CXOU 110648.1+723412. Its spectrum can be characterized as a power law with a photon index Γ ∼1.8–2.6, or as thermal emission with a temperature kT ∼0.7–3 keV. Assuming a location within NGC 3516, isotropic emission implies a luminosity $L \sim 2$–$8 \times 10^{39} h_{75}^{-2}$ erg s^{-1} in the 0.4–2 keV band. If due to a single point source, the object is super-Eddington for a $1.4 M_{\odot}$ neutron star. However, multiple sources or a small, extended source cannot be excluded using the current data. Large-scale extended X-ray emission is also detected out to $\sim$ 10 arcsec ($\sim 1.7 h_{75}^{-1}$ kpc) from the nucleus to the NE and SW, and is approximately aligned with the morphologies of the radio emission and extended narrow emission line region (ENLR). The mean luminosity of this emission is 1–$5 \times 10^{37} h_{75}^{-2}$ erg s^{-1} arcsec^{-2}, in the 0.4–2 keV band. Unfortunately the current data cannot usefully constrain its spectrum. These results are consistent with earlier suggestions of circumnuclear X-ray emission in NGC 3516. If the extended emission is due to scattering of the nuclear X-ray continuum, then the pressure in the X-ray emitting gas is at least two orders of magnitude too small to provide the confining medium for the ENLR clouds.

Accepted by Astrophysical Journal

E-mail contact: ian.george@umbc.edu,
preprint available as astro-ph/0111523

Dissertation Abstracts

What made the quasar blush? Emission mechanisms in optically red quasars

Matthew Thomas Whiting

Thesis work conducted at: School of Physics, University of Melbourne, Australia

Current address: Astrophysics group, School of Physics, University of Melbourne, VIC 3010, Australia

Electronic mail: mwhiting@physics.unimelb.edu.au

Ph.D dissertation directed by: Rachel Webster

Ph.D degree awarded: September 2001

Quasars selected at radio frequencies have been shown to exhibit a much broader range of optical colours than the canonical blue colours of optically-selected quasars. This thesis sets out to explain this observation by the presence of optical non-thermal synchrotron emission, connected with the relativistic jet that powers the radio emission in these quasars.

In the first part of this thesis, we investigate the properties of synchrotron emission. This is firstly done from the perspective of observed optical synchrotron jets. The measured spectral indices of these jets show good evidence that the synchrotron spectrum is turning over at optical frequencies, indicating that the energy distribution of the emitting particles has a cutoff at some maximum energy. Secondly, we investigate analytic solutions for synchrotron emission from both ordered and tangled magnetic fields, and find that the emitted flux in the ordered field case exhibits a strong dependence on the viewing angle. This is compared with the expected dependence due to Doppler boosting caused by some bulk flow that would occur in a relativistic jet, and the implications for real jets are discussed.

The second part of the thesis is concerned with flat-spectrum radio quasars taken from the Parkes Half-Jansky Flat-spectrum Sample. We present an extensive data-set of optical and near-infrared photometry for > 100 objects, and fit theoretical models to these observations. We find that about 40% of the sources have power-law SEDs, while a similar number show evidence for two primary components: a blue power law and optical synchrotron emission. The blue power law is similar to the dominant component observed in the spectra of optically-selected QSOs. There is strong evidence that the synchrotron component has a turnover in the rest frame UV-optical region of the spectrum. In the remaining sources it is likely that the synchrotron peaks at longer wavelengths, while peaks at shorter wavelengths appear to be ruled out. The relative strengths of these two components show variations of more than four orders of magnitude. The sources with power law SEDs show evidence for an excess number of red power law slopes compared to optically-selected quasars.

Analysis of polarisation data, both optical (from the literature) and near-infrared (new observations), supports the presence of an optically red, highly polarised component, which is consistent with the fitted synchrotron component.

The properties of the BL Lacertae objects in the sample are examined. It is found that, aside from having much lower emission line equivalent widths (by definition), the BL Lacs are indistinguishable from the other synchrotron-dominated sources in the sample. This suggests that the BL Lac phenomenon is caused primarily by a relative lack of emission line gas, rather than an excessively boosted synchrotron component.

Finally, observations of variability on timescales of hours in a source with no optical synchrotron emission demonstrates that the blue power law emission can exhibit short-timescale variations, a property which is often ascribed to synchrotron emission. This indicates that both components are important for modelling the optical emission from flat-spectrum radio quasars.

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://www.ast.man.ac.uk/~rb/agn/
If you move or your e-mail address changes, please send the editor your new address. If the Newsletter repeatedly bounces back from an address then that address is deleted from the mailing list.