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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

A search for molecular gas in GHz Peaked Spectrum radio sources

Christopher O'Dea[1], Jack Gallimore[2], Carlo Stanghellini[3], Stefi Baum[4] and James Jackson[5]

[1] Rochester Institute of Technology, Department of Physics, 85 Lomb Memorial Drive, Rochester, NY 14623
[2] Bucknell University, Department of Physics, Lewisburg, PA 17837
[3] Istituto di Radioastronomia del CNR, via Gobetti 101, Bologna I-40129
[4] Chester F. Carlson Center for Imaging Science, Rochester Institute of Technology, 54 Lomb Memorial Drive, Rochester, NY 14623
[5] Boston University, Department of Astronomy, 725 Commonwealth Ave, Boston, MA 02215

We present searches for molecular gas (CO, OH, CS, and Ammonia) in six GHz Peaked Spectrum (GPS) radio sources. We do not detect gas in any source and place upper limits on the mass of molecular gas which are generally in the range $\sim 10^9$ to a few $\times 10^{10}$ $M_\odot$. These limits are consistent with the following interpretations: (1) GPS sources do not require very dense gas in their hosts, & (2) The GPS sources are unlikely to be confined by dense gas and will evolve to become larger radio sources.

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E-mail contact: odea@cis.rit.edu,
preprint available at http://arxiv.org/abs/astro-ph/0411123

Fe XXV and Fe XXVI lines from low velocity, photoionised gas in the X-ray spectra of AGN

Stefano Bianchi[1], Giorgio Matt [1], Fabrizio Nicastro[2], Delphine Porquet[3] and Jacques Dubau[4]

[1] Dipartimento di Fisica, Università degli Studi Roma Tre, Via della Vasca Navale 84, I-00146, Roma, Italy
[2] Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA
[3] Max-Planck-Institut für extraterrestrische Physik, Postfach 1312, 85741 Garching, Germany
[4] LIXAM, Université Paris-Sud, 91405 Orsay cedex, France

We have calculated the equivalent widths of the absorption lines produced by Fe XXV and Fe XXVI in a Compton-thin, low-velocity photoionised material illuminated by the nuclear continuum in AGN. The results, plotted against the ionisation parameter and

the column density of the gas, are a complement to those presented by Bianchi & Matt (2002) for the emission lines from the same ionic species. As an extension to the work by Bianchi & Matt (2002), we also present a qualitative discussion on the different contributions to the He-like iron emission line complex in the regimes where recombination or resonant scattering dominates, providing a useful diagnostic tool to measure the column density of the gas. Future high resolution missions (e.g., *Astro-E2*) will allow us to fully take advantage of these plasma diagnostics. In the meantime, we compare our results with an up-to-date list of Compton-thick and unobscured (at least at the iron line energy) Seyfert galaxies with emission and/or absorption lines from H- and He-like iron observed with *Chandra* and XMM-*Newton*.

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E-mail contact: Stefano.Bianchi@sciops.esa.int,
preprint available at http://es.arxiv.org/abs/astro-ph/0411603

X-rays from the First Massive Black Holes

W.N. Brandt[1], C. Vignali[2], B.D. Lehmer[1], L.A. Lopez[1], D.P. Schneider[1] and I.V. Strateva[1]

[1] Department of Astronomy & Astrophysics, The Pennsylvania State University, 525 Davey Lab, University Park, PA 16802, USA

[2] Dipartimento di Astronomia, Università degli Studi di Bologna, Via Ranzani 1, 40127 Bologna, Italy

We briefly review some recent results from Chandra and XMM-Newton studies of the highest redshift ($z > 4$) active galactic nuclei (AGNs). Specific topics covered include radio-quiet quasars, radio-loud quasars, moderate-luminosity AGNs in X-ray surveys, and future prospects. No significant changes in AGN X-ray emission properties have yet been found at high redshift, indicating that the small-scale X-ray emission regions of AGNs are insensitive to the dramatic changes on larger scales that occur from $z \approx 0$–6. X-ray observations are also constraining the environments of high-redshift AGNs, relevant emission processes, and high-redshift AGN demography.

Contribution to proceedings of the conference on “Growing Black Holes” held in Garching, Germany on June 21–25, 2004. Edited by A. Merloni, S. Nayakshin, R. Sunyaev, Springer-Verlag series of “ESO Astrophysics Symposia”

E-mail contact: niel@astro.psu.edu,
preprint available at http://www.astro.psu.edu/users/niel/papers/papers.html or http://arxiv.org/abs/astro-ph/0411355

Opacity Variations in the Ionized Absorption in NGC 3783: A Compact Absorber

Y. Krongold[1], F. Nicastro[2], N. S. Brickhouse[2], M. Elvis[2], S. Mathur[3]

[1] Instituto de Astronomia, Universidad Nacional Autonoma de Mexico
[2] Harvard-Smithsonian Center for Astrophysics
[3] Department of Astronomy, Ohio State University

We show that the Fe (VII-XII) M-shell unresolved transition array (UTA) in the NGC 3783 900 ks *Chandra* HETGS observation clearly changes in opacity in a timescale of 31 days responding to a factor of ~ 2 change in the ionizing continuum. The opacity variation is observed at a level $> 10\sigma$. There is also evidence for variability in the O VI K edge (at $\sim 3\sigma$). The observed changes are consistent with the gas producing these absorption features (the low ionization component) being close to photoionization equilibrium. The gas responsible for the Fe (XVII-XXII) L-shell absorption (the high ionization component), does not seem to be responding as expected in photoionization equilibrium. The observed change in opacity for the UTA implies a density $> 1 \times 10^4$ cm^{-3}, and so locates the gas within 6 pc of the X-ray source. The scenario in which the gas is composed of a continuous radial range of ionization structures is ruled out, as in such scenario, no opacity variations are expected. Rather, the structure of the absorber is likely composed by heavily clumped gas.

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E-mail contact: yair@astroscu.unam.mx,
http://arxiv.org/abs/astro-ph/0411554

X-ray Properties of Lyman Break Galaxies in the Great Observatories Origins Deep Survey

B. D. Lehmer[1], W. N. Brandt[1], D. M. Alexander[2], F. E. Bauer[2], C. J. Conselice[3], M. E. Dickinson[4], M. Giavalisco[5], N. A. Grogin[6], A. M. Koekemoer[5], K. S. Lee[5,6], L. A. Moustakas[5], and D. P. Schneider[1]

[1] Department of Astronomy & Astrophysics, 525 Davey Lab, The Pennsylvania State University, University Park, PA 16802.
[2] Institute of Astronomy, Madingley Road, Cambridge, CB3 0HA, United Kingdom.
[3] Palomar Observatory, California Institute of Technology, Pasadena, CA 91125
[4] NOAO, 950 N. Cherry Ave., Tucson, AZ 85719
[5] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218
[6] Johns Hopkins University, 3400 North Charles Street, Baltimore, MD 21218-2686

We constrain the X-ray emission properties of Lyman break galaxies (LBGs) at $z \approx 3$–6 using the ≈ 2 Ms *Chandra* Deep Field-North and ≈ 1 Ms *Chandra* Deep Field-South. Large samples of LBGs were discovered using HST as part of the Great Observatories Origins Deep Survey (GOODS). Deep optical and X-ray imaging over the GOODS fields have allowed us to place the most significant constraints on the X-ray properties of LBGs to date. Mean X-ray properties of 449, 1734, 629, and 247 LBGs with $z \sim 3$, 4, 5, and 6, respectively, were determined using stacking techniques. When stacked, we detect X-ray emission from LBGs at $z \sim 3$ ($\sim 7\sigma$) and from an optically bright subset (brightest 25%) of LBGs at $z \sim 4$ ($\sim 3\sigma$); the latter is the highest redshift detection yet for "normal" galaxies in the X-ray band. The effective exposure times for these stacked observations are ≈ 0.7 and 0.5 Gs, respectively. The derived average rest-frame 2.0–8.0 keV luminosities are 1.5 and 1.4 $\times$ 10^{41} erg s^{-1}, respectively. X-ray emission from these LBGs is likely due to high mass X-ray binaries (HMXBs) and Type II supernovae; the corresponding star formation rates are $\approx$ 85–240 $M_\odot$ yr^{-1}. The X-ray to B-band mean luminosity ratio (L_X/L_B) at $z \sim 3$ is somewhat elevated with respect to that measured for starburst galaxies in the local Universe (significance $\sim 3\sigma$). When stacking full samples of LBGs at $z \sim 4$, 5, and 6 we do not obtain significant detections ($< 3\sigma$) and derive rest-frame 2.0–8.0 keV luminosity upper limits (3σ) of 0.9, 2.8, and 7.1 $\times$ 10^{41} erg s^{-1}, respectively. These upper limits constrain any widespread AGN activity in these objects to be modest at best. Furthermore, we find that ~ 0.5% of our LBGs from $z \approx 3$–6 are detected individually in the X-ray band. These LBGs have spectral shapes and luminosities characteristic of moderate-power AGN (e.g., Seyfert galaxies and quasars).

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E-mail contact: blehmer@astro.psu.edu,
preprint available at http://arxiv.org/abs/astro-ph/0409600

VLBA Imaging of Central Engines in Radio Quiet Quasars

James S. Ulvestad[1], Robert R. J. Antonucci[2] and Richard Barvainis[3,4]

[1] National Radio Astronomy Observatory, P.O. Box O, Socorro, NM 87801, USA
[2] University of California at Santa Barbara, Dept. of Physics, Santa Barbara, CA 93106, USA
[3] National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, USA
[4] Department of Physics, Gettysburg College, Gettysburg, PA 17325, USA

We have used the Very Long Baseline Array (VLBA) to image five radio-quiet quasars (RQQs) at milliarcsecond resolution, at frequencies between 1.4 and 5 GHz. These quasars have typical total flux densities of a few millijansky at gigahertz frequencies, and are compact on arcsecond scales. The VLBA images reveal that four of the quasars are dominated by unresolved radio cores, while the fifth has an apparent two-sided jet. Typical core brightness temperatures range from 10^8 K to at least 10^9 K. The compact radio morphologies and X-ray luminosities of many objects in the RQQ sample seem to indicate classical accretion onto black holes as massive as $10^9 M_\odot$, with emission physics in many ways similar to their radio-loud counterparts. Therefore, the relatively small amount of radiative energy emerging at radio wavelengths in the RQQs may simply be due to the presence of less powerful radio jets.

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E-mail contact: julvesta@nrao.edu
http://arxiv.org/abs/astro-ph/0411678

Lag-Luminosity Relationship for Interband Lags between Variations in B, V, R, and I Bands in Active Galactic Nuclei

S. G. Sergeev[1,2], V. T. Doroshenko[3,2], Yu. V. Golubinskiy[1,2], N. I. Merkulova[1,2], and E. A. Sergeeva[1,2]

[1] Crimean Astrophysical Observatory, P/O Nauchny, Crimea 98409, Ukraine
[2] Isaac Newton Institute of Chile, Crimean Branch
[3] Crimean Laboratory of the Sternberg Astronomical Institute, University of Moscow, Russia; Crimea 98409, Ukraine

We determine interband lags between variations in B band and variations in V, R, I bands for 14 active galactic nuclei observed at the Crimean Astrophysical Observatory. The computed lag ranges from tenths of day to several days, and it is positive (by the mean V, R, I bands lag behind B) in most cases with except for few cases for the filter V. In some cases the lag is greater than zero with more than 3σ confidence. The lag is systematically less for the filter V than for the red filters and the lag determined from the CCF (cross-correlation function) centroid is systematically greater than the lag determined from the CCF peak. We find that the lag scales with luminosity as L^b, where $b \approx 0.4 - 0.5$. We attribute this lag to the light time travel effect, so it reflects geometrical size of the region that emits optical continuum. We consider a model in which optical emission is mainly re-processed emission that arises in the accretion disk heated by X -ray source above the disk.

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E-mail contact: sergeev@crao.crimea.ua,
Light curves are available at

`http://www.crao.crimea.ua/~sergeev/papers/photometry/lag-lum/data.htm`

The host galaxies of luminous quasars

David J. E. Floyd[1], Marek J. Kukula[1], James S. Dunlop[1], Ross J. McLure[1], Lance Miller[2], Will J. Percival[1], Stefi A. Baum[3] and Christopher P. O'Dea[3]

[1] Institute for Astronomy, University of Edinburgh, Royal Observatory, Edinburgh EH9 3HJ, U.K.
[2] Astrophysics, Department of Physics, Keble Road, Oxford, OX1 3RH, U.K.
[3] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, U.S.A.

We present results of a deep HST/WFPC2 imaging study of 17 quasars at $z \sim 0.4$, designed to determine the properties of their host galaxies. The sample consists of quasars with absolute magnitudes in the range $-24 > M_V > -28$, allowing us to investigate host galaxy properties across a decade in quasar luminosity, but at a single redshift. We find that the hosts of all the RLQs, and all the RQQs with nuclear luminosities $M_V < -24$, are massive bulge-dominated galaxies, confirming and extending the trends deduced from our previous studies. From the best-fitting model host galaxies we have estimated spheroid and black-hole masses, and the efficiency (with respect to Eddington luminosity) with which each quasar is radiating. The largest inferred black-hole mass in our sample is $\sim 3 \times 10^9 M_\odot$, comparable to those at the centres of M87 and Cygnus A. We find no evidence for super-Eddington accretion in even the most luminous objects. We investigate the role of scatter in the black-hole:spheroid mass relation in determining the ratio of quasar to host-galaxy luminosity, by generating simulated populations of quasars lying in hosts with a Schechter mass function. Within the subsample of the highest luminosity quasars, the observed variation in nuclear-host luminosity ratio is consistent with being the result of the scatter in the black-hole:spheroid relation. Quasars with high nuclear-host ratios can be explained by sub-Eddington accretion onto black holes in the high-mass tail of the black-hole:spheroid relation. Our results imply that, owing to the Schechter cutoff, host mass should not continue to increase linearly with quasar luminosity, at the very highest luminosities. Any quasars more luminous than $M_V = -27$ should be found in massive elliptical hosts which at the present day would have $M_V \sim -24.5$.

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E-mail contact: floyd@stsci.edu,
Preprint available at http://arxiv.org/abs/astro-ph/0308436
or ftp://ftp.roe.ac.uk/pub/djef/preprints/floyd_2004/

Jobs: PhD Fellowships

International Max-Planck Research School for Astronomy and Cosmic Physics (IMPRS)

University of Heidelberg, Germany

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With kind regards,
Christian Fendt
Email enquires: imprs-hd@mpia.de