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| Active Galaxies Newsletter | *An electronic publication dedicated to the observation and theory of active galaxies* |
| No. 100 — July 2005 | Editor: Rob Beswick (rb@ast.man.ac.uk) |

*Abstracts - Thesis Abstracts - Jobs - Meetings*

## From the Editor

The Active Galaxies Newsletter has been in existence since October 1996 and has now passed 100 issues. As editor I wish to thank all of the contributers and subscribers, without whom there would be no newsletter.

As ever the deadline for contributions to the next issue will be the last day 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 SDSS View of the Palomar-Green Bright Quasar Survey

**Sebastian Jester [1], Donald P. Schneider [2], Gordon T. Richards [3], Richard F. Green [4], Maarten Schmidt [5], Patrick B. Hall [6], Michael A. Strauss [3], Daniel E. Vanden Berk [2], Chris Stoughton [1], James E. Gunn [3], Jon Brinkmann [7], Stephen M. Kent [1,8], J. Allyn Smith [9,10], Douglas L. Tucker [1], Brian Yanny [1]**

[1] Fermilab,
[2] Penn State,
[3] Princeton,
[4] KPNO,
[5] Caltech,
[6] York U,
[7] Apache Point Obs.,
[8] U Chicago,
[9] U Wyoming,
[10] LANL

We investigate the extent to which the Palomar-Green (PG) Bright Quasar Survey (BQS) is complete and representative of the general quasar population by comparing with imaging and spectroscopy from the Sloan Digital Sky Survey. A comparison of SDSS and PG photometry of both stars and quasars reveals the need to apply a color and magnitude recalibration to the PG data. Using the SDSS photometric catalog, we define the PG's parent sample of objects that are not main-sequence stars and simulate the selection of objects from this parent sample using the PG photometric criteria and errors. This simulation shows that the effective U–B cut in the PG survey is U–B$< -0.71$, implying a color-related incompleteness. As the color distribution of bright quasars peaks near U–B= $-0.7$ and the 2-$\sigma$ error in U–B is comparable to the full width of the color distribution of quasars, the color incompleteness of the BQS is approximately 50% and essentially random with respect to U–B color for $z < 0.5$. There is, however, a bias against bright quasars at $0.5 < z < 1$, which is induced by the color-redshift relation of quasars (although quasars at $z > 0.5$ are inherently rare in bright surveys in any case). We find no evidence for any other systematic incompleteness when comparing the distributions in color, redshift, and FIRST radio properties of the BQS and a BQS-like subsample of the SDSS quasar sample. However, the application of a bright magnitude limit biases the BQS toward the inclusion of objects which are blue in $g - i$, in particular compared to the full range of $g - i$ colors found among the $i$-band limited SDSS quasars, and even at $i$-band magnitudes comparable to those of the BQS objects.

Accepted by Astron. J.

E-mail contact: jester@fnal.gov,
preprint available at http://arxiv.org/abs/astro-ph/0506022

## Radiative Transfer and Acceleration in Magnetocentrifugal Winds

**John E. Everett**

CITA, University of Toronto, Toronto ON, M5S 3H8, Canada

Detailed photoionization and radiative acceleration of self-similar magnetocentrifugal accretion disk winds are explored. First, a general-purpose hybrid magnetocentrifugal and radiatively-driven wind model is defined. Solutions are then examined to determine how radiative acceleration modifies magnetocentrifugal winds and how those winds can influence radiative driving in Active Galactic Nuclei (AGNs). For the models studied here, both radiative acceleration by bound-free ("continuum-driving") and bound-bound ("line-driving") processes are found to be important, although magnetic driving dominates the mass outflow rate for the Eddington ratios studied ($L/L_{\rm Edd} = 0.001 - 0.1$). The solutions show that shielding by a magnetocentrifugal wind can increase the efficiency of a radiatively-driven wind, and also that, within a magnetocentrifugal wind, radiative acceleration is sensitive to both the column in the shield, the column of the wind and the initial density at the base of the wind.

Accepted by Ap.J.

E-mail contact: everett@cita.utoronto.ca,
preprint available at http://arxiv.org/abs/astro-ph/0506321

## Evidence for Orbital Motion of Material close to the Central Black Hole of Mrk 766

**T.J.Turner[1,2], L. Miller[3], I.M.George[1,2] & J.N.Reeves** 2, 4

[1] Dept. of Physics, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250
[2] Code 662, Exploration of the Universe Division,NASA/GSFC, Greenbelt, MD 20771
[3] Dept. of Physics, University of Oxford, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH
[4] Dept. of Physics and Astronomy, Johns Hopkins University, 3400 N Charles Street, Baltimore, MD 21218

Time-resolved X-ray spectroscopy has been obtained for the narrow line Seyfert galaxy Mrk 766 from *XMM-Newton* observations. We present analysis in the energy-time plane of EPIC pn data in the $4 - 8$ keV band with energy resolution $R \simeq 50$. A component of Fe K$\alpha$ emission detected in the maps shows a variation of photon energy with time that appears both to be statistically significant and to be consistent with sinusoidal variation. We investigate the interpretation that there exists a component of line emission from matter in a Keplerian orbit around a supermassive black hole. The orbit has a period $\sim 165$ ks and a line-of-sight velocity $\sim 13,500\,{\rm km\,s^{-1}}$. This yields a lower limit for the central mass of M$> 4.9 \times 10^5$M$_\odot$ within a radius of $3.6 \times 10^{13}$ cm (2.4 A.U.). The orbit parameters are consistent with higher black hole masses, but the lack of any substantial gravitational redshift of the orbit implies an upper limit to the black hole mass of $4.5 \times 10^7$ M$_\odot$.

Accepted by A&A

# The Ionized Gas and Nuclear Environment in NGC 3783 V. Variability and Modeling of the Intrinsic Ultraviolet Absorption

**J. R. Gabel[1], S. B. Kraemer[2], D. M. Crenshaw[3], I. M. George[4,5], W. N. Brandt[6], F. W. Hamann[7], M. E. Kaiser[8], S. Kaspi[9,10], G. A. Kriss[8,11], S. Mathur[12], K. Nandra[13], H. Netzer[10], B .M. Peterson[12], J. C. Shields[14], T. J. Turner[4,5], & W. Zheng[8]**

[1] Center for Astrophysics and Space Astronomy, University of Colorado, 389 UCB, Boulder CO 80309-0389
[2] The Catholic University of America/IACS, NASA/Goddard Space Flight Center, Laboratory for Astronomy and Solar Physics, Code 681, Greenbelt, MD 20771.
[3] Department of Physics and Astronomy, Georgia State University, Atlanta, GA 30303.
[4] Laboratory for High Energy Astrophysics, NASA/Goddard Space Flight Center, Code 662, Greenbelt, MD 20771.
[5] Joint Center for Astrophysics, Physics Department, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250.
[6] Department of Astronomy and Astrophysics, 525 Davey Laboratory, The Pennsylvania State University, University Park, PA 16802.
[7] Department of Astronomy, University of Florida, 211 Bryant Space Science Center, Gainesville, FL, 32611-2055.
[8] Center for Astrophysical Sciences, Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD 21218-2686.
[9] Physics Department, Technion, Haifa 3200, Israel.
[10] School of Physics and Astronomy, Raymond and Beverly Sackler Faculty of Exact Sciences, Tel-Aviv University, Tel-Aviv 69978, Israel.
[11] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218.
[12] Department of Astronomy, Ohio State University, 140 West 18th Avenue, Columbus, OH 43210-1173.
[13] Astrophysics Group, Imperial College London, Blackett Laboratory, Prince Consort Road, London SW7 2AW.
[14] Department of Physics and Astronomy, Clippinger Research Labs 251B, Ohio University, Athens, OH 45701-2979.

We present results on the location, physical conditions, and geometry of the outflow in the Seyfert 1 galaxy NGC 3783 from a study of the variable intrinsic UV absorption. Based on analysis of 18 observations with the Space Telescope Imaging Spectrograph aboard the *Hubble Space Telescope* and 6 observations with the *Far Ultraviolet Spectroscopic Explorer* obtained between 2000 February and 2002 January, we obtain the following results: 1) The lowest-ionization species detected in each of the three strong kinematic components (components 1 – 3 at radial velocities −1350, −550, and −725 km s$^{-1}$, respectively) varied, with equivalent widths inversely correlated with the continuum flux. This indicates the ionization structure in the absorbers responded to changes in the photoionizing flux, with variations occurring over the weekly timescales sampled by our observations. 2) A multi-component model of the line-of-sight absorption covering factors, which includes an unocculted narrow emission-line region (NLR) and separate covering factors derived for the broad line region and continuum emission sources, predicts saturation in several lines, consistent with the lack of observed variability in these lines. Differences in covering factors and kinematic structure imply component 1 is comprised of two physically distinct regions (1a and 1b). 3) We obtain column densities for the individual metastable levels from the resolved C III* $\lambda$1175 absorption complex in component 1a. Based on our computed metastable level populations, the electron density of this absorber is $\sim 3{\times}10^4$ cm$^{-3}$. Combined with photoionization modeling results, this places component 1a at $\sim$ 25 pc from the central source. 4) Using time-dependent calculations, we are able to reproduce the detailed variability observed in component 1 and derive upper limits on the distances for components 2 and 3 of $\leq$ 25 and $\leq$ 50 pc, respectively. 5) The ionization parameters derived for the higher ionization UV absorbers (components 1b, 2, and 3 with log($U$)$\approx -0.5$) are consistent with the modeling results for the lowest-ionization X-ray component, but with smaller total column density. The high-ionization UV components are found to have similar pressures as the three X-ray ionization components. These results are consistent with an inhomogeneous wind model for the outflow in NGC 3783, with denser, colder, lower-ionization regions embedded in more highly-ionized gas. 6) Based on the predicted emission-line luminosities, global covering factor constraints, and distances derived for the UV absorbers, they may be identified with emission-line gas observed in the inner NLR of AGNs. We explore constraints for dynamical models of AGN outflows implied by these results.

Accepted by The Astrophysical Journal

E-mail contact:jgabel@colorado.edu,

preprint available at http://arxiv.org/abs/astro-ph/0506323

## Black Hole Masses and Host Galaxy Evolution of Radio-loud Active Galactic Nuclei

**J.-H. Woo[1], C. M. Urry[2], R. P. van der Marel[3], P. Lira[4], and J. Maza[5]**

[1] Department of Astronomy and Yale Center for Astronomy and Astrophysics, Yale University, P.O. Box 208101, New Haven, CT 06520-8101; jhwoo@astro.yale.edu
[2] Department of Physics and Yale Center for Astronomy and Astrophysics, Yale University, P.O. Box 208101, New Haven, CT 06520-8121; meg.urry@yale.edu
[3] Space Telescope Science Institute, 3700 San Martin Dr. Baltimore MD 21218; marel@stsci.edu
[4] Departamento de Astronom?a, Universidad de Chile, Casilla 36-D, Santiago, Chile; plira@das.uchile.cl
[5] Departamento de Astronom?a, Universidad de Chile, Casilla 36-D, Santiago, Chile; jmaza@das.uchile.cl

We report stellar velocity dispersion measurements for a sample of 28 AGN host galaxies including our previous work. Using the mass-dispersion ($M_\bullet - \sigma$) and the fundamental plane relations, we estimate the black hole mass for a sample of 66 BL Lac objects and investigate the role of black hole mass in the energetics of BL Lac objects. The black hole mass range for different BL Lac spectral types is similar, $10^7 < M_\bullet < 4 \times 10^9$. Neither X-ray nor radio luminosity correlates with black hole mass. Low-frequency-peaked BL Lac objects have higher Eddington ratios on average, because of either more beaming or higher intrinsic power. For the black hole mass range $3 \times 10^7 < M_\bullet < 10^9$, the radio luminosity of BL Lac objects and flat-spectrum radio quasars spans over 4 orders of magnitude, with BL Lac objects being low-power AGNs. We also investigate the evolution of host galaxies for 39 AGNs out to $z \approx 0.5$ with measured stellar velocity dispersions. Comparing the mass-to-light ratio evolution in the observed frame with population synthesis models, we find that single burst star formation models with $z_{form} = 1.4^{+0.9}_{-0.2}$ are consistent with the observations. ¿From our $z_{form} = 1.4$ model, we estimated the intrinsic mass-to-light ratio evolution in the Cousins $R$ band, $\Delta log(M/L)/\Delta z = -0.502 \pm 0.08$, consistent with that of normal early type galaxies.

Accepted by ApJ

E-mail contact: jhwoo@astro.yale.edu,
preprint available at http://arxiv.org/abs/astro-ph/0506316

## Dust Emission by AGN and Starbursts

**Ralf Siebenmorgen**

European Southern Observatory, Karl-Schwarzschildstr. 2, D-85748 Garching b. München

Present AGN and starburst models aiming to account for the observed infrared SEDs consider a physical description of the dust and a solution of the radiative transfer problem. MIR spectra obtained at different spatial scales (SST-IRS, ISO and TIMMI2) are presented. They show that PAH bands are detected in starburst regions but significantly reduced near the centre of AGN. This is explained by examining the heating mechanism of PAHs after hard (FUV, X-ray) photon interactions. Economic radiative transfer models of starbursts and AGN are made available. The successful application of the starburst model is demonstrated by fitting broad band data and detailed Spitzer spectra of NGC7714. The AGN model is applied to ISO data of a sample of 68 radio galaxies and quasars of the 3CR catalogue. Radiative transfer models of galaxies with Hidden Broad Line Regions are shown. Their SED enable us to separate the contributions from the dusty disc of the AGN and the starbursts. The composite model is consistent with the unified scheme and the idea that the infrared emission of AGN is dominated in the MIR and starbursts in the FIR. According to the unified scheme, AGN are surrounded by a dust-torus, and the observed diversity of AGN properties results from the different orientations relative to our line of sight. The strong resonance of silicate dust at 10$\mu$m is therefore, as expected, seen in absorption towards many type-2 AGN. In type-1 AGN, it should be seen in emission because the hot inner surface of the dust torus becomes visible. However, this has not been observed so far, thus challenging the unification scheme or leading to exotic modifications of the dust-torus model. Here the recent discovery of the 10$\mu$m silicate feature in emission in luminous quasar spectra is reported.

To appear in: Moriond conference: "WHEN UV MEETS IR: A HISTORY OF STAR FORMATION", 2005

E-mail contact: rsiebenm@eso.org,

preprint available at http://arxiv.org/abs/astro-ph/0506582

## The Extended *Chandra* Deep Field South Survey: X-ray Point-Source Catalog

**Shanil Virani[1], Ezequiel Treister[1,2,3] and C. Megan Urry[1,2]**

[1] Department of Astronomy, Yale University, P.O. Box 208101, New Haven, CT 06520
[2] Yale Center for Astronomy and Astrophysics, Yale University, P.O. Box 208121, New Haven, CT 06520
[3] Departamento de Astronomia, Universidad de Chile, Casilla 36-D, Santiago, Chile

The Extended *Chandra* Deep Field South (E-CDF-S) survey consists of 4 *Chandra* ACIS-I pointings and covers $\approx 1100$ square arcminutes ($\approx 0.3$ deg$^2$) surrounding the original CDF-S field to a depth of approximately 228 ks. This is the largest *Chandra* survey ever conducted at such depth and only one XMM-Newton survey reaches a lower flux limit in the hard 2.0–8.0 keV band. We detect 642 unique sources, of which 532 are detected in the full 0.5–8.0 keV band, 480 in the soft 0.5–2.0 keV band, and 334 in the hard 2.0–8.0 keV band. For point sources near the aim point, the limiting fluxes are approximately $1.8 \times 10^{-16}$ erg cm$^{-2}$ s$^{-1}$ and $7.8 \times 10^{-16}$ erg cm$^{-2}$ s$^{-1}$ in the 0.5–2.0 keV and 2.0–8.0 keV bands, respectively. We present the differential and cumulative flux distributions, which are in good agreement with the number counts from previous deep X-ray surveys and with the predictions from an AGN population synthesis model that can explain the X-ray background. In general, fainter sources have harder X-ray spectra, consistent with the hypothesis that these sources are mainly obscured AGN.

Submitted to Astron. J.

E-mail contact: svirani@astro.yale.edu,
preprint available at http://arxiv.org/abs/astro-ph/0506551
Full catalog available at http://www.astro.yale.edu/svirani/ecdfs/

## FIRST-based survey of Compact Steep Spectrum sources
## II. MERLIN and VLA observations of Medium-sized Symmetric Objects

**M. Kunert-Bajraszewska[1], A. Marecki[1], P. Thomasson[2] and R. E. Spencer[2]**

[1] Toruń Centre for Astronomy, N. Copernicus University, PL-87-100 Toruń, Poland
[2] Jodrell Bank Observatory, The University of Manchester, Macclesfield, Cheshire, SK11 9DL, UK

A new sample of candidate Compact Steep Spectrum (CSS) sources that are much weaker than the CSS source prototypes has been selected from the VLA FIRST catalogue. MERLIN 'snapshot' observations of the sources at 5 GHz indicate that six of them have an FR II-like morphology, but are not edge-brightened as is normal for Medium-sized Symmetric Objects (MSOs) and FR IIs. Further observations of these six sources with the VLA at 4.9 GHz and MERLIN at 1.7 GHz, as well as subsequent full-track observations with MERLIN at 5 GHz of what appeared to be the two sources of greatest interest are presented. The results are discussed with reference to the established evolutionary model of CSS sources being young but in which not all of them evolve to become old objects with extended radio structures. A lack of stable fuelling in some of them may result in an early transition to a so-called coasting phase so that they fade away instead of growing to become large-scale objects. It is possible that one of the six sources (1542+323) could be labelled as a prematurely 'dying' MSO or a 'fader'.

Accepted by Astronomy & Astrophysics

E-mail contact: amr@astro.uni.torun.pl,
preprint available at http://arxiv.org/abs/astro-ph/0505435

## Multiwavelength Monitoring of the Dwarf Seyfert 1 Galaxy NGC 4395. I. A Reverberation-Based Measurement of the Black Hole Mass

**Bradley M. Peterson[1], Misty C. Bentz[1], Louis-Benoit Desroches[2], Alexei V. Filippenko[2], Luis C. Ho[3], Shai Kaspi[4,5], Ari Laor[5], Dan Maoz[4], Edward C. Moran[6], Richard W. Pogge[1], and Alice C. Quillen[7]**

[1] Department of Astronomy, The Ohio State University, 140 West 18th Avenue, Columbus, OH 43210-1173
[2] Department of Astronomy, University of California, Berkeley, CA 94720-3411
[3] Carnegie Observatories, 813 Santa Barbara Street, Pasadena, CA 91101

[4] Wise Observatory and School of Physics and Astronomy, Tel-Aviv University, Tel-Aviv 69978, Israel
[5] Department of Physics, Technion, Haifa 32000, Israel
[6] Department of Astronomy, Wesleyan University, Van Vleck Observatory, Middletown, CT 06459
[7] Department of Physics and Astronomy, University of Rochester, Bausch and Lomb Building, Rochester, NY 14627

A reverberation-mapping program on NGC 4395, the least-luminous known Seyfert 1 galaxy, undertaken with the Space Telescope Imaging Spectrograph on the *Hubble Space Telescope*, yields a measurement of the mass of the central black hole $M_{\rm BH} = (3.6 \pm 1.1) \times 10^5\, M_\odot$. The observations consist of two visits of 5 orbits each, in 2004 April and July. During each of these visits, the UV continuum varied by at least 10% (rms) and only C IV $\lambda$1549 showed corresponding variations large enough to reliably determine the emission-line lag, which was measured to be of order one hour for both visits. The size of the C IV-emitting region is about a factor of three smaller than expected if the slope of the broad-line region radius-luminosity relationship is identical to that for the H$\beta$ emission line. NGC 4395 is underluminous even for its small black hole mass; the Eddington ratio of $\sim 1.2 \times 10^{-3}$ is lower than that of any other active galactic nucleus for which a black hole mass measurement has been made by emission-line reverberation.

Accepted by Ap.J.

E-mail contact: peterson@astronomy.ohio-state.edu,
preprint available at http://arxiv.org/abs/astro-ph/0506665

## Thesis

# Active Black Holes and the Evolution of Their Host Galaxies

**Jong-Hak Woo**

Thesis work conducted at: Department of Astronomy, Yale University, USA

Current address: Department of Physics, University of California at Santa Barbara, CA 93106

Address as of July 1 2005:

Electronic mail: jhwoo@astro.yale.edu

Ph.D dissertation directed by: C. Megan Urry

Ph.D degree awarded: May 2005

Black hole mass, along with mass accretion rate, is a fundamental property of active galactic nuclei (AGNs). We collect and estimate black hole mass for a large sample of $\sim 500$ AGNs, and investigate the relation of AGN activity to black hole mass. For a subsample of 39 AGNs at $z < 0.6$, we measure and collect stellar velocity dispersion, estimate black hole mass, and invesigate the evolution of host galaxies.

We compare black hole mass estimates generated by different methods and find, for individual objects, a scatter as high as a couple of orders of magnitude. The less direct the method, the larger the discrepancy with other estimates, probably due to the large scatter in the underlying correlations assumed.

In contrast to other studies, we find no significant correlation of black hole mass with AGN luminosity, other than those induced by circular reasoning in the estimation of black hole mass. For any given black hole mass, there is a range in Eddington ratio of up to 3 orders of magnitude, with the Eddington limit as an approximate upper envelope to the distribution of luminosities. The black hole mass of radio-loud and radio-quiet AGNs span the same large range, $10^6 - 10^{10} M_\odot$, suggesting radio loudness in AGNs does not depend on black hole mass.

The black hole mass range for different BL Lac spectral types, defined by X-ray to radio flux ratio, is similar, $10^7 \lesssim M_{BH}/M_\odot \lesssim 4 \times 10^9$. Neither X-ray or radio luminosity correlates with black hole mass. Low-frequency-peaked BL Lac objects have higher Eddington ratios on average, because of either more beaming or larger intrinsic power. For the black hole mass range $3 \times 10^7 \lesssim M_\bullet \lesssim 10^9$, the radio luminosity of BL Lac objects and flat-spectrum radio quasars spans over 4 orders of magnitude, with BL Lac objects being low-power AGNs.

BL Lac object host galaxies and radio galaxies seem to lie on the same fundamental plane as normal galaxies. Comparing the mass-to-light ratio evolution in the observed-frame with our population synthesis models, we find that single burst star formation models with $z_{form} = 1.4^{+0.9}_{-0.2}$ are consistent with the observations. After $K$-correction using our $z_{form} = 1.4$ model, we estimate the intrinsic mass-to-light ratio evolution in the Cousins $R$ band, $\Delta log(M/L)/\Delta z = -0.502$, consistent with that of normal early-type galaxies. The normality of AGN host galaxies supports the hypothesis that AGNs are a transient phase in the evolution of most or all galaxies.

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/
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