Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 147 — June 2009	Editor: Rob Beswick (agnews@manchester.ac.uk)

Accepted Abstracts - Submitted Abstracts - Thesis Abstracts
Jobs Adverts - Meetings Adverts - Special Announcements

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.

As always as editor of the newsletter I am very interested to hear any suggestions or feedback regarding the newsletter. So do not hesitate in emailing me your suggestions.

Many thanks for your continued subscription.

Rob Beswick

Origin and Dynamical Support of Ionized Gas in Galaxy Bulges

Luis C. Ho[1]

[1] The Observatories of the Carnegie Institution of Washington, 813 Santa Barbara St., Pasadena, CA 91101

We combine ionized gas ([N II] λ6583) and stellar central velocity dispersions for a sample of 345 galaxies, with and without active galactic nuclei (AGNs), to study the dynamical state of the nuclear gas and its physical origin. The gas dispersions strongly correlate with the stellar dispersions over the velocity range of $\sigma \approx 30 - 350$ km s^{-1}, such that $\sigma_g/\sigma_* \approx 0.6 - 1.4$, with an average value of 0.80. These results are independent of Hubble type (for galaxies from E to Sbc), presence or absence of a bar, or local galaxy environment. For galaxies of type Sc and later and that have $\sigma_* \lesssim 40$ km s^{-1}, the gas seems to have a minimum threshold of $\sigma_g \approx 30$ km s^{-1}, such that σ_g/σ_* always exceeds 1. Within the sample of AGNs, σ_g/σ_* increases with nuclear luminosity or Eddington ratio, a possible manifestation of AGN feedback associated with accretion disk winds or outflows. This extra source of nongravitational line broadening should be removed when trying to use σ_g to estimate σ_*. We show that the mass budget of the narrow-line region can be accounted for by mass loss from evolved stars. The kinematics of the gas, dominated by random motions, largely reflect the velocity field of the hot gas in the bulge. Lastly, we offer a simple explanation for the correlation between line width and line luminosity observed in the narrow-line region of AGNs.

To appear in *ApJ.*

E-mail contact: lho@ociw.edu

Radiatively Inefficient Accretion in Nearby Galaxies

Luis C. Ho[1]

[1] The Observatories of the Carnegie Institution of Washington, 813 Santa Barbara St., Pasadena, CA 91101

We use new central stellar velocity dispersions and nuclear X-ray and Hα luminosities for the Palomar survey of nearby galaxies to investigate the distribution of nuclear bolometric luminosities and Eddington ratios for their central black holes (BHs). This information helps to constrain the nature of th eir accretion flows and the physical drivers that control the spectral diversity of nearby active galactic nuclei. The characteristic values of the bolometric luminosities and Eddington ratios, which span over 7–8 orders of magnitude, from $L_{\rm bol} \lesssim 10^{37}$ to 3×10^{44} erg s^{-1} and $L_{\rm bol}/L_{\rm Edd} \approx 10^{-9}$ to 10^{-1}, vary systematically with nuclear spectral classification, increasing along the sequence absorption-line nuclei → transition objects → low-ionization nuclear emission-line regions → Seyferts. The Eddington ratio also increases from early-type to late-type galaxies. We show that the very modest accretion rates inferred from the nuclear luminosities can be readily supplied through local mass loss from evolved stars and Bondi accretion of hot gas, without appealing to additional fueling mechanisms such as angular momentum transport on larger scales. Indeed, we argue that the fuel reservoir generated by local processes should produce far more active nuclei than is actually observed. This generic luminosity-deficit problem suggests that the radiative efficiency in these systems is much less than the canonical value of 0.1 for traditional optically thick, geometrically thin accretion disks. The observed values of $L_{\rm bol}/L_{\rm Edd}$, all substantially below unity, further support the hypothesis that massive BHs in most nearby galaxies reside in a low or quiescent state, sustained by accretion through a radiatively inefficient mode.

To appear in *ApJ*.

E-mail contact: lho@ociw.edu

A Search for “Dwarf” Seyfert Nuclei. VII. A Catalog of Central Stellar Velocity Dispersions of Nearby Galaxies

Luis C. Ho[1], Jenny E. Greene[2], Alexei V. Filippenko[3], and Wallace L. W. Sargent[4]

[1] The Observatories of the Carnegie Institution of Washington, 813 Santa Barbara St., Pasadena, CA 91101
[2] Department of Astrophysical Sciences, Princeton University, Princeton, NJ
[3] Department of Astronomy, University of California, Berkeley, CA 94720-3411
[4] Palomar Observatory, California Institute of Technology, MS 105-24, Pasadena, CA 91125

We present new central stellar velocity dispersion measurements for 428 galaxies in the Palomar spectroscopic survey of bright, northern galaxies. Of these, 142 have no previously published measurements, most being relatively late-type systems with low velocity dispersions ($\lesssim$100 km s^{-1}). We provide updates to a number of literature dispersions with large uncertainties. Our measurements are based on a direct pixel-fitting technique that can accommodate composite stellar populations by calculating an optimal linear combination of input stellar templates. The original Palomar survey data were taken under conditions that are not ideally suited for deriving stellar velocity dispersions for galaxies with a wide range of Hubble types. We describe an effective strategy to circumvent this complication and demonstrate that we can still obtain reliable velocity dispersions for this sample of well-studied nearby galaxies.

To appear in *ApJS*.

E-mail contact: lho@ociw.edu

X-ray Properties of Intermediate-Mass Black Holes in Active Galaxies. II. X-ray-Bright Accretion and Possible Evidence for Slim Disks

Louis-Benoit Desroches[1], Jenny E. Greene[2], and Luis C. Ho[3]

[1] Department of Astronomy, University of California, Berkeley, CA 94720-3411
[2] Department of Astrophysical Sciences, Princeton University, Princeton, NJ
[3] The Observatories of the Carnegie Institution of Washington, 813 Santa Barbara St., Pasadena, CA 91101

We present X-ray properties of optically selected intermediate-mass ($\sim 10^5 - 10^6\ M_\odot$) black holes (BHs) in active galaxies (AGNs), using data from the *Chandra* X-Ray Observatory. Our observations are a continuation of a pilot study by Greene & Ho (2007). Of the 8 objects observed, 5 are detected with X-ray luminosities in the range $L_{0.5-2{\rm keV}} = 10^{41} - 10^{43}$ erg s^{-1}, consistent with the previously observed sample. Objects with enough counts to extract a spectrum are well fit by an absorbed power law. We continue to find a range of soft photon indices $1 < \Gamma_s < 2.7$, where $N(E) \propto E^{-}\Gamma_s$, consistent with previous AGN studies, but generally flatter than other narrow-line Seyfert 1 active nuclei (NLS1s). The soft photon index correlates strongly with X-ray luminosity and Eddington ratio, but does not depend on BH mass. There is no justification for the inclusion of any additional components, such as a soft excess, although this may be a function of the relative inefficiency of detecting counts above 2 keV in these relatively shallow observations. As a whole, the X-ray-to-optical spectral slope $\alpha_{\rm ox}$ is flatter than in more massive systems, even other NLS1s. Only X-ray-selected NLS1s with very high Eddington ratios share a similar $\alpha_{\rm ox}$. This is suggestive of a physical change in the accretion structure at low masses and at very high accretion rates, possibly due to the onset of slim disks. Although the detailed physical explanation for the X-ray-loudness of these intermediate-mass BHs is not certain, it is very striking that targets selected on the basis of optical properties should be so distinctly offset in their broader spectral energy distributions.

To appear in *ApJ*; preprint in arXiv:0903.2257.

E-mail contact: lho@ociw.edu

The accretion disc in the quasar SDSS J0924+0219

David Floyd[1,2], Nick Bate[2] and Rachel Webster[3]

[1] OCIW, Las Campanas Observatory, Casilla 601, Colina El Pino, La Serena, Chile
[2] School of Physics, The University of Melbourne, Parkville, Vic, 3010, Australia

We present single-epoch multi-wavelength optical-NIR observations of the "anomalous" lensed quasar SDSS J0924+0219, made using the Magellan 6.5-metre Baade telescope at Las Campanas Observatory, Chile. The data clearly resolve the anomalous bright image pair in the lensed system, and exhibit a strong decrease in the anomalous flux ratio with decreasing wavelength. This is interpreted as a result of microlensing of a source of decreasing size in the core of the lensed quasar. We model the radius of the continuum emission region, σ, as a power-law in wavelength, $\sigma \propto \lambda^{\zeta}$. We place an upper limit on the Gaussian radius of the u'-band emission region of $3.04 \times 10^{16} h_{70}^{-1/2} (\langle M \rangle / M_{\odot})^{1/2}$ cm, and constrain the size-wavelength power-law index to $\zeta < 1.34$ at 95% confidence. These observations rule out an alpha-disc prescription for the accretion disc in SDSS J0924+0219 with 94% confidence.

Accepted by MNRAS

E-mail contact: dfloyd@lco.cl,
preprint available at http://arxiv.org/abs/0905.2651

CAIXA: a catalogue of AGN in the XMM-*Newton* archive II. Multiwavelength correlations

Stefano Bianchi[1,2], Nuria Fonseca Bonilla[2], Matteo Guainazzi[2], Giorgio Matt[1] and Gabriele Ponti[3]

[1] Dipartimento di Fisica, Università degli Studi Roma Tre, via della Vasca Navale 84, 00146 Roma, Italy
[2] XMM-Newton Science Operations Center, European Space Astronomy Center, ESA, Apartado 50727, E-28080 Madrid, Spain
[3] Laboratoire APC, UMR 7164, 10 rue A. Domon et L. Duquet, 75205 Paris, France

The availability of large amounts of multiwavelength data allows us to perform an extensive statistical analysis to look for correlations between different parameters of AGN. The physical implications of these correlations, when considered within the framework of current AGN models, can be enlightening in the resolution of the problems and the open issues which still characterise this class of sources.

We presented CAIXA, a Catalogue of AGN in the XMM-*Newton* Archive, in a companion paper. It consists of radio-quiet X-ray unobscured sources, which cover a range in X-ray luminosities between $L_{2-10\,\mathrm{keV}} = 2.0 \times 10^{41}$ and 3.9×10^{46} erg s^{-1}, and in redshift from z=0.002 to z=4.520. Here, a systematic search for correlations between the X-ray spectral properties and the multiwavelength data was performed for the sources in CAIXA. All the significant ($> 99.9\%$ confidence level) correlations are discussed along with their physical implications for current models of AGN.

Two main correlations are discussed in this paper: a) a very strong anti-correlation between the FWHM of the Hβ optical line and the ratio between the soft and the hard X-ray luminosity. Although similar anti-correlations between optical line width and X-ray spectral steepness have already been discussed in the literature, we consider the formulation we present in this paper as more fundamental, as it links model-independent quantities. Coupled with a strong anti-correlation between the V to hard X-ray flux ratio and the Hβ FHWM, it supports scenarios for the origin of the soft excess in AGN, which require strong suppression of the hard X-ray emission; b) a strong (and expected) correlation between the X-ray luminosity and the black hole mass. Its slope, flatter than 1, is consistent with Eddington ratio-dependent bolometric corrections. Moreover, we critically review through various statistical tests the role that distance biases play in the strong radio to X-ray luminosity correlation found in CAIXA and elsewhere; we conclude that only complete, unbiased samples should be used to draw observation al constraints on the origin of radio emission in radio-quiet AGN.

Accepted by A&A

E-mail contact: bianchi@fis.uniroma3.it,
preprint available at http://arxiv.org/abs/0905.0267

Discovery of Radio Emission from the Quasar SDSS J1536+0441, a Candidate Binary Black-Hole System

J.M. Wrobel[1] **and A. Laor**[2]

[1] National Radio Astronomy Observatory, P.O. Box O, Socorro, NM 87801, USA
[2] Physics Department, Technion, Haifa 32000, Israel

The radio-quiet quasar SDSS J1536+0441 shows two broad-line emission systems that Boroson & Lauer interpret as a candidate binary black-hole system with a separation of 0.1 pc (0.02 mas). From new VLA imaging at 8.5 GHz, two faint sources, separated by 0.97 arcsec (5.1 kpc), have been discovered within the quasar's optical localization region. Each radio source is unresolved, with a diameter of less than 0.37 arcsec (1.9 kpc). A double radio structure is seen in some other radio-quiet quasars, and the double may be energized here by the candidate 0.1-pc binary black-hole system. Alternatively, the radio emission may arise from a binary system of quasars with a projected separation of 5.1 kpc, and the two quasars may produce the two observed broad-line emission systems. Binary active galactic nuclei with a kpc scale separation are known from radio and X-ray observations, and a few such system are expected in the Boroson & Lauer sample based on the observed clustering of quasars down to the 10 kpc scale. Future observations designed to distinguish between the 0.1 pc and 5 kpc scales for the binary system are suggested.

Accepted by ApJL on 2009 May 21

Preprint at http://arxiv.org/abs/0905.3566

An X-ray Spectral Model for Compton-Thick Toroidal Reprocessors

Kendrah D. Murphy[1,2] **and Tahir Yaqoob**[2,3]

[1]MIT Kavli Institute for Astrophysics and Space Research, 77 Massachusetts Avenue, NE80-6013, Cambridge, MA 02139.
[2]Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD 21218.
[3]Astrophysics Science Division, NASA/Goddard Space Flight Center, Greenbelt, MD 20771.

The central engines of both type 1 and type 2 AGNs are thought to harbor a toroidal structure that absorbs and reprocesses high-energy photons from the central X-ray source. Unique features in the reprocessed spectra can provide powerful physical constraints on the geometry, column density, element abundances, and orientation of the circumnuclear matter. If the reprocessor is Compton-thick, the calculation of emission-line and continuum spectra that are suitable for direct fitting to X-ray data is challenging because the reprocessed emission depends on the spectral shape of the incident continuum, which may not be directly observable. We present new Monte-Carlo calculations of Green's functions for a toroidal reprocessor that provide significant improvements over currently available models. The Green's function approach enables the construction of X-ray spectral fitting models that allow arbitrary incident spectra as part of the fitting process. The calculations are fully relativistic and have been performed for column densities that cover the Compton-thin to Compton-thick regime, for incident photon energies up to 500 keV. The Green's function library can easily be extended cumulatively to provide models that are valid for higher input energies and a wider range of element abundances and opening angles of the torus. The reprocessed continuum and fluorescent line emission due to Fe Kα, Fe Kβ, and Ni Kα are treated self-consistently, eliminating the need for *ad hoc* modeling that is currently common practice. We find that the spectral shape of the Compton-thick reflection spectrum in both the soft and hard X-ray bands in our toroidal geometry is different compared to that obtained from disk models. A key result of our study is that a Compton-thick toroidal structure that subtends the same solid angle at the X-ray source as a disk can produce a reflection spectrum that is ~ 6 times weaker than that from a disk. This highlights the widespread and erroneous interpretation of the so-called "reflection-fraction" as a solid angle, obtained from fitting disk-reflection models to Compton-thick sources without regard for proper consideration of geometry.

Accepted by MNRAS

E-mail contact: kdmurphy@space.mit.edu,
preprint available at http://arxiv.org/abs/0905.3188

An X-ray view of 82 LINERs with *Chandra* and *XMM-Newton* data

O. González-Martín[1], **J. Masegosa**[2], **I. Márquez**[2], **M. Guainazzi**[3] **and E. Jiménez-Bailón**[4]

[1] X-ray Astronomy Group, Department of Physics and Astronomy, Leicester University, Leicester, UK
[2] Instituto de Astrofísica de Andalucía, CSIC, Granada, SPAIN
[3] European Space Astronomy Centre of ESA, Villanueva de la Canada, Madrid, SPAIN
[4] Instituto de Astronomía, Universidad Nacional Autónoma de Mexico, Mexico DF, MEXICO

We present the results of an homogeneous X-ray analysis for 82 nearby LINERs selected from the catalogue of Carrillo et al. (1999). All sources have available *Chandra* (68 sources) and/or *XMM-Newton* (55 sources) observations. This is the largest

sample of LINERs with X-ray spectral data (60 out of the 82 objects) and significantly improves our previous analysis based on *Chandra* data for 51 LINERs (Gonzalez-Martin et al. 2006). It increases both the sample size and adds *XMM-Newton data*. New models permit the inclusion of double absorbers in the spectral fits. Nuclear X-ray morphology is inferred from the compactness of detected nuclear sources in the hard band (4.5-8.0 keV). Sixty per cent of the sample shows a compact nuclear source and are classified as AGN candidates. The spectral analysis indicates that best fits involve a composite model: absorbed primary continuum and (2) soft spectrum below 2 keV described by an absorbed scatterer and/or a thermal component. The resulting median spectral parameters and their standard deviations are: $<\Gamma>$=2.11± 0.52, $<$kT$>$=0.54± 0.30 keV, $<$log(NH1)$>$=21.32± 0.71 and $<$log(NH2)$>$=21.93± 1.36. We complement our X-ray results with our analysis of HST optical images and literature data on emission lines, radio compactness and stellar population. Adding all these multiwavelength data, we conclude that evidence do exist supporting the AGN nature of their nuclear engine for 80% of the sample (66 out of 82 objects).

Accepted by Astronomy and Astrophysics

E-mail contact: gmo4@star.le.ac.uk,
preprint available at http://arxiv.org/abs/0905.2973

The Contribution from Scattered Light to Quasar Galaxy Hosts

S. Young[1,2], D. J. Axon[1,2], A. Robinson[1,2] and A. Capetti[3]

[1] Department of Physics, Rochester Institute of Technology, 54 Lomb Memorial Drive, Rochester, NY, 14623, USA
[2] Centre for Astrophysics Research, Science & Technology Research Institute, University of Hertfordshire, Hatfield, AL10 9AB, UK
[3] Osservatorio Astronomico di Torino, Strada Osservatorio 20, I-10025 Pino Torinese, Italy

We present models representing the scattering of quasar radiation off free electrons and dust grains in geometries that approximate the structure of quasar host galaxies. We show that, for reasonable assumptions, scattering alone can easily produce ratios of nuclear (point-source) to extended fluxes comparable to those determined in studies of quasar hosts. This casts doubt on the standard assumption that direct stellar emission from the host galaxy dominates the detected extended flux, and hence also on the inferred properties of quasar host galaxies. A significant contribution from scattered quasar light will lead to overestimates of the luminosity and hence mass of the host galaxy, and may also distort its morphology. Scattering of quasar light within the host galaxy may provide alternative explanations for the apparent peak in host luminosity at $z = 2$ to 3; the higher luminosity of radio-loud host galaxies relative to those of radio-quiet quasars, and the apparent preference of high luminosity radio-quiet quasars for spheroidal rather than disk galaxies.

Accepted by Astrophysical Journal Letters

E-mail contact: sxysps@rit.edu,
preprint available at http://arxiv.org/abs/0905.4012