Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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

Abstracts of recently accepted papers

Suzaku Observations of Local Ultraluminous Infrared Galaxies

Stacy H. Teng[1], Sylvain Veilleux[1], Naohisa Anabuki[2], Charles D. Dermer[3], Luigi C. Gallo[4], Takao Nakagawa[5], Christopher S. Reynolds[1], D. B. Sanders[6], Yuichi Terashima[7], and Andrew S. Wilson[1]

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We report the results from our analysis of *Suzaku* XIS (0.5–10 keV) and HXD/PIN (15–40 keV) observations of five well-known local ULIRGs: *IRAS F*05189–2524, *IRAS F*08572+3915, Mrk 273, PKS 1345+12, and Arp 220. The XIS observations of *F*05189–2524 and Mrk 273 reveal strong iron lines consistent with Fe Kα and changes in spectral shapes with respect to previous *Chandra* and *XMM-Newton* observations. Mrk 273 is also detected by the HXD/PIN at $\sim$1.8-σ. For *F*05189–2524, modeling of the data from the different epochs suggests that the change in spectral shape is likely due to the central source switching off, leaving behind a residual reflection spectrum, or an increase in the absorbing column. An increase in the covering fraction of the absor ber can describe the spectral variations seen in Mrk 273, although a reduction in the intrinsic AGN luminosity cannot be formally ruled out. The *Suzaku* spectra of Mrk 273 are well fit by a $\sim$94% covering fraction model with a column density of $\sim 10^{24}$ cm^{-2}. The absorption-corrected $\log[L_{2-10\ \mathrm{keV}}/L_{\mathrm{IR}}]$ ratio is consistent with those found in PG Quasars. The 0.5–10 keV spectrum of PKS 1345+12 and Arp 220 seem unchanged from previous observations and their hard X-ray emission is not convincingly detected by the HXD/PIN. The large column density derived from CO observations and the large equivalent width of an ionized Fe line in Arp 220 can be reconciled by an ionized reflection model. *F*08572+3915 is

undetected in both the XIS and HXD/PIN, but the analysis of unpublished *Chandra* data provides a new measurement at low energies.

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preprint available at: http://www.astro.umd.edu/∼stacyt

Obscured and powerful AGN and starburst activities at $z \sim 3.5$

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Short phases of coeval powerful starburst and AGN activity during the lifetimes of the most massive galaxies are predicted by various models of galaxy formation and evolution. In spite of their recurrence and high luminosity, such events are rarely observed. Finding such systems, understanding their nature, and constraining their number density can provide key constraints to galaxy evolutionary models and insights into the interplay between starburst and AGN activities. We report the discovery of two sources at z=3.867 and z=3.427 that exhibit both powerful starburst and AGN activities. They benefit from multi-wavelength data from radio to X rays from the CFHTLS-D1/SWIRE/XMDS surveys. Follow-up optical and near-infrared spectroscopy, and millimeter IRAM/MAMBO observations are also available. We performed a multi-wavelength analysis of their spectral energy distributions with the aim of understanding the origin of their emission and constraining their luminosities. A comparison with other composite systems at similar redshifts from the literature is also presented. The AGN and starburst bolometric luminosities are $\sim 10^{13}\,L_{\odot}$. The AGN emission dominates at X ray, optical, mid-infrared wavelengths, and probably also in the radio. The starburst emission dominates in the far-infrared. The estimated star formation rates range from 500 to $3000\,M_{\odot}$/yr. The AGN near-infrared and X ray emissions are heavily obscured in both sources with an estimated dust extinction $A_v \geq 4$, and Compton-thick gas column densities. The two sources are the most obscured and most luminous AGNs detected at millimeter wavelengths currently known. The sources presented in this work are heavily obscured QSOs, but their properties are not fully explained by the standard AGN unification model. In one source, the ultraviolet and optical spectra suggest the presence of outflowing gas and shocks, and both sources show emission from hot dust, most likely in the vicinity of the nucleus. Evidence of moderate, AGN-driven radio activity is also found in both sources. Based on the estimated stellar and black hole masses, the two sources lie on the local $M_{BH} - M_{bulge}$ relation. To remain on this relation as they evolve, their star formation rate has to decrease or stop. Our results support evolutionary models that invoke radio feedback as star formation quenching mechanism, and suggest that such a mechanism might play a major role also in powerful AGNs.

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preprint available at http://xxx.lanl.gov/abs/0810.2518

A Catalog of Broad Absorption Line Quasars in Sloan Digital Sky Survey Data Release 5

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We present a catalog of 5039 broad absorption line (BAL) quasars (QSOs) in the Sloan Digital Sky Survey (SDSS) Data Release 5 (DR5) QSO catalog that have absorption troughs covering a continuous velocity range ≥ 2000 km s^{-1}. We have fit ultraviolet (UV) continua and line emission in each case, enabling us to report common diagnostics of BAL strengths and velocities in the range $-25,000$ to 0 km s^{-1} for Si IV λ1400, C IV λ1549, Al III λ1857, and Mg II λ2799. We calculate these diagnostics using the spectrum listed in the DR5 QSO catalog, and also for spectra from additional SDSS observing epochs when available. In cases where BAL QSOs have been observed with *Chandra* or *XMM-Newton*, we report the X-ray monochromatic luminosities of these sources.

We confirm and extend previous findings that BAL QSOs are more strongly reddened in the rest-frame UV than non-BAL QSOs and that BAL QSOs are relatively X-ray weak compared to non-BAL QSOs. The observed BAL fraction is dependent on the spectral signal-to-noise (S/N); for higher-S/N sources, we find an observed BAL fraction of ≈15%. BAL QSOs show a similar Baldwin effect as for non-BAL QSOs, in that their C IV emission equivalent widths decrease with increasing continuum luminosity. However, BAL QSOs have weaker C IV emission in general than do non-BAL QSOs. Sources with higher UV luminosities are more likely to have higher-velocity outflows, and the BAL outflow velocity and UV absorption strength are correlated with relative X-ray weakness. These results are in qualitative agreement with models that depend on strong X-ray absorption to shield the outflow from over-ionization and enable radiative acceleration. In a scenario in which BAL trough shapes are primarily determined by outflow geometry, observed differences in Si IV and C IV trough shapes would suggest that some outflows have ion-dependent structure.

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preprint available at http://adsabs.harvard.edu/abs/2008arXiv0810.2747G

First Results from the Lick AGN Monitoring Project: The Mass of the Black Hole in Arp 151

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We have recently completed a 64-night spectroscopic monitoring campaign at the Lick Observatory 3-m Shane telescope with the aim of measuring the masses of the black holes in 13 nearby ($z < 0.05$) Seyfert 1 galaxies with expected masses in the range $\sim 10^6 - 10^7$ M$_\odot$. We present here the first results from this project – the mass of the central black hole in Arp 151. Strong variability throughout the campaign led to an exceptionally clean Hβ lag measurement in this object of $4.25^{+0.68}_{-0.66}$ days in the observed frame. Coupled with the width of the Hβ emission line in the variable spectrum, we determine a black hole mass of $(7.1 \pm 1.2) \times 10^6$ M$_\odot$, assuming the Onken et al. normalization for reverberation-based virial masses. We also find velocity-resolved lag information within the Hβ emission line which clearly shows infalling gas in the Hβ-emitting region. Further detailed analysis may lead to a full model of the geometry and kinematics of broad line region gas around the central black hole in Arp 151.

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An Improved Method for Using MgII to Estimate Black Hole Masses in Active Galactic Nuclei

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We present a method for obtaining accurate black hole (BH) mass estimates from the MgII emission line in active galactic nuclei (AGNs). Employing the large database of AGN measurements from the Sloan Digital Sky Survey (SDSS) presented by Shen et al., we find that AGNs in the redshift range 0.3–0.9, for which a given object can have both H-beta and MgII line widths measured, display a modest but correctable discrepancy in MgII-based masses that correlates with the Eddington ratio. We use the SDSS database to estimate the probability distribution of the true (i.e., H-beta-based) mass given a measured MgII line width. These probability distributions are then applied to the SDSS measurements from Shen et al. across the entire MgII-accessible redshift range (0.3–2.2). We find that accounting for this residual correlation generally increases the dispersion of Eddington ratios by a small factor ($\sim$0.09 dex for the redshift and luminosity bins we consider). We continue to find that the intrinsic distribution of Eddington ratios for luminous AGNs is extremely narrow, 0.3–0.4 dex, as demonstrated by Kollmeier et al. Using the method we describe, MgII emission lines can be used with confidence to obtain BH mass estimates.

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The *Chandra* Deep Protocluster Survey: Evidence for an Enhancement of AGN Activity in the SSA22 Protocluster at $z = 3.09$

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We present results from a new ultra-deep $\approx$400 ks *Chandra* observation of the SSA22 protocluster at $z = 3.09$. We have studied the X-ray properties of 234 $z \sim 3$ Lyman break galaxies (LBGs; protocluster and field) and 158 $z = 3.09$ Lyα emitters (LAEs) in SSA22 to measure the influence of the high-density protocluster environment on the accretion activity of supermassive black holes (SMBHs) in these UV-selected star forming populations. We detect individually X-ray–emission from active galactic nuclei (AGNs) in six LBGs and five LAEs; due to small overlap between the LBG and LAE source population, ten of these sources are unique. At least six and potentially eight of these sources are members of the protocluster. These sources have rest-frame 8–32 keV luminosities in the range of $L_{8-32\ \mathrm{keV}} = (3\text{–}50) \times 10^{43}$ ergs s^{-1} and an average observed-frame 2–8 keV to 0.5–2 keV band-ratio of ≈0.8 (mean effective photon index of $\Gamma_{\mathrm{eff}} \approx 1.1$), suggesting significant absorption columns of $N_{\mathrm{H}} \geq 10^{22}\text{–}10^{24}$ cm^{-2}. We find that the fraction of LBGs and LAEs in the $z = 3.09$ protocluster harboring an AGN with $L_{8-32\ \mathrm{keV}} \geq 3 \times 10^{43}$ ergs s^{-1} is $9.5^{+12.7}_{-6.1}$% and $5.1^{+6.8}_{-3.3}$%, respectively. These AGN fractions are somewhat larger (by a mean factor of $6.1^{+10.3}_{-3.6}$; significant at the ≈95% confidence level) than $z \sim 3$ sources found in lower-density "field" environments. Theoretical models imply that these results may be due to the presence of more actively growing and/or massive SMBHs in LBGs and LAEs within the protocluster compared to the field. Such a result is expected in a scenario where enhanced merger activity in the protocluster drives accelerated galaxy and SMBH growth at $z \geq 2$–3. Using *Spitzer* IRAC imaging we found that the fraction of IRAC detected LBGs is significantly larger in the protocluster than in the field (by a factor of $3.0^{+2.0}_{-1.3}$). From these data, we constrained the median rest-frame H-band luminosity in the protocluster to be ≥1.2–1.8 times larger than that for the field. When combined with our X-ray data, this suggests that both galaxies and SMBHs grew more rapidly in protocluster environments.

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Systematic Uncertainties in Black Hole Masses Determined from Single Epoch Spectra

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We explore the nature of systematic errors that can arise in measurement of black hole masses from single-epoch spectra of active galactic nuclei (AGNs) by utilizing the many epochs available for NGC 5548 and PG1229+204 from reverberation mapping databases. In particular, we examine systematics due to AGN variability, contamination due to constant spectral components (i.e., narrow lines and host galaxy flux), data quality (i.e., signal-to-noise ratio, S/N), and blending of spectral features. We investigate the effect that each of these systematics has on the precision and accuracy of single-epoch masses calculated from two commonly-used line-width measures by comparing these results to recent reverberation mapping studies. We calculate masses by characterizing the broad Hβ emission line by both the full width at half maximum and the line dispersion and demonstrate the importance of removing narrow emission-line components and host starlight. We find that the reliability of line width measurements rapidly decreases for S/N lower than $\sim$ 10 to 20 (per pixel) and that fitting the line profiles instead of direct measurement of the data does not mitigate this problem but can, in fact, introduce systematic errors. We also conclude that a full spectral decomposition to deblend the AGN and galaxy spectral features is unnecessary except to judge the contribution of the host galaxy to the luminosity and to deblend any emission lines that may inhibit accurate line width measurements. Finally, we present an error budget which summarizes the minimum observable uncertainties as well as the amount of additional scatter and/or systematic offset that can be expected from the individual sources of error investigated. In particular, we find that the minimum observable uncertainty in single-epoch mass estimates due to variability is $<\sim$ 0.1 dex for high S/N ($\gtrsim$ 20 pixel^{-1}) spectra.

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The Spectral Energy Distributions of Red 2MASS AGN

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We present infrared (IR) to X–ray spectral energy distributions (SEDs) for 44 red AGN selected from the 2MASS survey on

the basis of their red J$-$K$_S$ color (>2 mag.) and later observed by *Chandra*. In comparison with optically-, radio-, and X-ray selected AGN, their median SEDs are red in the optical and near-IR with little/no blue bump. Comparison of the various broad-band luminosity ratios show that the main differences lie at the blue end of the optical and in the near-IR to far-IR ratios (when available), with the red 2MASS AGN being redder than the other samples. It thus seems that near-IR color selection isolates the reddest subset of AGN that can be classified optically. The shape of the SEDs is generally consistent with modest absorption by gas (in the X-ray) and dust (in the optical-IR), as demonstrated by comparing the optical and near-IR colors with a reddened median SED and observed optical+near–IR to intrinsic X-ray ratios. The levels of obscuration, estimated from X-rays, far-IR and our detailed optical/near-IR color modeling are all consistent implying $N_H \leq$few$\times 10^{22}$ cm^{-2}. We present SED models that show how the AGN optical/near-IR colors change due to differing amounts of reddening, AGN to host galaxy ratio, redshift and scattered light emission and apply them to the sources in the sample. We find that the 2MASS AGN optical color, B$-$R, and to a lesser extent the near-IR color, J$-$K$_S$, are strongly affected by reddening, host galaxy emission, redshift, and in few, highly polarized objects, also by scattered AGN light (<2% of intrinsic AGN light in R band is scattered; this contribution becomes significant as the direct AGN light is absorbed). The lack of low equivalent widths in the distribution of the [O III] λ5007 emission line implies a predominance of inclined objects in the red 2MASS sample. The obscuration/inclination of the AGN allows us to see weaker emission components which are generally swamped by the AGN.

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E-mail contact: joasia@head.cfa.harvard.edu
preprint available at http://hea-www.harvard.edu/~joasia/2MASSAGN/2MASSsed.pdf or astro-ph/0810.5704

PCA of the Spectral Energy Distribution and Emission Line Properties of Red 2MASS AGN

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We analyze the spectral energy distributions (SEDs) and emission line properties of the red (J$-$K$_S > 2$) 2MASS AGN using principle component analysis (PCA). The sample includes 44 low redshift AGN with low or moderate obscuration ($N_H < 10^{23}$ cm^{-2}) as indicated by X-rays and SED modeling. The obscuration of the AGN allows us to see weaker emission components (host galaxy emission, AGN scattered light) which are usually outshone by the AGN. The first four eigenvectors explain 70% of the variance in the sample. Eigenvector 1 (33% variance in the sample) correlates with the ratios of the intrinsic X-ray flux to the observed optical/IR fluxes and the F(2$-$10keV)/F([O III]) ratio. We suggest that it is primarily driven by the L/L_{Edd} ratio and strengthened by intrinsic absorption (both circumnuclear and galactic). Eigenvector 2 (18% of variance) correlates with optical/IR colors (B$-$K$_S$, B$-$R, J$-$K$_S$) and optical spectral type and depends on the contribution of the host galaxy relative to the observed AGN emission. Eigenvector 3 (12% of variance) correlates with reddening indicators obtained from the X-rays (hardness ratio, spectral index, N_H) and the narrow Hα/Hβ emission line ratio. Their relation suggests a common absorber for the optical/X-rays lying outside the narrow-line region (NLR), possibly in a moderately inclined host galaxy. Eigenvector 4 (8% of variance) correlates with the degree of polarization and the broad Hα/Hβ ratio, indicating that dust which scatters the nuclear emission (continuum and the broad-line region emission) also reddens the broad-lines. Our analysis shows that, although as suggested by unification schemes, the inclination dependent obscuration (circumnuclear and the host galaxy) is important in determining the AGN SEDs, the L/L_{Edd} ratio is the most important factor, followed by host galaxy emission.

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preprint available at http://hea-www.harvard.edu/~joasia/2MASSAGN/2MASSpca.pdf or astro-ph/0810.5714

Jobs

Postdoctoral Research Position in AGN Evolution

Applications are invited for a postdoctoral research position in **AGN evolution** to work with Dr. Mari Polletta at the IASF-INAF Milan (Italy).

Candidates must possess a PhD or equivalent in astronomy, physics, or astrophysics. Experience in modeling spectral energy distributions, observation and analysis of X-ray and infrared data, and stacking techniques, are advantageous. Experience with database management is also desirable.

The start date is beginning 2009. The initial appointment is for 18 months, with possible extension subject to future funding levels. Applications are accepted until November 30, 2008.

The call is available at `http://www.iasf-milano.inaf.it/p̌olletta/DD40-08_bando_assegno_agn_v3.pdf`

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Postdoctoral Research Position, University of Kentucky

Prof. Moshe Elitzur

Physics & Astronomy Department, University of Kentucky, Lexington, KY 40506-0055, USA

Applications are invited for a postdoctoral research position in theoretical astrophysics to work with Prof. Moshe Elitzur at the University of Kentucky. The start date is around September 2009. Interest in AGN and radiative processes is advantageous. Applicants should send curriculum vita, bibliography and a statement of research interests by e-mail to moshe@pa.uky.edu and arrange for three letters of recommendation to be sent the same way. The initial appointment is for one year, with an expected extension for another year. The review of applications will start at the end of December, and will be continued until the position is filled.

E-mail contact: moshe@pa.uky.edu

Postdoctoral and PhD Positions in computational astrophysics for ALMA

Institution: Argelander Institute for Astronomy (AIfA), University of Bonn

Applications are invited for a postdoctoral position and at least one PhD position at the Argelander Institute for Astronomy (AIfA). Here the successful candidates will join the local ALMA Regional Center (ARC) node's growing submillimeter-interferometry research group, which has scientific interests ranging from galaxy evolution to star formation and evolved stars.

The candidates will work on radiative transfer modeling as part of the ASTRONET project 'Adaptable Radiative Transfer Innovations for Submillimeter Telescopes' (ARTIST). The ARTIST collaboration between the University of Bonn, Leiden University (Netherlands) and CSIC-IEEC (Spain) aims to develop the next generation model suite for comprehensive multi-dimensional radiative transfer calculation of the dust and line emission as well as their polarization. Prior experience in computational astrophysics and/or radiative transfer is highly desirable.

The postdoctoral and PhD positions are for three years, and will include a number of working visits to the partner institutes.

Applicants for the postdoctoral position should send a CV, description of research interests, a publication list and arrange for the submission of three letters of recommendation. For the PhD position a CV and two letters of recommendation are requested. Applications should be sent to the address below.

Applications received before 15 December 2008 will receive full consideration. Women and minorities are particularly encouraged to apply.

More information can be found at the weblinks below.

Postdoctoral Position in ALMA science

Applications are invited for at least one postdoctoral position on ALMA-related science at the Argelander Institute for Astronomy. Here the successful candidate will join the local ALMA Regional Center (ARC) node's growing submillimeter-interferometry research group, which has scientific interests ranging from galaxy evolution to star formation and evolved stars. The successful candidate shall follow a strong research program that is related to the scientific mission of ALMA.

The applicant should have observational experience at (sub)millimeter or radio wavelengths and/or radiative transfer modeling techniques. He/she is expected to participate in the technical and scientific preparation for ALMA within the European ARC, e.g., through the development of the next generation data analysis and modeling tools, and by helping to define early science programs. He/she will have the opportunity for extended visits to the joint ALMA office in Chile to participate in ALMA commissioning.

The position is for two years, and subject to funding carries the possibility of renewal for a third year.

Applicants should send (preferably as a single pdf) a CV, publication list, description of research interests, and arrange for the submission of three letters of recommendation to the below address. Applications will be accepted until the position is filled. Women and minorities are particularly encouraged to apply.

Attention: Christina Stein-Schmitz, Institute Secretary
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For further information about the positions, please contact Jes Joergensen (jes@astro.uni-bonn.de: ARTIST coordinator, low-mass star formation and radiative transfer modeling) Wouter Vlemmings (wouter@astro.uni-bonn.de: High-mass star formation/evolved stars) or Frank Bertoldi (bertoldi@astro.uni-bonn.de; Galaxy Evolution).

More information can be found at:
http://www.astro.uni-bonn.de/ARC/artist/ (ARTIST homepage)
http://www.astro.uni-bonn.de/english/index.php (AIfA)
http://www.astro.uni-bonn.de/ARC/ (Bonn-Cologne-Bochum ARC Node)

Meetings

Intermediate-Mass Black Holes: from First Light to Galactic Nuclei

Irvine, California, USA
April 1-3, 2009

Webpage: `http://www.physics.uci.edu/IMBH/`
Email: `imbh2009@gamblor.ps.uci.edu`

This meeting will focus on intermediate-mass black holes, broadly defined as spanning the mass range between stellar-mass black holes and the smallest supermassive black holes found in galaxy centers. The past few years have seen important advances in many areas relevant to IMBHs: models for formation of black hole seeds, accretion and early growth of low-mass black holes, mergers and gravity-wave kicks, and observational searches for IMBHs in nearby galaxies and star clusters. The goal of this workshop is to bring together theorists and observers from the cosmology, gravity-wave, stellar dynamics, and AGN communities to explore topics of common interest, review new and recent results, and discuss the impact of upcoming observatories and space missions for black hole research.

For further information and registration, see the meeting web page:

`http://www.physics.uci.edu/IMBH`