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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

Active Galactic Nuclei with Candidate Intermediate-Mass Black Holes

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We present an initial sample of 19 intermediate-mass black hole candidates in active galactic nuclei culled from the First Data Release of the Sloan Digital Sky Survey. Using the linewidth-luminosity-mass scaling relation established for broad-line active nuclei, we estimate black hole masses in the range of $M_{\rm BH} \approx 8 \times 10^4 - 10^6\, M_\odot$, a regime in which only two objects are currently known. The absolute magnitudes are faint for active galactic nuclei, ranging from $M_g \approx -15$ to -18 mag, while the bolometric luminosities are all close to the Eddington limit. The entire sample formally satisfies the linewidth criterion for so-called narrow-line Seyfert 1 galaxies; however, they display a wider range of FeII and [OIII] λ5007 line strengths than is typically observed in this class of objects. Although the available imaging data are of insufficient quality to ascertain the detailed morphologies of the host galaxies, it is likely that the majority of the hosts are relatively late-type systems. The host galaxies have estimated g-band luminosities ~ 1 mag fainter than M^* for the general galaxy population at $z \approx 0.1$. Beyond simply extending the known mass range of central black holes in galactic nuclei, these objects provide unique observational constraints on the progenitors of supermassive black holes. They are also expected to contribute significantly to the integrated signal for future gravitational wave experiments.

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Thermal Dust Reverberation Observed In Markarian 335 With YALO

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Simultaneous optical-infrared monitoring of the Seyfert galaxy Markarian 335 with the YALO telescope at Cerro Tololo has revealed a clear signature of thermal dust reverberation. Photometry relative to field stars was obtained in V and K bads every 5 days on average from August 2000 through December 2001. The 0.4 mag variability shown at V is mirrored by a delayed and broadened response at K with a lag time of $\sim$ 100 days as determined by cross-correlation analysis. A simple consistency check holds up: dust residing at a distance of 100 light-days from the central engine is heated to near the maximum possible temperature for graphite grains. Thus Mrk 335 joins the ranks of the handful other AGN for which infrared lag times consistent with thermal dust reprocessing have been measured.

Poster presented at American Astronomical Society 204th Meeting, Denver, CO, June 2004

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INTEGRAL and *XMM-Newton* Spectral Studies of NGC 4388

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We present first *INTEGRAL* and *XMM-Newton* observations of a Seyfert galaxy, the type 2 AGN NGC 4388. Several *INTEGRAL* observations performed in 2003 allow us to study the spectrum in the 20 - 300 keV range. In addition two *XMM-Newton* observations give detailed insight into the 0.2 - 10 keV emission. The measurements presented here and comparison with previous observations by *BeppoSAX*, *SIGMA* and *CGRO*/OSSE show that the overall spectrum from soft X-rays up to the gamma-rays can be described by a highly absorbed ($N_H \simeq 2.7 \times 10^{23}\,\mathrm{cm}^{-2}$) and variable non-thermal component in addition to constant non-absorbed thermal emission ($T \simeq 0.8\,\mathrm{keV}$) of low abundance ($Z \sim 7\% Z_\odot$), plus a constant Fe K$\alpha$ and Kβ line. The hard X-ray component is well described by a simple power law with a mean photon index of $\Gamma = 1.7$. During the *INTEGRAL* observations the 20 – 100 keV flux increased by a factor of 1.4. The analysis of *XMM-Newton* data implies that the emission below 3 keV is decoupled from the AGN and probably due to extended emission as seen in *Chandra* observations. The constant iron line emission is apparently also decoupled from the direct emission of the central engine and likely to be generated in the obscuring material, e.g. in the molecular torus.

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VLBI imaging of OH absorption: The puzzle of the nuclear region of NGC 3079

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Broad hydroxyl (OH) absorption-lines in the 1667 MHz and 1665 MHz transition towards the central region of NGC 3079 have been observed at high resolution with the European VLBI Network (EVN). Velocity fields of two OH absorption components were resolved across the unresolved nuclear radio continuum of $\sim$ 10 parsecs. The velocity field of the OH absorption close to the systemic velocity shows rotation in nearly the same sense as the edge-on galactic-scale molecular disk probed by CO(1–0) emission. The velocity field of the blue-shifted OH absorption displays a gradient in almost the opposite direction. The blue-shifted velocity field represents a non-rotational component, which may trace an outflow from the nucleus, or material driven and shocked by the kiloparsec-scale superbubble. This OH absorption component traces a structure that does not support a counter-rotating disk suggested on the basis of the neutral hydrogen absorption.

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Near Infrared Spectroscopy of High Redshift Active Galactic Nuclei. I. A Metallicity–Accretion Rate Relationship

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We present new near infrared spectroscopic measurements of the Hβ region for a sample of 29 luminous high redshift quasars. We have measured the width of Hβ in those sources, and added archival Hβ width measurements, to create a sample of 92 active galactic nuclei (AGNs) for which Hβ width and rest-frame UV measurements of N V λ1240 and C IV λ1549 emission-lines are available. Our sample spans six orders of magnitude in luminosity and includes 31 radio-loud AGNs. It also includes 10 narrow-line Seyfert 1 galaxies and one broad absorption-line quasar. We find that metallicity, indicated by the N V/C IV line ratio, is primarily correlated with accretion rate, which is a function of luminosity and Hβ line-width. This may imply an intimate relation between starburst, responsible for the metal enrichment of the nuclear gas, and AGN fueling, represented by the accretion rate. The correlation of metallicity with luminosity, or black hole (BH) mass, is weaker in contrast with recent results which were based on measurements of the width of C IV. We argue that using C IV as a proxy to Hβ in estimating $M_{\rm BH}$ might be problematic and lead to spurious BH mass and accretion rate estimates in individual sources. We discuss the potential implications of our new result in the framework of the starburst–AGN connection and theories of BH growth.

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Near Infrared Spectroscopy of High Redshift Active Galactic Nuclei. II. Disappearing Narrow Line Regions and the Role of Accretion

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We present new near infrared spectroscopic measurements for 29 luminous high-redshift active galactic nuclei (AGNs) and use the data to discuss the size and other properties of the narrow line regions (NLRs) in those sources. The high resolution spectra have been used to carefully model the Fe II blends and to provide reliable [O III] λ5007, Fe II and Hβ measurements. We find that about 2/3 of all very high luminosity sources show strong [O III] λ5007 lines while the remaining objects show no or very weak such line. While weak [O III] λ5007 emitters are also found among lower luminosity AGNs, we argue that the implications for very high luminosity objects are different. In particular, we suggest that the averaging of these two populations in other works gave rise to claims of a Baldwin relationship in [O III] λ5007 which is not confirmed by our data. We also argue that earlier proposed relations of the type $R_{\rm NLR} \propto L^{1/2}_{\rm [O\ III]}$, where $R_{\rm NLR}$ is the radius of the NLR, are theoretically sound yet they must break down for $R_{\rm NLR}$ exceeding a few kpc. This suggests that the NLR properties in high luminosity sources are very different from those observed in nearby AGNs. In particular, we suggest that some sources lost their very large, dynamically unbound NLR while others are in a phase of violent star-forming events that produce a large quantity of high density gas in the central kpc. This gas is ionized and excited by the central radiation source and its spectroscopic properties may be different from those observed in nearby, lower luminosity NLRs. We also discuss the dependence of EW(Hβ) and Fe II/Hβ on luminosity, black hole mass, and accretion rate for a large sample of AGNs. The strongest dependence of the two quantities is on the accretion rate and the Fe II/Hβ correlation is probably due to the EW(Hβ) dependence on accretion rate. We show the most extreme values measured so far of Fe II/Hβ and address its correlation with EW([O III] λ5007).

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Gaseous Outflows in Seyferts and Unification: The Case of Mrk 533

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We present our recent results from the observation of the O VI λ λ1032,1038 emission doublet in Seyfert galaxies of type 2 with the FUV spectrograph on the *FUSE* satellite. These observations are part of our investigation to contrast the properties of the OVI emission line and the absorbing outflows in a sample of rigorously matched Sy1s and 2s in the framework of the Unified Scheme. The OVI emission line is an excellent diagnostic of the outflowing hot gas at temperatures of $\sim 10^6$K. In the Unified Scheme, Seyferts of type 2 are those whose central regions are obscured by the ubiquitous dusty torus. We interpret our results in this framework.

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CO in Southern Seyfert galaxies Molecular Gas Properties of *I*. The Southern Sample

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We have used the 15m Swedish ESO Sub-millimetre Telescope (SEST) to observe the J = 1 $\rightarrow$ 0 and J = 2 $\rightarrow$ 1 transition lines of CO in 30 Southern hemisphere Seyfert galaxies from the extended 12 μm sample of Rush, Malkan & Spinoglio. We detected CO J = 1 $\rightarrow$ 0 in 16 out of the 30 Seyfert galaxies and CO J = 2 $\rightarrow$ 1 in 17 out of the 30 Seyfert galaxies. From the observed spectra various CO gas properties have been derived including the luminosity of the CO gas and using a standard conversion factor, the H_2 mass. The average H_2 gas mass for Seyfert 1 galaxies was 3×10^9 $M_\odot$ for CO J = 1 $\rightarrow$ 0 and 1×10^9 $M_\odot$ for CO J = 2 $\rightarrow$ 1, while in comparison the H_2 gas mass for Seyfert 2 type galaxies was 11×10^9 $M_\odot$ for CO J = 1 $\rightarrow$ 0 and 3×10^9 $M_\odot$ CO J = 2 $\rightarrow$ 1. From this small sample of Seyfert galaxies we tentatively support the conclusion that type 2 Seyfert galaxies contain more molecular gas than their type 1 counterparts.

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The Nuclear Reddening Curve For Active Galactic Nuclei and the Shape of the Infra-red to X-ray Spectral Energy Distribution

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We present extinction curves derived from the broad emission lines and continua of samples of radio-loud and radio-quiet AGNs. The curves are significantly flatter in the UV than are curves for the local ISM. The reddening curves for the radio-quiet LBQS quasars are slightly steeper than those of the radio-loud quasars in the UV, probably because of additional reddening by dust further out in the host galaxies of the former. The UV extinction curves for the radio-loud AGNs are very flat. This is explicable with slight modifications to standard MRN dust models: there is a relative lack of small grains in the nuclear dust. Our continuum and broad-emission line reddening curves agree in both shape and amplitude, confirming that the continuum shape is indeed profoundly affected by reddening for all but the bluest AGNs. With correction by our generic extinction curve, all of the radio-loud AGNs have continuous optical-UV spectra consistent with a single shape. We show that radio-quiet AGNs have very similar intrinsic UV to optical shape over orders of magnitude in luminosity. We also argue that radio-loud and radio-quiet AGNs probably share the same underlying continuum shape and that most of the systematic differences between their observed continuum shapes are due to higher nuclear reddening in radio-selected AGNs, and additional reddening from

dust further out in the host galaxies in radio-quiet AGNs. Our conclusions have important implications for the modelling of quasar continua and the analysis of quasar demographics.

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Fire and Ice: IRS Mid-IR Spectroscopy of IRAS F00183-7111

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We report the detection of strong absorption and weak emission features in the 4–27 μm *Spitzer-IRS* spectrum of the distant ultraluminous infrared galaxy (ULIRG) IRAS F 00183–7111 (z=0.327). The absorption features of CO_2 and CO gas, water ice, hydrocarbons and silicates are indicative of a strongly obscured ($A_{9.6} \geq 5.4$; $A_V \geq 90$) and complex line of sight through both hot diffuse ISM and shielded cold molecular clouds towards the nuclear power source. ¿From the profile of the 4.67 μm CO fundamental vibration mode we deduce that the absorbing gas is dense ($n \sim 10^6$ cm^{-3}) and warm (720 K) and has a CO column density of $\sim 10^{19.5}$ cm^{-2}, equivalent to $N_H \sim 10^{23.5}$ cm^{-2}. The high temperature and density, as well as the small infered size (< 0.03 pc), locates this absorbing gas close to the power source of this region. Weak emission features of molecular hydrogen, PAHs and Ne^+, likely associated with star formation, are detected against the 9.7 μm silicate feature, indicating an origin away from the absorbing region. Based on the 11.2 μm PAH flux, we estimate the star formation component to be responsible for up to 30% of the IR luminosity of the system. While our mid-infrared spectrum shows no tell-tale signs of AGN activity, the similarities to the mid-infrared spectra of deeply obscured sources (e.g. NGC 4418) and AGN hot dust (e.g. NGC 1068), as well as evidence from other wavelength regions, suggest that the power source hiding behind the optically thick dust screen may well be a buried AGN.

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