Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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 Stringent Limit on the Accretion Luminosity of the Possible Central Black Hole in the Globular Cluster M15

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The globular cluster M15 has recently been found to host a possible central black hole with a mass of $\sim$2000 $M_\odot$. A deep, high-resolution *Chandra* image failed to detect the "nucleus" of the cluster in X-rays. The upper limit on the X-ray luminosity ($L_{\rm x} \lesssim 5.6 \times 10^{32}$ erg s^{-1}) corresponds to a bolometric Eddington ratio of $L_{\rm bol}/L_{\rm Edd} \lesssim (2-4) \times 10^{-8}$. Combining this limit with an estimate of the electron density of the intracluster ionized plasma derived from pulsar dispersion measures, we show that the radiative efficiency of the accretion flow, if it accretes at the Bondi rate, must be much lower than that of a standard optically thick, geometrically thin disk.

Accepted by ApJ (Letters).

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The Central Engines of Low-Luminosity AGNs

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I summarize the main characteristics of AGNs in nearby galaxies and present a physical picture of their central engines.

To appear in *Active Galactic Nuclei: from Central Engine to Host Galaxy*, ed. S. Collin, F. Combes, & I. Shlosman (San Francisco: ASP), in press.

Detection of the "Active" Nucleus of M32

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M32 hosts a 2.5×10^6 $M_\odot$ central black hole, but signs of nuclear activity in this galaxy have long eluded detection. We report the first conclusive detection of the nucleus of M32 in X-rays, based on high-resolution, sensitive observations made with *Chandra*. The 2–10 keV luminosity is merely $9.4{\times}10^{35}$ erg s^{-1}, $\sim 3 \times 10^{-9}$ of the Eddington luminosity of the black hole. Weak diffuse emission, consistent with thermal gas at a temperature of 0.37 keV, is seen in an annular region ~100 pc from the center. We also present a deep, moderately high-resolution ($0.9''$), radio continuum observation obtained with the Very Large Array, which places a tight upper bound on the nuclear radio power at 8.4 GHz. We combine these new measurements with upper limits at other wavelengths to discuss implications for the nature of accretion onto the central black hole.

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A Chandra X-Ray Study of NGC 1068: II. The Luminous X-Ray Source Population

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We present an analysis of the compact X-ray source population in the Seyfert 2 galaxy NGC 1068, imaged with a $\sim$ 50 ks *Chandra* observation. We find a total of 84 compact sources on the S3 chip, of which 66 are located within the 25.0 B-magnitude (arc sec)$^{-2}$ isophote of the galactic disk of NGC 1068. Spectra have been obtained for the 21 sources with at least 50 counts, and modeled with both multi-color disk blackbody and power-law models. The power-law model provides the better description of the spectrum for 18 of these sources. For fainter sources, the spectral index has been estimated from the hardness ratio. Five sources have 0.4-8 keV intrinsic luminosities greater than 10^{39} erg s^{-1}, assuming that their emission is isotropic and that they are associated with NGC 1068. We refer to these sources as Intermediate Luminosity X-ray Objects (IXOs). If these five sources are X-ray binaries accreting with luminosities that are both sub-Eddington and isotropic, then the implied source masses are greater than $7\,M_\odot$, and so they are inferred to be black holes. Most of the spectrally modeled sources have spectral shapes similar to Galactic black hole candidates. However, the brightest compact source in NGC 1068 has a spectrum which is much harder than that found in Galactic black hole candidates and other IXOs. The brightest source also shows large amplitude variability on both short-term and long-term timescales, with the count rate possibly decreasing by a factor of two in $\sim$ 2 ks during our *Chandra* observation, and the source flux decreasing by a factor of five between our observation and the grating observations taken just over nine months later. The ratio of the number of sources with luminosities greater than 2.1×10^{38} erg s^{-1} in the 0.4–8 keV band to the rate of massive ($> 5\,M_\odot$) star formation is the same, to within a factor of two, for NGC 1068, the Antennae, NGC 5194 (the main galaxy in M51), and the Circinus galaxy. This suggests that the rate of production of X-ray binaries per massive star is approximately the same for galaxies with currently active star formation, including "starbursts".

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Absorption spectra of Fe L-lines in Seyfert 1 galaxies

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Absorption L-lines of iron ions are observed, in absorption, in spectra of Seyfert 1 galaxies by the new generation of X-ray satellites: Chandra (NASA) and XMM-Newton (ESA). Lines associated to Fe^{23+} to Fe^{17+} are well resolved. Whereas, those corresponding to Fe^{16+} to Fe^{6+} are unresolved. Forbidden transitions of the Fe^{16+} to Fe^{6+} ions were previously observed, for the same objects, in the visible and infra-red regions, showing that the plasma had a low density. To interpret X-ray, visible and infra-red data, astrophysical models assume an extended absorbing medium of very low density surrounding an intense X-ray source. We have calculated atomic data (wavelengths, radiative and autoionization rates) for n=2 to n'=3-4 transitions and

used them to construct refined synthetic spectra of the unresolved part of the L-line spectra.

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Chandra and XMM-Newton observations of the first quasars: X-rays from the age of cosmic enlightenment

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We report on *Chandra* and XMM-*Newton* observations of a sample of 13 quasars at $z \approx 4.7$–5.4, mostly taken from the Sloan Digital Sky Survey (SDSS). The present sample complements previous X-ray studies of $z \geq 4$ quasars, in which the majority of the objects are optically more luminous and at lower redshifts. All but two of our quasars have been detected in the X-ray band, thus doubling the number of $z \geq 4.8$ X-ray detected quasars. The two non-detections are likely to be due to a short exposure time (SDSSp J033829.31+002156.3) and to the presence of intrinsic absorption (SDSSp J173744.87+582829.5). confirm and extend to the highest redshifts the presence of a correlation between $AB_{1450(1+z)}$ magnitude and soft X-ray flux for $z \geq 4$ quasars, and the presence of a steeper optical-to-X-ray spectral energy distribution (parameterized by $\alpha_{\rm ox}$) for high-luminosity, high-redshift quasars than for lower-luminosity, lower-redshift quasars. The second effect is likely due to the known anti-correlation between $\alpha_{\rm ox}$ and rest-frame 2500 Å luminosity, whose significance is confirmed via partial correlation analysis. $\approx$ 2.5–36 keV rest-frame spectrum of the $z > 4.8$ SDSS quasars observed thus far by *Chandra* is well parameterized by a power-law with photon index Γ=$1.84^{+0.31}_{-0.30}$; this photon index is consistent with those of $z \approx 0$–3 quasars and that obtained from joint spectral fitting of $z \approx 4.1$–4.5 optically luminous Palomar Digital Sky Survey quasars. No evidence for widespread intrinsic X-ray absorption has been found ($N_{\rm H} \leq 4.0 \times 10^{22}$ cm^{-2} on average at 90% confidence). We also obtained Hobby-Eberly Telescope (HET) photometric observations for eight of our target quasars. None of these shows significant ($> 30\%$) optical variability over the time interval of a few years (in the observed frame) between the SDSS and HET observations.

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New radiative transfer models for obscuring tori in active galaxies

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Two-dimensional radiative transfer is employed to obtain the broad-band infrared spectrum of active galaxies. In the models we vary the geometry and size of the obscuring medium, the surface density, the opacity and the grain size distribution. Resulting spectral energy distributions are constructed for different orientations of the toroid. Colour-colour comparisons with observational data are consistent with previous observations that the emission longward of 60 μm is produced by star-formation and unrelated to the presence of an obscuring torus. We also find that the toroid cannot be flat, but is rather conical or flaring. The density is most likely constant with radius, and the size is relatively large with an inner radius around 10 pc. A direct comparison with radio galaxy Cygnus A yields a best fit for a conical disk with constant surface density, and a size from 10 to 30 pc, assuming the far-infrared emission is due to star-formation in the host galaxy.

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The Structure of The Narrow Line Region in Cygnus A

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We present intermediate resolution spectra for the powerful radio galaxy Cygnus A taken with ISIS spectrograph on the William Herschel Telescope. The spectra show complex emission line profiles across the entire extent of the narrow line region (NLR) along the radio axis (PA105), with line splittings ($\Delta V \sim 300$ km s^{-1}) at radial distances of $1-2$ kpc both to the north east and south west, and a combination of broad ($500 < FWHM < 800$ km s^{-1}) and narrow ($FWHM < 300$ km s^{-1}) components within a radial distance of 1kpc of the nucleus. The wide spectral coverage of the data allows us for the first time to measure the reddening, physical conditions and ionisation of the kinematic sub-components individually. Only the broad component detected in the near-nuclear regions shows evidence for significant reddening over and above that due to the Galaxy. The level of reddening of the nuclear broad component is consistent with the idea that the extinction associated with the kpc-scale dust lane induces a mild ($\leq$ factor 2) anisotropy in the total emission line flux, although there is no evidence for a compact, high density inner narrow line region (INLR) in this source. Following correction for reddening, we find a remarkable degree of uniformity in the physical conditions and ionisation state between the various spatial and kinematic sub-components, suggesting a common ionisation mechanism for all the sub-components, despite the differences in kinematics. We use diagnostic diagrams to demonstrate that AGN photoionisation is the dominant ionisation mechanism. However, a combination of matter- and radiation- bounded photoionised components is required to explain the strength of the [FeVII]λ6087 line and the high electron temperature measured from the [OIII](5007+4959)/4363 diagnostic ratio. A major outstanding issue for our understanding of the NLR gas in this and other radio galaxies, is how the uniformity in the ionisation and physical conditions can be maintained in a mixed photoionised medium across a range of spatial scales and kinematic sub-components.

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A Low-Mass Central Black Hole in the Bulgeless Seyfert 1 Galaxy NGC 4395

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NGC 4395 is one of the least luminous and nearest known type 1 Seyfert galaxies, and it also lacks a bulge. We present a *Hubble Space Telescope (HST) I*-band image of its nuclear region, and Keck high-resolution (~ 8 km s^{-1}) echelle spectra containing the Ca II near-infrared triplet. In addition to the unresolved point source, there is a nuclear star cluster of size $r \approx 3.9$ pc; the upper limit on its velocity dispersion is only 30 km s^{-1}. We thus derive an upper limit of $\sim 6.2 \times 10^6$ $M_\odot$ for the mass of the compact nucleus. Based on the amount of spatially resolved light in the *HST* image, a sizable fraction of this is likely to reside in stars. Hence, this estimate sets a stringent upper limit on the mass of the central black hole. We argue, from other lines of evidence, that the true mass of the black hole is likely to be $\sim 10^4 - 10^5$ $M_\odot$. Although the black hole is much less massive than those thought to exist in classical active galactic nuclei, its accretion rate of $L_{\rm bol}/L_{\rm Edd} \approx 2 \times 10^{-2}$ to 2×10^{-3} is consistent with the mass-luminosity relation obeyed by classical AGNs. This may explain why NGC 4395 has a high-excitation (Seyfert) emission-line spectrum; active galaxies having low-ionization spectra seem to accrete at significantly lower rates. NGC 4395, a pure disk galaxy, demonstrates that supermassive black holes are not associated exclusively with bulges.

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Announcments

Announcing the Availability of the 2MASS All-Sky Catalogs

The Two Micron All Sky Survey[1]

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The Two Micron All Sky Survey (2MASS) is pleased to announce that the All-Sky Data Release Point Source Catalog (PSC) and Extended Source Catalog (XSC) are now available. The All-Sky PSC contains accurate positions and J, H and K_s photometry for over 470 million sources, most of which are stars in the Milky Way, but some of which are extragalactic sources. The All-Sky XSC contains positions, three-band photometry and basic shape information for over 1.6 million resolved sources, most of which are galaxies. The 2MASS "Quicklook" Atlas Images, have been available online since October of last year.

An introduction to the Release data products and supporting documentation is available at http://www.ipac.caltech.edu/2mass/releases/allsky/, or you may access the Catalogs and Images directly from the NASA/Infrared Science Archive at http://irsa.ipac.caltech.edu/. The Catalogs will be available via bulk ftp download soon and on a limited-distribution DVD-ROM in the near future.

Users are strongly encouraged to review the Explanatory Supplement to the 2MASS All-Sky Data Release at http://www.ipac.caltech.edu/2mass/releases/allsky/doc/explsup.html for general information about the Survey, the formats, characteristics and cautionary notes about the Catalogs.

User support is available via the 2MASS Help Desk at 2mass@ipac.caltech.edu.

E-mail contact: 2mass@ipac.caltech.edu. See http://www.ipac.caltech.edu/2mass/.

Meetings

JENAM-2003 Minisymposium: Synergies in Wide Field Observations Budapest, Hungary 29-30 August 2003

During the last few years the development of large CCD mosaics, and their use at the prime focus of medium and large telescopes, supplied the unique opportunity to cover large sky fields ($\sim 1\ deg^2$) with limited amount of telescope time. Different scientific programs can benefit of these resources. Looking for synergies between different programs and merging their requirements can lead to highly efficient observational strategies. In particular the study of variability, on various time scales, with Wide Field Imagers (WFIs) is crucial in several astrophysical fields such as Supernovae search (SNe), active galactic nuclei (AGNs), variable stars (VSs), fast moving objects (FMOs), and gravitational microlensing (GML). Wide field surveys present various technical problems, connected with data reduction, and data archival/retrieval independent of the scientific use of the data.

The symposium will provide an occasion to discuss different requirements taking into account the results of the existing major surveys and the observing facilities which will be available in the immediate future. Invited talks will cover the following areas:

AGN variability
Supernova searches
Detection of fast moving objects
Gravitational microlensing
Variable stars surveys
Ongoing wide field surveys
Handling of large data flows
Software for astrometry and photometry

There will be the opportunity for a limited number of contributed talks and for poster presentations. Although variability studies will be specially emphasized in the choice of the invited speakers, other contribution related to wide field observations designed for different scientific uses will be included in the program.

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information available at http://astro.elte.hu/jenam2003/minisymp/widefield.html,
and at http://www.konkoly.hu/jenam03/

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