Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 113 — August 2006	Editor: Rob Beswick (rb@ast.man.ac.uk)

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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

Hubble Space Telescope Near-Infrared Snapshot Survey of 3CR radio source counterparts at low redshift

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We present newly acquired images of the near-infrared counterpart of 3CR radio sources. All the sources were selected to have a redshift of less than 0.3 to allow us to obtain the highest spatial resolution. The observations were carried out as a snapshot program using the Near-Infrared Camera and Multiobject Spectrograph (NICMOS) on-board the Hubble Space Telescope (HST). In this paper we describe 69 radio galaxies observed for the first time with NICMOS during HST cycle 13. All the objects presented here are elliptical galaxies. However, each of them has unique characteristics such as close companions, dust lanes, unresolved nuclei, arc-like features, globular clusters and jets clearly visible from the images or with basic galaxy subtraction.

Astrophysical Journal Supplement Series, 164, 307

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preprint available at http://arxiv.org/abs/astro-ph/0603239 or
http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=2006ApJS..164..307M

Discovery of an X-ray Jet and Extended Jet Structure in the Quasar PKS 1055+201

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This letter reports rich X-ray jet structures found in the *Chandra* observation of PKS 1055+201. In addition to an X-ray jet coincident with the radio jet we detect a region of extended X-ray emission surrounding the jet as far from the core as the radio hotspot to the North, and a similar extended X-ray region along the presumed path of the unseen counterjet to the Southern radio lobe. Both X-ray regions show a similar curvature to the west, relative to the quasar. We interpret this as the first example where we separately detect the X-ray emission from a narrow jet and extended, residual jet plasma over the entire length of a powerful FRII jet.

Accepted by Ap. J. Letters

E-mail contact: das@head-cfa.harvard.edu,
preprint available at http://arxiv.org/abs/astro-ph/0607276

Discovery of Hα absorption in the unusual broad absorption line quasar SDSS J083942.11+380526.3

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We discovered an Hα absorption in a broad Hα emission line of an unusual broad absorption line quasar, SDSS J083942.11+380526.3 at $z = 2.318$, by near-infrared spectroscopy with the Cooled Infrared Spectrograph and Camera for OHS (CISCO) on the Subaru telescope. The Presence of non-stellar Hα absorption is known only in the Seyfert galaxy NGC 4151 to date, thus our discovery is the first case for quasars. The Hα absorption line is blueshifted by 520 km s^{-1} relative to the Hα emission line, and its redshift almost coincides with those of UV low-ionization metal absorption lines. The width of the Hα absorption ($\sim$ 340 km s^{-1}) is similar to those of the UV low-ionization absorption lines. These facts suggest that the Hα and the low-ionization metal absorption lines are produced by the same low-ionization gas which has a substantial amount of neutral gas. The column density of the neutral hydrogen is estimated to be $\sim 10^{18}$ cm^{-2} by assuming a gas temperature of 10,000 K from the analysis of the curve of growth. The continuum spectrum is reproduced by a reddened ($E(B-V) \sim 0.15$ mag for the SMC-like reddening law) composite quasar spectrum. Furthermore, the UV spectrum of SDSS J083942.11+380526.3 shows a remarkable similarity to that of NGC 4151 in its low state, suggesting the physical condition of the absorber in SDSS J083942.11+380526.3 is similar to that of NGC 4151 in the low state. As proposed for NGC 4151, SDSS J083942.11+380526.3 may be also seen through the close direction of the surface of the obscuring torus.

Accepted by Astrophys. J.

E-mail contact: kaoki@subaru.naoj.org,
preprint available at http://arxiv.org/abs/astro-ph/0607036

X-ray Absorption and an X-ray Jet in the Radio-Loud Broad Absorption Line Quasar PG 1004+130

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We investigate the X-ray properties of PG 1004+130, a radio-loud broad absorption line (BAL) quasar with a hybrid FR I/FR II radio morphology. This optically bright, low-redshift quasar was undetected by *Einstein*, marking it as anomalously X-ray weak relative to other radio-loud quasars. The 22.2 ks *XMM-Newton* and 41.6 ks *Chandra* observations presented here are the first X-ray detections of PG 1004+130 and constitute the highest spectral quality X-ray observations of a radio-loud BAL quasar available to date. The *Chandra* ACIS-S spectrum shows evidence for complex soft X-ray absorption not detected in the data obtained 1.7 yr previously with *XMM-Newton*, with a best-fit intrinsic column density of $N_{\rm H}$=1.2 $\times$ 10^{22} cm^{-2} for the preferred partial-covering model. There is no significant difference in the hard-band power-law photon index of $\Gamma \approx$1.5 between the two observations. The *Chandra* image also reveals extended X-ray emission $\approx$8$''$ (30 kpc) south-east of the nucleus, aligned with the FR I jet but upstream of the 1.4 GHz radio-brightness peak. The jet is not detected by *HST*, and the optical upper limit rules out a simple single-component synchrotron interpretation of the radio-to-X-ray emission. The multiwavelength characteristics of the PG 1004+130 jet, including its relatively flat X-ray power law and concave spectral energy distribution, are similar to those of powerful FR II jets. The lack of strong beaming in PG 1004+130 limits the efficiency of inverse Compton upscattering, and we consider the X-ray emission to most likely arise from a second synchrotron component generated by highly energetic electrons.

Accepted by ApJ

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A Radio Study of the Seyfert galaxy Markarian 6: Implications for Seyfert life-cycles

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We have carried out an extensive radio study with the Very Large Array on the Seyfert 1.5 galaxy Mrk 6 and imaged a spectacular radio structure in the source. The radio emission occurs on three different spatial scales, from $\sim$7.5 kpc bubbles to $\sim$1.5 kpc bubbles lying nearly orthogonal to them and a $\sim$1 kpc radio jet lying orthogonal to the kpc-scale bubble. To explain the complex morphology, we first consider a scenario in which the radio structures are the result of superwinds ejected by a nuclear starburst. However, recent Spitzer observations of Mrk 6 provide an upper limit to the star formation rate (SFR) of $\sim$ 5.5 $M_{\odot}$ yr^{-1}, an estimate much lower than the SFR of $\sim$ 33 $M_{\odot}$ yr^{-1} derived assuming that the bubbles are a result of starburst winds energized by supernovae explosions. Thus, a starburst alone cannot meet the energy requirements for the creation of the bubbles in Mrk 6. We show that a single plasmon model is energetically infeasible, and we argue that a jet-driven bubble model while energetically feasible does not produce the complex radio morphologies. Finally, we consider a model in which the complex radio structure is a result of an episodically-powered precessing jet that changes its orientation. This model is the most attractive as it can naturally explain the complex radio morphology, and is consistent with the energetics, the spectral index and the polarization structure. Radio emission in this scenario is a short-lived phenomenon in the lifetime of a Seyfert galaxy which results due to an accretion event.

Accepted by the Astrophysical Journal

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preprint available at http://arxiv.org/abs/astro-ph/0607603

A Survey for Redshifted Molecular and Atomic Absorption Lines I

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We are currently undertaking a large survey for redshifted atomic and molecular absorption lines at radio frequencies. In this paper we present the results from the first phase of this: the search for H I 21-cm and OH 18-cm absorption lines in the hosts of reddened quasars and radio galaxies. Although we observed each source for up to several hours with two of the world's most sensitive radio telescopes, the Giant Metrewave Radio Telescope (GMRT) and Westerbork Synthesis Radio Telescope (WSRT), only one clear and one tentative detection were obtained: H I absorption at $z = 0.097$ in PKS 1555–140 and OH absorption at $z = 0.126$ in PKS 2300–189, respectively, with the Australia Telescope Compact Array (ATCA). For the latter, no H I absorption was detected at the same redshift as the borderline OH detection. In order to determine why no clear molecular absorption was detected in any of the 13 sources searched, we investigate the properties of the five redshifted systems currently known to exhibit OH absorption. In four of these, molecules were first detected via millimetre-wave transitions and the flat radio spectra indicate compact background continuum sources, which may suggest a high degree of coverage of the background source by the molecular clouds in the absorber. Furthermore, for these systems we find a relationship between the molecular line strength and red optical–near infrared $(V - K)$ colours, thus supporting the notion that the reddening of these sources is due to dust, which provides an environment conducive to the formation of molecules. Upon comparison with the $V - K$ colours of our sample, this relationship suggests that, presuming the reddening occurs at the host galaxy redshift at least in some of the targets, many of our observations still fall short of the sensitivity required to detect OH absorption, although a confirmation of the "detection" of OH in 2300–189 could contravene this.

Accepted by MNRAS

E-mail contact: sjc@phys.unsw.edu.au, preprint available at http://www.phys.unsw.edu.au/∼sjc/home/res.html

The Detectability of HI 21-cm Absorption in Damped Lyman-α Systems

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In this paper we investigate the possible reasons why H I 21-cm absorption in damped Lyman-α systems (DLAs) has only been detected at low redshift: To date, no 21-cm absorption has yet been detected at $z_{\rm abs} > 2.3$ and at redshifts less than this, there is a mix of detections and non-detections in the DLAs searched. This has been attributed to the morphologies of the galaxies hosting the DLAs, where at low redshift the DLAs comprise of both large and compact galaxies, which are believed to have low and high spin temperatures, respectively. Likewise, at high redshift the DLA population is believed to consist exclusively of compact galaxies of high spin temperature. However, in a previous paper we found that by not assuming or assigning an, often uncertain, value for the coverage of the radio continuum source by the 21-cm absorbing gas, that there is generally no difference in the spin temperature/covering factor ratio between the 21-cm detections and non-detections or between the low and high redshift samples. Furthermore, only one of the 18 non-detections has a known host morphology, thus making any link between morphology and 21-cm detectability highly speculative.

We suggest that the lack of 21-cm absorption detections at high redshift arises from the fact that these DLAs are at similar angular diameter distances to the background quasars (i.e. the distance ratios are always close to unity): Above $z_{\rm abs} \sim 1.6$ the covering factor becomes largely independent of the DLA–QSO distance, making the high redshift absorbers much less effective at covering the background continuum emission. At low redshift, small distance ratios are strongly favoured by the 21-cm detections, whereas large ratios are favoured by the non-detections. This mix of distance ratios gives the observed mix of detections and non-detections at $z_{\rm abs} \lesssim 1.6$. In addition to the predominance of large distance ratios and non-detections at high redshift, this strongly suggests that the observed distribution of 21-cm absorption in DLAs is dominated by geometric effects.

Accepted by MNRAS

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The X-ray Properties of Active Galactic Nuclei with Double-Peaked Balmer Lines

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Double-peaked Balmer-line profiles originate in the accretion disks of a few percent of optically selected AGN. The reasons behind the strong low-ionization line emission from the accretion disks of these objects is still uncertain. In this paper, we characterize the X-ray properties of 39 double-peaked Balmer line AGN, 29 from the Sloan Digital Sky Survey and 10 low optical-luminosity double-peaked emitters from earlier radio-selected samples. We find that the UV-to-X-ray slope of radio-quiet (RQ) double-peaked emitters as a class does not differ substantially from that of normal RQ AGN with similar UV monochromatic luminosity. The radio-loud (RL) double-peaked emitters, with the exception of LINER galaxies, are more luminous in the X-rays than RQ AGN, as has been observed for other RL AGN with single-peaked profiles. The X-ray spectral shapes of double-peaked emitters, measured by their hardness ratios or power-law photon indices, are also largely consistent with those of normal AGN of similar radio-loudness. In practically all cases studied here, external illumination of the accretion disk is necessary to produce the Balmer-line emission, as the gravitational energy released locally in the disk by viscous stresses is insufficient to produce lines of the observed strength. In the Appendix we study the variability of Mrk 926, a double-peaked emitter with several observations in the optical and X-ray bands.

Accepted by Astrophys. J.

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Cosmic evolution of mass accretion rate and metalicity in active galactic nuclei

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We present line and continuum measurements for 9818 SDSS type-I active galactic nuclei (AGNs) with $z \leq 0.75$. The data are used to study the four dimensional space of black hole mass, normalized accretion rate (L/L_{Edd}), metalicity and redshift. The main results are: 1. L/L_{Edd} is smaller for larger mass black holes at all redshifts. 2. For a given black hole mass, $L/L_{Edd} \propto z^{\gamma}$ or $(1+z)^{\delta}$ where the slope γ increases with black hole mass. The mean slope is similar to the star formation rate slope over the same redshift interval. 3. The FeII/Hβ line ratio is significantly correlated with L/L_{Edd}. It also shows a weaker negative dependence on redshift. Combined with the known dependence of metalicity on accretion rate, we suggest that the FeII/Hβ line ratio is a metalicity indicator. 4. Given the measured accretion rates, the growth times of most AGNs exceed the age of the universe. This suggests past episodes of faster growth for all those sources. Combined with the FeII/Hβ result, we conclude that the broad emission lines metalicity goes through cycles and is not a monotonously decreasing function of redshift. 5. FWHM([O III] λ5007) is a poor proxy of σ_* especially for high L/L_{Edd}. 6. We define a group of narrow line type-I AGNs (NLAGN1s) by their luminosity (or mass) dependent Hβ line width. Such objects have $L/L_{Edd} \geq 0.25$ and they comprise 8% of the type-I population. Other interesting results include negative Baldwin relationships for EW(Hβ) and EW(FeII) and a relative increase of the red part of the Hβ line with luminosity.

Accepted by ApJ

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The Spiral Host Galaxy of the Double Radio Source 0313-192

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We present new *Hubble*, *Gemini-S*, and *Chandra* observations of the radio galaxy 0313-192, which hosts a 350-kpc double source and jets, even though previous data have suggested that it is a spiral galaxy. We measure the bulge scale and luminosity, radial and vertical profiles of disk starlight, and consider the distributions of H II regions and absorbing dust. In each case, the HST data confirm its classification as an edge-on spiral galaxy, the only such system known to produce such an extended radio source of this kind. The *Gemini* near-IR images and *Chandra* spectral fit reveal a strongly obscured central AGN, seen through the entire ISM path length of the disk and showing X-ray evidence of additional absorption from warm or dense material

close to the central object. We consider several possible mechanisms for producing such a rare combination of AGN and host properties, some combination of which may be at work. These include an unusually luminous bulge (suggesting a black hole of mass $5-9 \times 10^8\ M_\odot$), orientation of the jets near the pole of the gas-rich disk, and some evidence of a weak gravitational interaction which has warped the disk and could have enhanced fuelling of the central engine. We detect an X-ray counterpart of the kiloparsec-scale radio jet emerging to the south; jet/counterjet limits on both radio and X-ray regimes allow them to be symmetric if seen more than 15° from the plane of the sky, still consistent with the jet axes being within $\sim 30°$ of the poles of the gas-rich galaxy disk. A linear or disklike emission-line structure is seen around the nucleus, inclined by $\sim 20°$ to the stellar disk but nearly perpendicular to the jets; this may represent the aftermath of a galaxy encounter, in which gas is photoionized by a direct view of the nuclear continuum.

Accepted by Astron. J.

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preprint available as astro-ph/0608086.

The AGN Obscuring Torus — End of the "Doughnut" Paradigm?

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Unified schemes of active galactic nuclei (AGN) require an obscuring dusty torus around the central engine. The compact sizes (only a few pc) determined in recent high-resolution observations require that the obscuring matter be clumpy and located inside the region where the black-hole gravity dominates over the galactic bulge. This location is in line with the scenario depicting the torus as the region of the clumpy wind coming off the accretion disk in which the clouds are dusty and optically thick. We study here the outflow scenario within the framework of hydromagnetic disk winds, incorporating the cloud properties determined from detailed modeling of the IR emission from clumpy tori. We find that torus clouds were likely detected in recent water maser observations of NGC 3079. In the wind scenario, the AGN main dynamic channel for release of accreted mass seems to be switching at low luminosities from torus outflow to radio jets. The torus disappears when the bolometric luminosity decreases below $\sim 10^{42}$ erg s^{-1} because the accretion onto the central black hole can no longer sustain the required cloud outflow rate. This disappearance seems to have been observed in both LINERs and radio galaxies. With further luminosity decrease, suppression of cloud outflow spreads radially inward from the disk's dusty, molecular region into its atomic, ionized zone, resulting in disappearance of the broad emission line region at lower luminosities, yet to be determined.

To appear in ApJ Letters

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preprint available at http://arxiv.org/abs/astro-ph/0605686