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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. Web page at http://www.ast.man.ac.uk/~rb/agn

Rob Beswick

Abstracts of recently accepted papers

XMM–Newton observations of ultraluminous X–ray sources in nearby galaxies

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An *XMM–Newton* study of ultraluminous X–ray sources (ULX) has been performed in a sample of 10 nearby Seyfert galaxies. Eighteen ULX have been found with positional uncertainty of about $4''$. The large collecting area of *XMM–Newton* makes the statistics sufficient to perform spectral fitting with simple models in 8 cases. The main results of the present minisurvey strengthen the theory that the ULX could be accreting black holes in hard or soft state. In some cases, the contribution of the ULX to the overall X–ray flux appears to be dominant with respect to that of the active nucleus. In addition, 6 ULX present probable counterparts at other wavelengths (optical/infrared, radio). A multiwavelength observing strategy is required to better assess the nature of these sources.

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preprint available at http://tonno.tesre.bo.cnr.it/~foschini/ULX/ULX.html

AGN Black Hole Masses and Bolometric Luminosities

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Black hole mass, along with mass accretion rate, is a fundamental property of active galactic nuclei. Black hole mass sets an approximate upper limit to AGN energetics via the Eddington limit. We collect and compare all AGN black hole mass estimates from the literature; these 177 masses are mostly based on the virial assumption for the broad emission lines, with the broad-line region size determined from either reverberation mapping or optical luminosity. We introduce 200 additional black hole mass estimates based on properties of the host galaxy bulges, using either the observed stellar velocity dispersion or using the fundamental plane relation to infer σ; these methods assume that AGN hosts are normal galaxies. We compare 36 cases for which black hole mass has been generated by different methods and find, for individual objects, a scatter as high as a couple of orders of magnitude. The less direct the method, the larger the discrepancy with other estimates, probably due to the large scatter in the underlying correlations assumed. Using published fluxes, we calculate bolometric luminosities for 234 AGNs and investigate the relation between black hole mass and luminosity. In contrast to other studies, we find no significant correlation of black hole mass with luminosity, other than those induced by circular reasoning in the estimation of black hole mass. The Eddington limit defines an approximate upper envelope to the distribution of luminosities, but the lower envelope depends entirely on the sample of AGN included. For any given black hole mass, there is a range in Eddington ratio of up to three orders of magnitude.

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CHANDRA Detects Relativistic Broad Absorption Lines from APM 08279+5255

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We report the discovery of X-ray broad absorption lines (BALs) from the BALQSO APM 08279+5255 originating from material moving at relativistic velocities with respect to the central source. The large flux magnification by a factor of $\sim$ 100 provided by the gravitational lens effect combined with the large redshift (z = 3.91) of the quasar have facilitated the acquisition of the first high signal-to-noise X-ray spectrum of a quasar containing X-ray BALs. Our analysis of the X-ray spectrum of APM 08279+5255 places the rest-frame energies of the two observed absorption lines at 8.1 and 9.8 keV. The detection of each of these lines is significant at the $>$ 99.9% confidence level based on the F-test. Assuming that the absorption lines are from Fe XXV Kα, the implied bulk velocities of the X-ray BALs are $\sim 0.2c$ and $\sim 0.4c$, respectively. The observed high bulk velocities of the X-ray BALs combined with the relatively short recombination time-scales of the X-ray absorbing gas imply that the absorbers responsible for the X-ray BALs are located at radii of $\lesssim 2 \times 10^{17}$ cm, within the expected location of the UV absorber. With this implied geometry the X-ray gas could provide the necessary shielding to prevent the UV absorber from being completely ionized by the central X-ray source, consistent with hydrodynamical simulations of line-driven disk winds. Estimated mass-outflow rates for the gas creating the X-ray BALs are typically less than a solar mass per year. Our spectral analysis also indicates that the continuum X-ray emission of APM 08279+5255 is consistent with that of a typical radio-quiet quasar with a spectral slope of $\Gamma = 1.72^{+0.06}_{-0.05}$.

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Chandra Imaging of the X-ray Core of the Virgo Cluster

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We report sub-arcsecond X-ray imaging spectroscopy of M87 and the core of the Virgo cluster with the Chandra X-ray Observatory. The X-ray morphology shows structure on arcsecond ($\sim$ 100 pc) to ten arcminute ($\sim$ 50 kpc) scales, the most prominent feature being an "arc" running from the east, across the central region of M87 and off to the southwest. A ridge in the radio map, ending in an "ear"-shaped structure, follows the arc to the east. Depressions in the X-ray surface brightness correspond to the inner radio lobes and there is no evidence of shock-heated gas surrounding them. There are also at least two approximately circular (centered near the nucleus) "edges" in the X-ray brightness distribution, the radii of which are slightly larger than the nuclear distances of the inner radio lobes and intermediate radio ridges, respectively. We speculate that these discontinuities may be spherical pulses or "fronts" driven by the same jet activity as is responsible for the radio structure; such pulses are

found in recent numerical simulations. All these results provide good evidence that the nuclear activity affects the intra-cluster medium. We present a temperature map of the intra-cluster medium, and obtain the temperature, pressure and cooling time as a function of nuclear distance for the arcs and the ambient intra-cluster medium. We show that the gas in the arcs is cooler than, and probably over-pressured with respect to, the ambient intra-cluster medium. The metal abundances of the cooler gas in the arc are somewhat enhanced relative to the ambient intra-cluster medium, favoring a "buoyant plume" origin for the X-ray arc, in which ambient gas near the nucleus is entrained by buoyant radio plasma and carried to larger nuclear distances. The gas within the inner "front" (nuclear distance $\simeq 3.5$ kpc $\simeq 45''$) is at least a two-temperature plasma, with the cool component at $\simeq 1$ keV. This cool region is concentrated to the north of the nucleus and is strongly correlated with the Hα + [NII] emission-line distribution.

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Is a minor-merger driving the nuclear activity in the Seyfert 2 galaxy NGC 2110?

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We report on a detailed morphological and kinematic study of the isolated non-barred nearby Seyfert 2 galaxy NGC 2110. We combine Integral Field optical spectroscopy, with long-slit and WFPC2 imaging available in the HST archive to investigate the fueling mechanism in this galaxy. Previous work (Wilson & Baldwin 1985) concluded that the kinematic center of the galaxy is displaced ~ 220 pc from the apparent mass center of the galaxy, and the ionized gas follows a remarkably normal rotation curve. Our analysis based on the stellar kinematics, 2D ionized gas velocity field and dispersion velocity, and high spatial resolution morphology at V, I and Hα reveals that: 1) The kinematic center of NGC 2110 is at the nucleus of the galaxy. 2) The ionized gas is not in pure rotational motion. 3) The morphology of the 2D distribution of the emission line widths suggests the presence of a minor axis galactic outflow. 4) The nucleus is blue-shifted with respect to the stellar systemic velocity, suggesting the NLR gas is out-flowing due to the interaction with the radio jet. 5) The ionized gas is red-shifted ~ 100 km/s over the corresponding rotational motion south of the nucleus, and 240 km/s with respect to the nuclear stellar systemic velocity. This velocity is coincident with the HI red-shifted absorption velocity detected by Gallimore et al (1999). We discuss the possibility that the kinematics of the south ionized gas could be perturbed by the collision with a small satellite that impacted on NGC 2110 close to the center with a highly inclined orbit. Additional support for this interpretation are the radial dust lanes and tidal debris detected in the V un-sharp masked image. We suggest that a minor-merger may have driven the nuclear activity in NGC 2110.

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Measuring the black hole masses of high redshift quasars

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A new technique is presented for determining the black-hole masses of high-redshift quasars from optical spectroscopy. The new method utilizes the full-width half maximum (FWHM) of the low-ionization MgII emission line and the correlation between broad-line region (BLR) radius and continuum luminosity at 3000Å. Using archival UV spectra it is found that the correlation between BLR radius and 3000Å luminosity is tighter than the established correlation with 5100Å luminosity. Furthermore, it is found that the correlation between BLR radius and 3000Å continuum luminosity is consistent with a relation of the form $R_{BLR} \propto \lambda L_{\lambda}^{0.5}$, as expected for a constant ionization parameter. Using a sample of objects with broad-line radii determined from reverberation mapping it is shown that the FWHM of Mg II and Hβ are consistent with following an exact one-to-one relation, as expected if both Hβ and MgII are emitted at the same radius from the central ionizing source. The resulting virial black-hole mass estimator based on rest-frame UV observables is shown to reproduce black-hole mass measurements based on reverberation mapping to within a factor of 2.5 (1σ). Finally, the new UV black-hole mass estimator is shown to produce

identical results to the established optical (Hβ) estimator when applied to 128 intermediate-redshift ($0.3 < z < 0.9$) quasars drawn from the Large Bright Quasar Survey and the radio-selected Molonglo quasar sample. We therefore conclude that the new UV virial black-hole mass estimator can be reliably used to estimate the black-hole masses of quasars from $z \sim 0.25$ through to the peak epoch of quasar activity at $z \sim 2.5$ via optical spectroscopy alone.

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Chandra Observations of the Evolving Core of the Starburst Galaxy NGC 253

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Chandra observations of the core of the nearby starburst galaxy NGC 253 reveal a heavily absorbed source of hard X-rays embedded within the nuclear starburst region. The source has an unabsorbed, 2 to 10 keV luminosity of $\geq 10^{39}$ erg s^{-1} and photoionizes the surrounding gas. We observe this source through a dusty torus with a neutral absorbing column density of $N_{\rm H} \sim 2 \times 10^{23}$ cm^{-2}. The torus is hundreds of pc across and collimates the starburst-driven nuclear outflow. We suggest that the ionizing source is an intermediate-mass black hole or a weakly accreting supermassive black hole, which may signal the beginnings or endings of AGN activity.

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ROSAT Blank Field Sources I: Sample Selection and Archival Data

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We have identified a population of 'blank field sources' (or 'blanks') among the *ROSAT* bright unidentified X-ray sources with faint optical counterparts. The extreme X-ray over optical flux ratio of blanks is not compatible with the main classes of X-ray emitters except for extreme BL Lacertae objects.
¿From the analysis of *ROSAT* archival data we found no indication of variability and evidence for only three sources, out of 16, needing absorption in excess of the Galactic value. We also found evidence for an extended nature for only one of the 5 blanks with a serendipitous HRI detection; this source (1WGA J1226.9+3332) was confirmed as a z=0.89 cluster of galaxies. Palomar images reveal the presence of a red ($O - E \geq 2$) counterpart in the X-ray error circle for 6 blanks. The identification process brought to the discovery of another high z cluster of galaxies, one (possibly extreme) BL Lac, two ultraluminous X-ray sources in nearby galaxies and two apparently normal type 1 AGNs. These AGNs, together with 4 more AGN-like objects seem to form a well defined group: they present unabsorbed X-ray spectra but red Palomar counterparts. We discuss the possible explanations for the discrepancy between the X-ray and optical data, among which: a suppressed big blue bump emission, an extreme dust to gas ($\sim 40 - 60$ the Galactic ratio), a high redshift ($z \geq 3.5$) QSO nature, an atypical dust grain size distribution and a dusty warm absorber. These AGN-like blanks seem to be the bright (and easier to study) analogs of the sources which are found in deep *Chandra* observations. Three more blanks have a still unknown nature.

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Multiband VLA Observations of the Faint Radio Core of 3CR 68.1

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The large, powerful Fanaroff-Riley class II radio source 3CR 68.1 is an optically red quasar with strong evidence for dust reddening, intrinsic ultraviolet line absorption, and X-ray absorption. In the context of its large, extended radio structure and the evidence for intrinsic material along the line of sight, it is a good candidate for a quasar seen through the edge of an obscuring torus proposed by unified schemes. The compact radio core coincident with the optical position of the quasar is extremely weak compared to the very bright and luminous radio lobes, suggesting that the radio core might also suffer absorption. We observed 3CR 68.1 at six frequencies and show that the radio core has a flat spectrum with no evidence for free-free absorption or other strong absorption mechanisms. This result helps establish an empirical intrinsic lower range for core-to-lobe radio flux in the most powerful radio sources.

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The Twice-Overlooked, Second FR II Broad Absorption Line Quasar LBQS 1138-0126

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We report the correct classification of an overlooked Fanaroff-Riley class II radio-loud quasar with broad absorption lines, only the second such object so identified. The rare properties of this quasar, LBQS 1138−0126, are twice overlooked. First LBQS 1138−0126 was found in the Large Bright Quasar Survey but only noted as a possible broad absorption line quasar without additional follow-up. Later LBQS 1138−0126 was rediscovered and classified as a radio-loud broad absorption line quasar but not recognized as an FR II radio source. We describe the radio, absorption line, and optical polarization properties of LBQS 1138−0126 and place it in context with respect to related quasars. In particular, spectropolarimetry shows that LBQS 1138−0126 has high continuum polarization increasing from 3% in the red (rest-frame 2400 Å) to over 4% in the blue (rest-frame 1650 Å), essentially confirming the intrinsic nature of the absorption. The polarization position angle rotates from $\sim -30\,\mathrm{deg}$ in the red to $\sim 0\,\mathrm{deg}$ in the blue; the radio lobe position angle is $\sim 52\,\mathrm{deg}$ for comparison. LBQS 1138−0126 is additionally notable for being one of the most radio-loud broad absorption line quasars, and for having low-ionization broad absorption lines as well.

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