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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

XMM-NEWTON Detection of X-ray Emission from the Compact Steep Spectrum Radio Galaxy 3C 303.1

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Using XMM we detect faint unresolved X-ray emission from the Compact Steep Spectrum radio galaxy 3C 303.1. We detect a thermal component at $kT \simeq 0.8$ keV which seems likely to be produced in the ISM of the host galaxy. There is evidence for a second component in the spectrum whose nature is currently ambiguous. Plausible hypotheses for the second component include (1) hot gas shocked by the expansion of the radio source, and (2) Synchrotron self-Compton emission from the southern radio lobe if the magnetic field is below the equipartition value by a factor of ~ 3.5.

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preprint available at http://arxiv.org/abs/astro-ph/0608320

Gemini/GMOS IFU stellar kinematics of the nuclear region of six nearby active galaxies

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We present two-dimensional (2D) mapping of the stellar velocity field within the inner 5 arcsec of six nearby active galaxies, using spectra obtained with the Integral Field Unit of the GMOS instrument at the Gemini North telescope. The sampling of the observations is 0.2 arcsec, corresponding at the galaxies to spatial extents ranging from 10 to 30 pc. The spatial resolution range from 20 to about 180 pc, and the observed field of view covers a few hundred parsecs around the nuclei. The Calcium II triplet absorption features at $\approx$ 8500Å were used to measure the stellar radial velocities and velocity dispersions. The radial velocity fields are dominated by rotation in all galaxies. A simple kinematical model assuming a purely rotating system with circular orbits in a plane was fitted to the radial velocity data. The turnover of the rotation curve is at only $\approx$ 50 pc for NGC 4051 and between 200 and 800 pc for the other 5 galaxies. The velocity dispersion (σ) maps show the largest values ($100 \geq \sigma \geq 150$ km s^{-1}) at the centre. In the cases of NGC 2273 and NGC 3227, there is a decrease to $\sigma \approx 70 - 80$ km s^{-1} at $\approx 200 - 300$ pc from the nucleus, delineating partial rings of low σ values. A similar broken ring seems to be present at $\approx$ 400 pc from the nucleus also in NGC 4593. We interpret these low σ rings as traces of recently formed stars that partially keep the cold kinematics of the original gas from which they have formed. In NGC 3516 there is a decrease of σ outwards with the steepest gradient observed along the direction of the galaxy major axis, where σ reaches $\approx 80 - 90$ km s^{-1} at $\approx$ 400 pc from the nuclei.

The main novelty of the present work is the unprecedented spatial resolution reached by a 2D study of stellar kinematics of Seyfert galaxies using an IFU. The few similar IFU studies available in the literature for Seyfert galaxies have a much poorer spatial resolution and/or are restricted to the study of emission line kinematics.

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Simultaneous Ultraviolet and X-ray Observations of the Seyfert Galaxy NGC 4151. II. Physical Conditions in the UV Absorbers

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We present a detailed analysis, including photoionization modeling, of the intrinsic absorption in the Seyfert 1 galaxy NGC 4151 using ultraviolet (UV) spectra from the *Hubble Space Telescope*/Space Telescope Imaging Spectrograph and the *Far Ultraviolet Spectrographic Explorer* obtained 2002 May as part of a set of contemporaneous observations that included *Chandra*/High Energy Transmission Grating Spectrometer spectra. In our analysis of the *Chandra* spectra, we determined that the X-ray absorption was dominated by two components: a high-ionization absorber, revealed by the presence of H-like and He-like lines of Mg, Si, and S, and a lower-ionization absorber, in which inner-shell absorption lines from lower-ionization species of these elements formed. We identified the latter as the source of the saturated UV lines of O VI, C IV, and N V associated with the absorption feature at a radial velocity of ~ -500 km s^{-1}, which we referred to as component D+E. In the present work, we have derived tighter constrains on the the line-of-sight covering factors, densities, and radial distances of the absorbers. We confirm the presence of the 3 sub-components of D+E described in our previous paper, with line-of-sight covering factors (C_{los}) ranging from $\sim$ 0.5 – 0.9, and find evidence for a fourth component, D+Ed characterized by low ionization and a C_{los} $\sim$ 0.2. The complexity of the UV absorption in NGC 4151 may be a consequence of the fact that we are viewing the black

hole/accretion disk system at a relatively high inclination and, therefore, may be detecting the densest part of the flow. Our deconvolution of the underlying C IV emission indicates that D+E must lie outside the Intermediate Line Region, hence at a radial distance of ~ 0.1 pc. We find that the Equivalent Widths (EWs) of the low-ionization lines associated with D+E varied over the period from 1999 July to 2002 May. Although over part of this time, the variations were correlated with changes in the UV continuum, the drop in the EWs of these lines between 2001 April and 2002 May are suggestive of bulk motion of gas out of our line-of-sight. Over this period, C_{los} for the low-ionization absorption lines dropped from ~ 0.7 to ~ 0.2. If these lines from these two epochs arose in the same sub-component, the transverse velocity of the gas is ≈ 2100 km s^{-1}. This is similar to the constraint on transverse velocity derived from the drop in the X-ray absorbing column between 2000 March and 2002 May. Transverse velocities of this order are consistent with an origin in a rotating disk, at the roughly radial distance we derived for D+E. As we suggested in our previous study, it is likely that the absorption arises in a disk-driven wind.

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preprint available at astro-ph/0608383

The Mass of the Black Hole in the Seyfert 1 Galaxy NGC 4593 from Reverberation Mapping

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We present new observations leading to an improved black hole mass estimate for the Seyfert 1 galaxy NGC 4593 as part of a reverberation-mapping campaign conducted at the MDM Observatory. Cross-correlation analysis of the Hβ emission-line light curve with the optical continuum light curve reveals an emission-line time delay of $\tau_{\rm cent} = 3.73 \pm 0.75$ days. By combining this time delay with the Hβ line width, we derive a central black hole mass of $M_{\rm BH} = (9.8 \pm 2.1) \times 10^6 M_\odot$, an improvement in precision of a factor of several over past results.

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Accretion states and radio loudness in Active Galactic Nuclei: analogies with X-ray binaries

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Hardness-intensity diagrams (HIDs) have been used with great success to study the accretion states and their connection to radio jets in X-ray binaries (XRBs). The analogy between XRBs and active galactic nuclei (AGN) suggests that similar diagrams may help to understand and identify accretion states in AGN and their connection to radio loudness. We construct "disc-fraction luminosity diagrams" (DFLDs) as a generalization of HIDs, which plot the intensity against the fraction of the disc contribution in the overall spectral energy distribution (SED). Using a sample of 4963 Sloan Digital Sky Survey (SDSS) quasars with ROSAT matches, we show empirically that an AGN is more likely to have a high radio:optical flux ratio when it has a

high total luminosity or a large non-thermal contribution to the SED. We find that one has to consider at least two-dimensional diagrams to understand the radio loudness of AGN. To extend our DFLD to lower luminosities we also include a sample of low-luminosity AGN. Using a simulated population of XRBs we show that stellar and supermassive BHs populate similar regions in the DFLD and show similar radio/jet properties. This supports the idea the AGN and XRBs have the same accretion states and associated jet properties.

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Optical and NIR spectroscopy of Mrk 1210: constraints and physical conditions of the active nucleus

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Near-infrared and optical spectroscopy of the nuclear and extended emission region of the Seyfert 2 galaxy Mrk 1210 is presented. This galaxy is outstanding because it displays signatures of recent circumnuclear star formation and a high-level of X-ray activity, in addition to the classical spectral characteristics typical of an AGN. The NIR nuclear spectrum, which covers the interval 0.8–2.4 μm, is dominated by H I and He I recombination lines as well as [S II], [S III] and [Fe II] forbidden lines. Coronal lines of [S VIII], [S IX], [Si VI], [Si X], and [Ca VIII] in addition to molecular H_2 lines are also detected. Outside the nuclear region, extended emission of [S III] and He I is found up to a distance of 500 pc from the center. An estimate of the contribution of the stellar population to the continuum is made by means of the ^{12}CO$(6-3)$ 1.618 μm overtone bandhead. It was found that $83 \pm 8\%$ of the H-band continuum is of stellar origin. It improves previous estimates, which claimed that at least 50% of the observed continuum was attributed to the AGN. The analysis of the emission line profiles, both allowed and forbidden, shows a narrower (FWHM ~ 500 km s^{-1}) line on top of a broad (FWHM $> 1\,000$ km s^{-1}) blue-shifted component. The latter seems to be associated to a nuclear outflow. This hypothesis is supported by 6 cm VLBI observations, which show a radio ejecta extending of up to $\sim$30 pc from the nucleus. This result does not required the presence of a hidden BLR claimed to be present in previous NIR observations of this object. Internal extinction, calculated by means of several indicators including [Fe II] flux ratios not previously used before in AGNs, reveals a dusty AGN, while the extended regions are little or not affected by dust. Density and temperature for the NLR are calculated using optical and NIR lines diagnostic ratios. The results show electronic temperatures from 10 000 K up to 40 000 K and densities between $10^3 - 10^5$ cm^{-3}. The larger temperatures points out that shocks, most probably related to the radio outflow, must contribute to the line emission.

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Testing the inverse-Compton catastrophe scenario in the intra-day variable blazar S5 0716+71: II. A search for intra-day variability at millimetre wavelengths with the IRAM 30 m telescope

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We report on a densely time sampled polarimetric flux density monitoring of the BL Lac object S5 0716+71 at 86 GHz and 229 GHz. The source was observed with the IRAM 30 m telescope at Pico Veleta within a coordinated multi-frequency observing campaign, which was centred around a 500 ks INTEGRAL observation during November 10 to 16, 2003. The aim of this campaign was to search for signatures of inverse-Compton catastrophes through the observation of the broad-band variability of the source.

At 86 GHz, S5 0716+71 showed no intra-day variability, but showed remarkable inter-day variability with a flux density increase of 34 % during the first four observing days, which can not be explained by source extrinsic causes. At this frequency, making use of a new calibration strategy, we reach a relative rms accuracy of the flux density measurements of 1.2 %. Although the flux density variability at 229 GHz was consistent with that at 86 GHz, the larger measurement errors at 229 GHz do not allow us to detect, with high confidence, inter-day variations at this frequency. At 86 GHz, the linear polarization fraction of S5 0716+71 was unusually large (15.0 ± 1.8) %. Inter-day variability in linear polarization at 86 GHz, with significance level $\gtrsim$ **95** %; $\sigma_P / < P >= 15\,\%$ and $\sigma_\chi = 6^\circ$, was observed during the first four observing days. From the total flux density variations at the synchrotron turnover frequency ($\sim$ 86 GHz) we compute an apparent brightness temperature $T_{\rm B}^{\rm app} > 1.4 \times 10^{14}$ K at a redshift of 0.3, which exceeds by two orders of magnitude the inverse-Compton limit. A relativistic correction for $T_{\rm B}^{\rm app}$ with a Doppler factor $\delta > 7.8$ brings the observed brightness temperature down to the inverse Compton limit. A more accurate lower limit of $\delta > 14.0$, consistent with previous estimates from VLBI observations, is obtained from the comparison of the 86 GHz synchrotron flux density and the upper limits for the synchrotron self-Compton flux density obtained from the INTEGRAL observations. The relativistic beaming of the emission by this high Doppler factor explains the non-detection of “catastrophic” inverse-Compton avalanches by INTEGRAL.

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The milliarcsecond-scale jet of PKS 0735+178 during quiescence

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We present polarimetric 5 GHz to 43 GHz VLBI observations of the BL Lacertae object PKS 0735+178, spanning March 1996 to May 2000. Comparison with previous and later observations suggests that the overall kinematic and structural properties of the jet are greatly influenced by its activity. Time intervals of enhanced activity, as reported before 1993 and after 2000 by other studies, are followed by highly superluminal motion along a rectilinear jet. In contrast the less active state in which we performed our observations, shows subluminal or slow superluminal jet features propagating through a twisted jet with two sharp bends of about 90° within the innermost three–milliarcsecond jet structure. Proper motion estimates from the data presented here allow us to constrain the jet viewing angle to values $\leq 9^\circ$, and the bulk Lorentz factor to be between 2 and 4.

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