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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

Investigating the central engine of Seyfert 2 galaxies with and without Polarized Broad Lines

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We study the hard X-ray emission of two samples of Seyfert 2 galaxies with and without Polarized Broad Lines (PBL). In the hard X-ray domain, absorption effects do not significantly modify the intrinsic emission allowing us a direct access to the central engine. The purpose of this study is to compare the primary emission of the two Seyfert 2 subclasses in order to investigate the nature of their central engine and to test unified models according to which they both have a hidden Seyfert 1 nucleus. We compute the average hard X-ray spectra of Seyfert 2 galaxies with and without PBL observed with BeppoSAX/PDS (15-136 keV). The two spectra have a common general behavior at first sight, but investigating deeper we find differences in the intrinsic properties of the two categories of Seyfert 2 galaxies. Sy 2 with polarized broad lines have physical conditions close to those of Sy 1 galaxies whereas Sy 2 without PBL differ substantially, suggesting that they may have a particular place in the scheme of Seyfert galaxies.

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available at http://www.edpsciences.org/articles/aa/abs/2004/07/aa3902/aa3902.html

Sub-milliarcsecond Imaging of Quasars and Active Galactic Nuclei III. Kinematics of Parsec-Scale Radio Jets

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We report the results of a 15 GHz (2 cm) multi-epoch VLBA program, begun in 1994 to study the outflow in radio jets ejected from quasars and active galaxies. The observed flow of 208 distinct features measured in 110 quasars, active galaxies, and BL Lac objects shows highly collimated relativistic motion with apparent transverse velocities typically between zero and about 15c, with a tail extending up to about 34c. Within individual jets, different features appear to move with a similar characteristic velocity which may represent an underlying continuous jet flow, but we also see some stationary and even apparently inward moving features which co-exist with the main features. Comparison of our observations with published data at other wavelengths suggests that there is a systematic decrease in apparent velocity with increasing wavelength, probably because the observations at different wavelengths sample different parts of the jet structure.

The observed distribution of linear velocities is not consistent with any simple ballistic model. Either there is a rather broad range of Lorentz factors, a significant difference between the velocity of the bulk relativistic flow and the pattern speed of underlying shocks, or a combination of these options. Assuming a ballistic flow, comparison of observed apparent velocities and Doppler factors computed from the time scale of flux density variations is consistent with a steep power law distribution of intrinsic Lorentz factors, an isotropic distribution of orientations of the parent population, and intrinsic brightness temperatures about an order of magnitude below the canonical inverse Compton limit. It appears that the parent population of radio jets is not dominated by highly relativistic flows, and contrary to the assumption of simple unified models, not all sources have intrinsic speeds close to c.

Usually, the observed jet flow is in the general direction of an established jet. However, many jets show significant bends and twists, where the observed motions are non-radial, but are alingned with the local jet direction suggesting that the jet flow occurs along pre-existing bent channels. In a few cases we have observed a clear change in the direction of a feature as it flows along the jet. Radio jets which are also strong gamma-ray sources detected by EGRET appear to have significantly faster speeds than the non EGRET sources, consistent with the idea that gamma ray sources have larger Doppler factors than non gamma-ray sources. Sources at high redshift have systematically lower angular speeds than low redshift jets, consistent with standard cosmologies.

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The Gamma-ray bright BL Lac object RX J1211+2242

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RX J1211+2242 is an optically faint ($B \simeq 19.2\,\mathrm{mag}$) but X-ray bright ($f_{2-10\,\mathrm{keV}} = 5 \times 10^{-12}\,\mathrm{erg\,cm^{-2}\,s^{-1}}$) AGN, which has been shown to be a BL Lac object at redshift $z = 0.455$. The *ROSAT* X-ray, Calar Alto optical, and NVSS radio data suggest that the peak of the synchrotron emission of this object is at energies as high as several keV. *BeppoSAX* observations have been carried out simultaneously with optical observations in order to extend the coverage to higher energies. The new data indeed indicate a turn-over in the $2-10\,\mathrm{keV}$ energy region. We propose that RX J1211+2242 is the counterpart of the unidentified EGRET source 3EG J1212+2304, making it a gamma-ray emitter with properties similar to, for example, Markarian 501 in its bright state, though being at a much larger distance.

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VLT spectropolarimetry of two powerful radio galaxies at $z \sim 1.4$: UV continuum, emission-line properties and the nature of high-redshift dust

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Deep spectropolarimetric observations, obtained with the Very Large Telescope (VLT), are presented for two powerful radio galaxies, 0850–206 (z=1.3373) and 1303+091 (z=1.4093). These observations cover the rest-frame wavelength range $\sim 1450-3750$ Å. New radio observations and continuum images of the same sources are also presented. These galaxies are the first two observed from a complete sample of nine radio sources with redshifts in the range $1.3 \leq z \leq 1.5$ (selected from the equatorial sample of powerful radio sources of Best, Röttgering & Lehnert), as part of a project aimed to investigate the multi-component nature of the UV continuum in radio galaxies and, in particular, any variations of the continuum properties with the radio source age.

The larger radio source of the two, 0850–206, presents a high continuum fractional polarization, averaging 17 per cent across the observed wavelength range and reaching 24 per cent at rest-frame wavelengths of $\lesssim 2000$ Å. The smaller radio source, 1303+091, shows a lower continuum polarization, averaging 8 per cent and rising to 11 per cent for rest-frame wavelengths $\gtrsim 3000$ Å. For both galaxies, the position angle of the electric vector is generally constant with wavelength and within $\sim 15°$ of perpendicular to the radio axis. Both their total flux spectra and polarized flux spectra reveal the 2200 Å dust feature, and comparison with dust scattering models suggests that the composition of the dust in these galaxies is similar to that of Galactic dust. In 0850–206, scattered quasar radiation dominates the UV continuum emission, with the nebular continuum accounting for no more than ~ 22 per cent and no requirement for any additional emission component such as emission from young stars. By contrast, in 1303+091, unpolarized radiation could be a major constituent of the UV continuum emission, with starlight accounting for up to ~ 50 per cent and the nebular continuum accounting for ~ 11 per cent.

The emission-line properties of the galaxies are also studied from their total intensity spectra. Comparison of the measured emission-line ratios with both shock- and photo-ionization models shows that the nuclear and extended gas in these galaxies is mainly photoionized by the central active nucleus.

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Jet evolution, flux ratios and light-travel time effects

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Studies of the knotty jets in both quasars and microquasars frequently make use of the ratio of the intensities of corresponding knots on opposite sides of the nucleus to infer the product of the intrinsic jet speed ($\beta_{\rm jet}$) and the cosine of the angle the jet-axis makes with the line-of-sight ($\cos\theta$), via the formalism $I_{\rm a}/I_{\rm r} = ((1+\beta_{\rm jet}\cos\theta)/(1-\beta_{\rm jet}\cos\theta))^{3+\alpha}$, where α relates the intensity I_ν as a function of frequency ν as $I_\nu \propto \nu^{-\alpha}$. In the cases where $\beta_{\rm jet}\cos\theta$ is determined independently, it is found that the intensity ratio of a given pair of jet to counter-jet knots is over-predicted by the above formalism compared with that actually measured from radio images. As an example in the case of the microquasar Cygnus X-3 the original formalism predicts an intensity ratio of $\sim$ 185, whereas the observed ratio at one single epoch is $\sim$ 3. Mirabel & Rodríguez have presented a refined approach to the original formalism which involves measuring the intensity ratio of knots when they are at equal angular separations from the nucleus. This method is however only applicable where there is sufficient time-sampling (with sufficient physical resolution) of the fading of the jet-knots so that interpolation of their intensities at equal distances from the nucleus is possible. It can therefore be difficult to apply to microquasars and is impossible to apply to quasars. We demonstrate that inclusion of two indisputable physical effects: (i) the light-travel time between the knots and (ii) the simple evolution of the knots themselves (e.g. via adiabatic expansion) reconciles this over-prediction (in the case of Cygnus X-3 quoted above, an intensity ratio of $\sim$ 3 is predicted) and renders the original formalism obsolete.

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X-ray Survey Results on Active Galaxy Physics and Evolution

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This "pedagogical" review describes the key Chandra and XMM-Newton extragalactic surveys to date and details some of their implications for AGN physics and evolution. We additionally highlight two topics of current widespread interest: (1) X-ray constraints on the AGN content of luminous submillimeter galaxies, and (2) the demography and physics of high-redshift ($z > 4$) AGN as revealed by X-ray observations. Finally, we discuss prospects for future X-ray surveys with Chandra, XMM-Newton, and upcoming missions.

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VLTI/VINCI observations of the nucleus of NGC 1068 using the adaptive optics system MACAO

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We present the first near-infrared K-band long-baseline interferometric measurement of the nucleus of the prototype Seyfert 2 Galaxy NGC 1068 with resolution $\lambda/B \sim 10$ mas obtained with the Very Large Telescope Interferometer (VLTI) and the two 8.2 m diameter Unit Telescopes UT 2 and UT 3. The adaptive optics system MACAO (Multi Application Curvature Adaptive Optics) was employed to deliver wavefront-corrected beams to the K-band commissioning instrument VINCI. A squared visibility amplitude of 16.3 ± 4.3 % was measured for NGC 1068 at a sky-projected baseline length of 45.8 m and azimuth angle 44.9 deg. This value corresponds to a FWHM of the K-band intensity distribution of 5.0 ± 0.5 mas (0.4 ± 0.04 pc at the distance of NGC 1068) if it consists of a single Gaussian component. Taking into account K-band speckle interferometry observations (Wittkowski et al. 1998; Weinberger et al. 1999; Weigelt et al. 2004), we favor a multi-component model for the intensity distribution where a part of the flux originates from scales clearly smaller than ~ 5 mas (< 0.4 pc), and another part of the flux from larger scales. The K-band emission from the small (< 5 mas) scales might arise from substructure of the dusty nuclear torus, or directly from the central accretion flow viewed through only moderate extinction.

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Motion and Properties of Nuclear Radio Components in Seyfert Galaxies Seen with VLBI

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We report EVN, MERLIN and VLBA observations at 18 cm, 6 cm and 3.6 cm of the Seyfert galaxies NGC 7674, NGC 5506, NGC 2110 and Mrk 1210 to study their structure and proper motions on pc scales and to add some constraints on the many possible causes of the radio-quietness of Seyferts. The component configurations in NGC 7674 and NGC 2110 are simple, linear

structures, whereas the configurations in NGC 5506 and Mrk 1210 have multiple components with no clear axis of symmetry. We suggest that NGC 7674 is a low-luminosity compact symmetric object. Comparing the images at different epochs, we find a proper motion in NGC 7674 of (0.92 ± 0.07) c between the two central components separated by 282 pc and, in NGC 5506, we find a 3 σ upper limit of 0.50 c for the components separated by 3.8 pc. Our results confirm and extend earlier work showing that the outward motion of radio components in Seyfert galaxies is non-relativistic on pc scales. We briefly discuss whether this non-relativistic motion is intrinsic to the jet-formation process or results from deceleration of an initially relativistic jet by interaction with the pc or sub-pc scale interstellar medium. We combined our sample with a list compiled from the literature of VLBI observations made of Seyfert galaxies, and found that most Seyfert nuclei have at least one flat-spectrum component on the VLBI scale, which was not seen in the spectral indices measured at arcsec resolution. We found also that the bimodal alignment of pc and kpc radio structures displayed by radio galaxies and quasars is not displayed by this sample of Seyferts, which shows a uniform distribution of misalignment between 0° and 90°. The frequent misalignment could result from jet precession or from deflection of the jet by interaction with gas in the interstellar medium.

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High resolution imaging of the radio continuum and neutral gas in the inner kiloparsec of the radio galaxy 3C 293

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Using a combination of observations involving the VLA, MERLIN and global VLBI networks we have made a detailed study of the radio continuum and the neutral hydrogen (HI) kinematics and distribution within the central kiloparsec of the radio galaxy 3C 293. These observations trace the complex jet structure and identify the position of the steeply inverted radio core at 1.3 GHz.

Strong HI absorption is detected against the majority of the inner kiloparsec of 3C 293. This absorption is separated into two dynamically different and spatially resolved systems. Against the eastern part of the inner radio jet narrow HI absorption is detected and shown to have higher optical depths in areas co-spatial with a central dust lane. Additionally, this narrow line is shown to follow a velocity gradient of $\sim$50 km s^{-1} arcsec^{-1}, consistent with the velocity gradient observed in optical spectroscopy of ionised gas. We conclude that the narrow HI absorption, dust and ionised gas are physically associated and situated several kiloparsecs from the centre of the host galaxy. Against the western jet emission and core component, broad and complex HI absorption is detected. This broad and complex absorption structure is discussed in terms of two possible interpretations for the gas kinematics observed. We explore the possibility that these broad, double absorption spectra are the result of two gas layers at different velocities and distances along these lines of sight. A second plausible explanation for this absorbing structure is that the HI is situated in rotation about the core of this radio galaxy with some velocity dispersion resulting from in-fall and outflow of gas from the core region. If the latter explanation were correct, then the mass enclosed by the rotating disk would be at least 1.7×10^9 solar masses within a radius of 400 pc.

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Mkn 1239: A highly polarized NLS1 with a steep X-ray spectrum and strong NeIX emission

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We report the results of an XMM-Newton observation of the Narrow-Line Seyfert 1 galaxy Mkn 1239. This optically highly polarized AGN has one of the steepest X-ray spectra found in AGN with α_X=3.0 based on ROSAT PSPC data. The XMM-Newton EPIC PN and MOS data confirm this steep X-ray spectrum. The PN data are best-fit by a powerlaw with a partial covering absorption model suggesting two light paths between the continuum source and the observer, one indirect scattered one which is less absorbed and a highly absorbed direct light path. This result agrees with the wavelength dependent degree of polarization in the optical/UV band. Residuals in the X-ray spectra of all three XMM-Newton EPIC detectors around 0.9 keV

suggest the presence of an emission line feature, most likely the Ne IX triplet. The detection of NeIX and the non-detection of OVII/OVIII suggest a super-solar Ne/O ratio.

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preprint available at http://arxiv.org/abs/astro-ph/0401167

Announcements

Network for UltraViolet Astrophysics (N.U.V.A.)

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We want to draw your attention to the recently formed **Network for UltraViolet Astrophysics (N.U.V.A.)** which has been established within the context of the OPTICON network of the European Union. The objectives of NUVA are to formulate and operate a UV astronomy network, with the intention to design a roadmap for the future needs of observational capabilities in the Ultraviolet. With the suppression of SM4 the possibilities for the acquisition of ultraviolet observations can be foreseen to be quite limited. As the UV domain is relevant for many different realms of Astrophysics, the NUVA board has constituted itself to represent a broad range of science covered. To start a proper discussion we invite the AGN community to express support for the NUVA and share with us the concerns you might have for the future of AGN research. To execute the road mapping exercise, NUVA activities will, during the next 18 months, be concentrated on a critical assessment of the publicly available information in various archives and an exploratory analysis to define the scientific requirements for the future. This is a completely open field since no in depth review has ever been made in a broad European context. NUVA will map the future needs in all fields of ultraviolet astronomy and you are herewith kindly invited to participate in this network and to send us comments and suggestions if you are interested in UV imaging and spectroscopy of Active Galactic Nuclei.

For further details see: http://www.mat.ucm.es/∼aig/NUVA/

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