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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.

As always as editor of the newsletter I am very interested to hear any suggestions or feedback regarding the newsletter. So do not hesitate in emailing me your suggestions.

Many thanks for your continued subscription.

Rob Beswick

Retardation magnification and the appearance of relativistic jets

Sebastian Jester

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Thanks to the availability of high-resolution high-sensitivity telescopes such as the Very Large Array, the *Hubble Space Telescope*, and the *Chandra X-ray Observatory*, there is now a wealth of observational data on relativistic jets from active galactic nuclei (AGN) as well as galactic sources such as Black-Hole X-ray Binaries. Since the jet speeds cannot be constrained well from observations, but are generally believed to be relativistic, physical quantities inferred from observables are commonly expressed in terms of the unknown beaming parameters: the bulk Lorentz factor and the line-of-sight angle, usually in their combination as relativistic Doppler factor. This paper aims to resolve the discrepancies existing in the literature about such "de-beaming" of derived quantities, in particular regarding the minimum-energy magnetic field estimate. The discrepancies arise because the distinction is not normally made between the case of a fixed source observed with different beaming parameters and the case where the source projection on the sky is held fixed. The former is usually considered, but it is the latter that corresponds to interpreting actual jet observations. Furthermore, attention is drawn to the fact that apparent superluminal motion has a spatial corollary, here called "retardation magnification", which implies that most parts of a relativistic jet that are actually present in the observer's frame (a "world map" in relativity terminology) are in fact hidden on the observer's image (the "world picture" in general, or "supersnapshot" in the special case of astronomy).

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E-mail contact: jester@mpia.de,
preprint available at http://arxiv.org/abs/0806.3798

The Fate of Young Radio Galaxies: Decelerations Inside Host Galaxies?

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We examine the evolution of variously-sized radio galaxies [i.e., compact symmetric objects (CSOs), medium-size symmetric objects (MSOs), Fanaroff-Riley type II radio galaxies (FRIIs)], by comparing the relation between the hot spot size and the projected linear size with a coevolution model of hot spots and a cocoon. We take account of the deceleration effect by the cocoon head growth. We find that the advance speed of hot spots and lobes inevitably show the deceleration phase (CSO-MSO phase) and the acceleration phase (MSO-FRII phase). This is ascribed to the change of the power-law index of ambient density profile in the MSO phase (∼1 kpc). It is also found that the cocoon shape becomes nearly spherical or disrupted for MSOs, while an elongated morphology is predicted for CSOs and FRIIs. This seems to be consistent with the higher fraction of distorted morphology of MSOs than that of CSOs and FRIIs. Finally, we predict that only CSOs whose initial advance speed is higher than about 0.1c can evolve into FRIIs, comparing the hot spot speed with the sound speed of the ambient medium.

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E-mail contact: kawakatu@th.nao.ac.jp,
preprint available at astro-ph/0807.2103

Steep-Spectrum Radio Emission from the Low-Mass Active Galactic Nucleus GH 10

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GH 10 is a broad-lined active galactic nucleus (AGN) energized by a black hole of mass 800,000 $M_\odot$. It was the only object detected by Greene et al. in their Very Large Array (VLA) survey of 19 low-mass AGNs discovered by Greene & Ho. New VLA imaging at 1.4, 4.9, and 8.5 GHz reveals that GH 10's emission has an extent of less than 320 pc, has an optically-thin synchrotron spectrum with a spectral index $\alpha = -0.76 \pm 0.05$ ($S_\nu \propto \nu^{+\alpha}$), is less than 11% linearly polarized, and is steady - although poorly sampled - on timescales of weeks and years. Circumnuclear star formation cannot dominate the radio emission, because the high inferred star formation rate, 18 $M_\odot$ yr^{-1}, is inconsistent with the rate of less than 2 $M_\odot$ yr^{-1} derived from narrow Hα and [O II] λ3727 emission. Instead, the radio emission must be mainly energized by the low-mass black hole. GH 10's radio properties match those of the steep-spectrum cores of Palomar Seyfert galaxies, suggesting that, like those Seyferts, the emission is outflow-driven. Because GH 10 is radiating close to its Eddington limit, it may be a local analog of the starting conditions, or seeds, for supermassive black holes. Future imaging of GH 10 at higher linear resolution thus offers an opportunity to study the relative roles of radiative versus kinetic feedback during black-hole growth.

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Quasar Host Galaxies in the FORS Deep Field

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The evolution of quasar host galaxies is still hardly studied at high redshifts ($z > 2$), although this is a very interesting redshift range as both the quasar activity and the star formation rate density have their peak at $z \approx 2$–3. This makes is especially interesting to study properties of quasar host galaxies, such as the star formation rate or the black hole mass at this redshift. A proper classification of quasar host galaxies at high redshift would help to answer the question which role quasars play in galaxy evolution. In this paper we study different properties of quasars and their host galaxies at high redshifts up to $z \approx 3.4$. We compare our results to those of other authors and discuss the correlation between galaxy evolution and quasar activity. We analysed broad-band images in eight filters (from U to K) of eight quasars in the FORS Deep Field with redshifts between $z = 0.87$ and $z = 3.37$. A fully 2-dimensional decomposition was carried out to detect and resolve the host galaxies. Using the magnitudes in different filters, we investigated the presumed galaxy type, galaxy age, star formation rate and the mass of the central black hole of the host galaxies. In addition, the masses of the central black hole for the whole sample were derived using the corresponding quasar spectra. We were able to resolve the host galaxies of two out of eight quasars between $z = 0.87$ and $z = 2.75$. Additionally, two host galaxies were possibly resolved. The resolved low-redshift quasar ($z = 0.865$) was identified as a late type galaxy with a moderate star formation rate of $1.8 M_\odot/yr$ hosting a supermassive black hole with a mass of $\lesssim 10^8 M_\odot$.

The resolved high redshift host galaxy ($z = 2.7515$) shows moderate star formation of 4.4–6.9$M_\odot/yr$, for the black hole mass we found a lower limit of $> 10^7 M_\odot$. All quasars host supermassive black hole with masses in the range $\sim 10^7$–$10^9 M_\odot$. Our findings are well consistent with those of other authors.

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E-mail contact: carovi@utu.fi
preprint available at http://arxiv.org/abs/0807.1091

Tracing jet–ISM interaction in young AGN: correlations between [OIII] 5007 and 5-GHz emission

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*AIMS: To study the interaction between young AGN and their host galaxies based on their ionized gas and radio emission, and to analyze possible implications for the radio galaxy evolution. *METHODS: The [OIII] 5007 line and 5-GHz radio properties are compared and studied on a large, representative sample of GPS and CSS (i.e., young) quasars and radio galaxies as well as large-scale sources using [OIII] 5007 line and 5-GHz radio data from literature and our observations. *RESULTS: Several correlations between the [OIII] 5007 line and 5-GHz radio emission have been found. The main result is that the [OIII] 5007 emission is strongly related to the GPS/CSS source size indicating that the [OIII] 5007 emission is clearly enhanced by the jet expansion through the host galaxy ISM. Shocks are the most likely enhancing mechanism, although jet-induced star formation could also be, partly, responsible for the [OIII] 5007 emission. The data also suggests a possible deceleration of the jet as it grows. In this case, however, the correlation is weak.

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E-mail contact: labiano@damir.iem.csic.es,
preprint available at http://xxx.lanl.gov/abs/0807.2230

An Offset Seyfert 2 Nucleus in the Minor Merger System NGC 3341

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We present the discovery of a triplet of emission-line nuclei in the disturbed disk galaxy NGC 3341, based on archival data from the Sloan Digital Sky Survey and new observations from the Keck Observatory. This galaxy contains two offset nuclei within or projected against its disk, at projected distances of 5.1 and 8.4 kpc from its primary nucleus and at radial velocity separation of less than 200 km s^{-1} from the primary. These appear to be either dwarf ellipticals or the bulges of low-mass spirals whose disks have already been stripped off while merging into the primary galaxy. The inner offset nucleus has a Seyfert 2 spectrum and a stellar velocity dispersion of 70 ± 7 km s^{-1}. The outer offset nucleus has very weak emission lines consistent with a LINER classification, and the primary nucleus has an emission-line spectrum close to the boundary between LINER/H II composite systems and H II nuclei; both may contain accreting massive black holes, but the optical classifications alone are ambiguous. The detection of an offset active nucleus in NGC 3341 provides a strong suggestion that black hole accretion episodes during minor mergers can be triggered in the nuclei of dwarf secondary galaxies as well as in the primary.

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E-mail contact: barth@uci.edu,
preprint available at http://arxiv.org/abs/0807.3314

Low-Mass Seyfert 2 Galaxies in the Sloan Digital Sky Survey

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We describe a sample of low-mass Seyfert 2 galaxies selected from the Sloan Digital Sky Survey, having a median absolute magnitude of $M_g = -19.0$ mag. These galaxies are Type 2 counterparts to the Seyfert 1 galaxies with intermediate-mass black holes identified by Greene & Ho (2004). Spectra obtained with the *Echellette Spectrograph and Imager* at the Keck Observatory are used to determine the central stellar velocity dispersions and to examine the emission-line properties. Overall, the stellar velocity dispersions are low ($\sim 40 - 90$ km s^{-1}), and we find 12 objects having $\sigma < 60$ km s^{-1}, a range where very few Seyfert 2 galaxies were previously known. The sample follows the correlation between stellar velocity dispersion and FWHM([O III]) seen in more massive Seyfert galaxies, indicating that the narrow-line FWHM values are largely determined by virial motion of gas in the central regions of the host galaxies, but the [O III] emission lines exhibit a higher incidence of redward asymmetries and double-peaked profiles than what is found in typical Seyfert samples. Using estimates of the black hole masses and AGN bolometric luminosities, we find that these galaxies are typically radiating at a high fraction of their Eddington rate, with a median $L_{\rm bol}/L_{\rm Edd} = 0.4$. We identify one galaxy, SDSS J110912.40+612346.7, as a Type 2 analog of the nearby dwarf Seyfert 1 galaxy NGC 4395, with a nearly identical narrow-line spectrum and a dwarf spiral host of only $M_g = -16.8$ mag. The close similarities between these two objects suggest that the obscuring torus of AGN unification models may persist even at the lowest luminosities seen among Seyfert galaxies, below $L_{\rm bol} = 10^{41}$ ergs s^{-1}. Spectropolarimetry observations of four objects do not reveal any evidence for polarized broad-line emission, but SDSS J110912.40+612346.7 has a continuum polarization significantly in excess of the expected Galactic foreground polarization, possibly indicative of scattered light from a hidden nucleus. Forthcoming observations of this sample, including X-ray and mid-infrared spectroscopy, can provide new tests of the obscuring torus model for active galaxies at low luminosities.

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E-mail contact: barth@uci.edu,
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On reverberation and cross-correlation estimates of the size of the broad-line region in active galactic nuclei

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It is known that the dependence of the emission-line luminosity of a typical cloud in the active galactic nuclei broad-line regions (BLRs) upon the incident flux of ionizing continuum can be nonlinear. We study how this nonlinearity can be taken into account in estimating the size of the BLR by means of the "reverberation" methods. We show that the BLR size estimates obtained by cross-correlation of emission-line and continuum light curves can be much (up to an order of magnitude) less than the values obtained by reverberation modelling. This is demonstrated by means of numerical cross-correlation and reverberation experiments with model continuum flares and emission-line transfer functions and by means of practical reverberation modelling of the observed optical spectral variability of NGC 4151. The time behaviour of NGC 4151 in the Hα and Hβ lines is modelled on the basis of the observational data by Kaspi *et al.* (1996, ApJ, 470, 336) and the theoretical BLR model by Shevchenko (1984, Sov. Astron. Lett., 10, 377; 1985, Sov. Astron. Lett., 11, 35). The values of the BLR parameters are estimated that allow to judge on the size and physical characteristics of the BLR. The small size of the BLR, as determined by the cross-correlation method from the data of Kaspi *et al.* (1996, ApJ, 470, 336), is shown to be an artefact of this method. So, the hypothesis that the BLR size varies in time is not necessitated by the observational data.

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preprint available at http://arxiv.org/pdf/0705.0583v2

Disk-outflow Connection and the Molecular Dusty Torus

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Toroidal obscuration is a keystone of AGN unification. There is now direct evidence for the torus emission in infrared, and possibly water masers. Here I summarize the torus properties, its possible relation to the immediate molecular environment of the AGN and present some speculations on how it might evolve with the AGN luminosity.

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The Large-Scale Atomic and Molecular Gas in the Circinus Galaxy

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We have used the Australia Telescope Compact Array (ATCA) and the Swedish-ESO Sub-millimetre Telescope (SEST) to map the large-scale atomic and molecular gas in the nearby (4 Mpc) Circinus galaxy. The ATCA H I mosaic of Circinus exhibits the warps in position angle and inclination revealed in the single-pointing image of Jones et al. (1999), both of which appear to settle beyond the inner 30 kpc which was previously imaged. The molecular gas has been mapped in both the CO $J = 1 \rightarrow 0$ and $J = 2 \rightarrow 1$ transitions down to a column density of $N_{\rm H_2} \gtrsim 10^{21}$ cm^{-2} (3σ), where we derive a total molecular gas mass of $M_{\rm H_2} \approx 2 \times 10^9$ M$_\odot$. Within a radius of 3 kpc, i.e. where CO was clearly detected, the molecular fraction climbs steeply from ≈ 0.7 to unity (where $N_{\rm H_2} = 4 \times 10^{22}$ cm^{-2}, cf. $N_{\rm HI} = 10^{21}$ cm^{-2}) with proximity to the nucleus. Our H I mosaic gives an atomic gas mass of $M_{\rm HI} \approx 6 \times 10^9$ M$_\odot$, which is 70% of the fully mapped single dish value. Combining the atomic and molecular gas masses gives a total gas mass of $M_{\rm gas} \equiv M_{\rm HI} + M_{\rm H_2} \approx 1 \times 10^{10}$ M$_\odot$, cf. the total dynamical mass of $\approx 3 \times 10^{11}$ M$_\odot$ within the inner 50 kpc of our mosaiced image. The total neutral gas mass to dynamical mass ratio is therefore 3%, consistent with the SAS3 classification of Circinus. The high (molecular) gas mass fraction of $M_{\rm H_2}/M_{\rm dyn} \approx 50\%$ found previously (Curran et al. 1998), only occurs close to the central ≈ 0.5 kpc and falls to $\lesssim 10\%$ within and outwith this region, allaying previous concerns regarding the validity of applying the Galactic $N_{\rm H_2}/I_{\rm CO}$ conversion ratio to Circinus. The rotation curve, as traced by both the H I and CO, exhibits a steep dip at ≈ 1 kpc, the edge of the atomic/molecular ring, within which the star-burst is occurring. We find the atomic and molecular gases to trace different kinematical features and believe that the fastest part ($\gtrsim 130$ km s^{-1}) of the sub-kpc ring consists overwhelmingly of molecular gas. Beyond the inner kpc, the velocity climbs to settle into a solid body rotation of ≈ 150 km s^{-1} at $\gtrsim 10$ kpc. Most of the starlight emanates from within this radius and so much of the dynamical mass, which remains climbing to the limit of our data ($\gtrsim 50$ kpc), must be due to the dark matter halo.

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Where is the Cold Neutral Gas in the Hosts of High Redshift AGN?

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Previous surveys for H I 21-cm absorption in $z > 0.1$ radio galaxies and quasars yield a $\approx 40\%$ detection rate, which is attributed to unified schemes of active galactic nuclei (AGN). In this paradigm absorption is only witnessed in (close to) type-2 objects, where the central obscuration is viewed (nearly) edge-on and thus absorbs the rest frame 1420 MHz emission along our sight-line. However, we find this mix of detections and non-detections to only apply at low redshift ($z < 1$): From a sensitive survey of eight $z \gtrsim 3$ radio sources we find no 21-cm absorption, indicating a low abundance of cold neutral gas in (the sight-lines searched in) these objects. Analysing the spectral energy distributions of these sources, we find that our high redshift selection introduces a bias where our sample consists exclusively of quasars with ultra-violet luminosities in excess of $L_{\rm UV} \sim 10^{23}$ W Hz^{-1}. This may suggest that we have selected a class of particularly UV bright type-1 objects. Whatever the cause, it must also be invoked to explain the non-detections in an equal number of $z < 0.7$ sources, where we find, for the first time, the same exclusive non-detections at $L_{\rm UV} \gtrsim 10^{23}$ W Hz^{-1}. These objects also turn out to be quasars and, from these exclusive high UV

luminosity–21-cm non-detections, it is apparent that orientation effects alone cannot account for the mix of 21-cm detections and non-detections at any redshift.

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E-mail contact: sjc@phys.unsw.edu.au,
DRAFT is available at http://arxiv.org/abs/0807.4983

Conference proceedings for "The Central Kiloparsec, Active Galactic Nuclei and Their Hosts", Ierapetra, Crete. 4-6 June 2008

Jobs

A post-doc position in the Jagiellonian University in Cracow (Poland)

July 25th, 2008

Jagiellonian University invites applications for the post-doc position - with teaching duties - in the High Energy Astrophysics Department of Astronomical Observatory. The successful candidate will work in the high energy astrophysics group led by Prof. Michal Ostrowski on one or more subjects including theoretical and observational studies of cosmic ray acceleration processes, relativistic jets and accretion flows onto the compact objects, X-ray and gamma ray studies of the astrophysical objects. The Department participates in the high energy gamma ray HESS experiment and is involved in developing of the CTA project.

The candidates with a PhD degree in Physics or Astronomy can apply **till the end of August 2008**. The post-doc ("assistant") position requires participation in teaching students (210 hours/year). The salary is at the level of the university assistant salary, not very high but sufficient to cover living expenses in Poland. The duration of the position is 1 year with extension possibility for 2 additional years.

The application send by e-mail to Prof. M. Ostrowski should include an introductory applicant letter, a detailed CV, a publication list, a short description of the candidate scientific carrier and his research interests, e-mail addresses of two scientists who agree to provide him reference letters.

E-mail contact: mio@oa.uj.edu.pl

Opportunities to apply for STFC advanced and postdoctoral fellowships at the University of Manchester

WEBSITE:http://www.jb.man.ac.uk/fellowships.html

The Jodrell Bank Centre for Astrophysics invites applications from candidates wishing to be considered for an STFC Advanced or Postdoctoral Fellowship to be based in the School of Physics and Astronomy at the University of Manchester.

STFC expects to award a number of 3 and 5-years fellowships, to be held at UK institutions. The 3-year positions are at postdoctoral level; the 5-year positions are expected to lead to a permanent position.

Candidates can only apply on behalf of one UK institution, and need to first apply to the proposed host to obtain support, before applying to STFC. Each prospective host may only support a limited a number of applicants.

The JBCA is one of the largest astronomy groups in the UK, with 26 permanent academic staff. It operates the Jodrell Bank Observatory and MERLIN, and hosts the international headquarters for the SKA project. e-MERLIN will become operational during 2009. The UK ALMA regional centre is expected to be hosted in Manchester. Active research areas in Manchester range from cosmology to planets, with particular strengths in pulsars, gravitational lensing, CMB (Planck, CLOVER), dust and astrochemistry, star formation, and solar astronomy. There is also an active instrumentation group spanning the wavelength range from sub-mm to centimeter. Observational interests further include the JCMT, the VLT and the VLTI.

Applications are welcomed within any of the research activities of the JBCA. We are especially interested in people wishing to make use of e-Merlin, ALMA and/or SCUBA-2. Science areas of particular interest are star formation at high redshift, and planet building.

Deadlines

- 1 September 2008: Receipt of application
- 8 September 2008: Decisions on endorsement by the School
- 15 October 2008: Receipt of full application at the STFC

Informal enquiries for astronomy and astrophysics may be made to Prof. Albert Zijlstra, email: a.zijlstra@manchester.ac.uk, Tel: 0161-3063925, after Aug 18

Applications should include a full curriculum vitae a brief description of your proposed research project (max 2 sides A4), and names of three referees, and may be sent before 1st September 2008 to:- lisa.mcdermott@manchester.ac.uk, with a cc: to sabina.a.hawthornthwaite@manchester.ac.uk,

or by post to the address below

Lisa McDermott
Jodrell Bank Center for Astrophysics
Alan Turing Building
School of Physics & Astronomy
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You will be contacted by 8th September 2008 as to whether your application will be endorsed by the School. If you are succesful, we will work with you on the proposed research plan.

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://www.manchester.ac.uk/jodrellbank/~agnews
If you move or your e-mail address changes, please send the editor your new address. If the Newsletter repeatedly bounces back from an address then that address is deleted from the mailing list.