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Accepted Abstracts - Submitted Abstracts - Thesis Abstracts
Jobs Adverts - Meetings Adverts - Special Announcements

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

Abstracts of recently accepted papers

Are galaxies with active galactic nuclei a transition population?

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We present the results of an analysis of a well-selected sample of galaxies with active and inactive galactic nuclei from the Sloan Digital Sky Survey, in the range $0.01 < z < 0.16$. The SDSS galaxy catalogue was split into two classes of active galaxies, Type 2 active galactic nuclei (AGN) and composites, and one set of inactive, star-forming/passive galaxies. For each active galaxy, two inactive control galaxies were selected by matching redshift, absolute magnitude, inclination, and radius. The sample of inactive galaxies naturally divides into a red and a blue sequence, while the vast majority of AGN hosts occur along the red sequence. In terms of Hα equivalent width (EW), the population of composite galaxies peaks in the valley between the two modes, suggesting a transition population. However, this effect is not observed in other properties such as colour-magnitude space, or colour-concentration plane. Active galaxies are seen to be generally bulge-dominated systems, but with enhanced Hα emission compared to inactive red-sequence galaxies. AGN and composites also occur in less dense environments than inactive red-sequence galaxies, implying that the fuelling of AGN is more restricted in high-density environments. These results are therefore inconsistent with theories in which AGN host galaxies are a 'transition' population. We also introduce a systematic 3D spectroscopic imaging survey, to quantify and compare the gaseous and stellar kinematics of a well-selected, distance-limited sample of up to 20 nearby Seyfert galaxies, and 20 inactive control galaxies with well-matched optical properties. The survey aims to search for dynamical triggers of nuclear activity and address outstanding controversies in optical/IR imaging surveys.

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E-mail contact: pbw@astro.livjm.ac.uk,
preprint available at http://ads.nao.ac.jp/abs/2007MNRAS.382.1541W

Molecular tracers of high mass star-formation in external galaxies

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Hot core molecules should be detectable in external active galaxies out to high redshift. We present here a detailed study of the chemistry of star-forming regions under physical conditions that differ significantly from those likely to be appropriate in the Milky Way Galaxy. We examine, in particular, the trends in molecular abundances as a function of time with respect to changes in the relevant physical parameters. These parameters include metallicity, dust:gas mass ratio, the H_2 formation rate, relative initial elemental abundances, the cosmic ray ionization rate, and the temperature of hot cores. These trends indicate how different tracers provide information on the physical conditions and on evolutionary age. We identify hot core tracers for several observed galaxies that are considered to represent spirals, active galaxies, low-metallicity galaxies, and high-redshift galaxies. Even in low-metallicity examples, many potential molecular tracers should be present at levels high enough to allow unresolved detection of active galaxies at high redshift containing large numbers of hot cores.

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An evolution of the IR-Radio correlation at very low flux densities?

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In this paper we investigate the radio-MIR correlation at very low flux densities using extremely deep 1.4 GHz sub-arcsecond angular resolution MERLIN+VLA observations of a $8'.5\times8'.5$ field centred upon the Hubble Deep Field North, in conjunction with *Spitzer* 24 μm data. From these results the MIR-radio correlation is extended to the very faint ($\sim$microJy) radio source population. Tentatively we detect a small deviation from the correlation at the faintest IR flux densities. We suggest that this small observed change in the gradient of the correlation is the result of a suppression of the MIR emission in faint star-forming galaxies. This deviation potentially has significant implications for using either the MIR or non-thermal radio emission as a star-formation tracer of very low luminosity galaxies.

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Mapping of molecular gas inflow towards the Seyfert nucleus of NGC 4051 using Gemini NIFS

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We present two-dimensional (2D) stellar and gaseous kinematics of the inner $\sim130\times180$ pc^2 of the Narrow Line Seyfert 1 galaxy NGC 4051 at a sampling of 4.5 pc, from near-infrared K-band spectroscopic observations obtained with the Gemini's Near-infrared Integral Field Spectrograph (NIFS) operating with the ALTAIR adaptive optics module. We have used the CO absorption bandheads around 2.3 μm to obtain the stellar kinematics which show the turnover of the rotation curve at only $\approx$55 pc from the nucleus, revealing a highly concentrated gravitational potential. The stellar velocity dispersion of the bulge is $\approx60\,\mathrm{km\,s^{-1}}$ – implying on a nuclear black hole mass of $\approx 10^6\,\mathrm{M_\odot}$ – within which patches of lower velocity dispersion suggest the presence of regions of more recent star formation. From measurements of the emission-line profiles we have constructed two-dimensional maps for the flux distributitions, line ratios, radial velocities and gas velocity dispersions for the H_2, H I and [Ca VIII] emitting gas. Each emission line samples a distinct kinematics. The Brγ emission-line shows no rotation as well as no blueshifts or redshifts in excess of $30\,\mathrm{km\,s^{-1}}$, and is thus not restricted to the galaxy plane. The [Ca VIII] coronal region

is compact but resolved, extending over the inner 75 pc. It shows the highest blueshifts – of up to $-250\,\mathrm{km\,s^{-1}}$, and the highest velocity dispersions, interpreted as due to outflows from the active nucleus, supporting an origin close to the nucleus. Subtraction of the stellar velocity field from the gaseous velocity field has allowed us to isolate non-circular motions observed in the H_2 emitting gas. The most conspicuous kinematic structures are two nuclear spiral arms – one observed in blueshift in the far side of the galaxy (to the NE), and the other observed in redshift in the near side of the galaxy (to the SW). We interpret these structures as inflows towards the nucleus, a result similar to those of previous studies in which we have found streaming motions along nuclear spirals in ionized gas using optical IFU observations. We have calculated the mass inflow rate along the nuclear spiral arms, obtaining $\dot{M}_{H_2} \approx 4\times10^{-5}\,\mathrm{M_\odot\,yr^{-1}}$, a value ~ 100 times smaller than the accretion rate necessary to power the active nucleus. This can be understood as due to the fact that we are only seeing the hot "skin" (the H_2 emitting gas) of the total mass inflow rate, which is probably dominated by cold molecular gas. From the H_2 emission-line ratios we conclude that X-ray heating can account for the observed emission, but the $H_2\,\lambda2.1218\,\mu$m/Brγ line ratio suggests some contribution from shocks in localized regions close to the compact radio jet.

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preprint available at http://arxiv.org/abs/0801.1488

The Trails of Superluminal Jet Components in 3C 111

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In 1996, a major radio flux-density outburst occured in the broad-line radio galaxy 3C 111. It was followed by a particularly bright plasma ejection associated with a superluminal jet component, which has shaped the parsec-scale structure of 3C 111 for almost a decade. Here, we present results from 18 epochs of Very Long Baseline Array (VLBA) observations conducted since 1995 as part of the VLBA 2 cm Survey and MOJAVE monitoring programs. This major event allows us to study a variety of processes associated with outbursts of radio-loud AGN in much greater detail than has been possible in other cases: the primary perturbation gives rise to the formation of a leading and a following component, which are interpreted as a forward and a backward-shock. Both components evolve in characteristically different ways and allow us to draw conclusions about the work flow of jet-production events; the expansion, acceleration and recollimation of the ejected jet plasma in an environment with steep pressure and density gradients are revealed; trailing components are formed in the wake of the primary perturbation possibly as a result of coupling to Kelvin-Helmholtz instability pinching modes from the interaction of the jet with the external medium. The interaction of the jet with its ambient medium is further described by the linear-polarization signature of jet components traveling along the jet and passing a region of steep pressure/density gradients.

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A sample of mJy radio sources at 1.4 GHz in the Lynx and Hercules fields - II. Cosmic evolution of the space density of FRI radio sources

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In this paper the cosmic evolution of the space density of Fanaroff & Riley Class I (FRI) radio sources is investigated out to $z \sim 1$, in order to understand the origin of the differences between these and the more powerful FRIIs. High resolution radio images are presented of the best high redshift FRI candidate galaxies, drawn from two fields of the Leiden Berkeley Deep Survey, and previously defined in Rigby, Snellen & Best (2007, Paper I). Together with lower resolution radio observations

(both previously published in Paper I and, for a subset of sources, also presented here) these are used to morphologically classify the sample. Sources which are clearly resolved are classified by morphology alone, whereas barely or unresolved sources were classified using a combination of morphology and flux density loss in the higher resolution data, indicative of resolved out extended emission. The space densities of the FRIs are then calculated as a function of redshift, and compared to both measurements of the local value and the behaviour of the more powerful FRIIs. The space density of FRI radio sources with luminosities (at 1.4 GHz) $> 10^{25}$ W/Hz is enhanced by a factor of 5–9 by $z \sim 1$, implying moderately strong evolution of this population; this enhancement is in good agreement with models of FRII evolution at the same luminosity. There are also indications that the evolution is luminosity dependent, with the lower powered sources evolving less strongly.

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Obscuration in extremely luminous quasars

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The SEDs and IR spectra of a remarkable sample of obscured AGNs selected in the MIR are modeled with recent clumpy torus models. The sample contains 21 AGNs at z=1.3–3 discovered in the largest *Spitzer* surveys (SWIRE, NDWFS, & FLS) by means of their extremely red IR to optical colors. All sources show the 9.7μm silicate feature in absorption and have extreme MIR luminosities [$L(6\mu m) \simeq 10^{46}\,\mathrm{ergs\,s^{-1}}$].

The IR SEDs and spectra of 12 sources are well reproduced with a simple torus model, while the remaining nine sources require foreground extinction from a cold dust component to reproduce both the depth of the silicate feature and the NIR emission from hot dust. The best-fit torus models show a broad range of inclinations.

Based on the unobscured QSO MIR luminosity function (Brown et al. 2006), and on a color-selected sample of AGNs, we estimate the surface densities of obscured and unobscured QSOs with L(6μm)$>10^{12}\mathrm{L}_\odot$ and z=1.3-3.0 to be about 17–22 deg^{-2}, and 11.7 deg^{-2}, respectively. Overall we find that ∼35–41% of luminous QSOs are unobscured, 37–40% are obscured by the torus, and 23–25% are obscured by a cold absorber detached from the torus. These fractions are consistent with a decrease of the torus covering fraction at large luminosities as predicted by receding torus models.

A FIR component is observed in eight objects with luminosity greater than $3.3\times10^{12}\mathrm{L}_\odot$, implying SFRs of 600–3000 $\mathrm{M}_\odot\,\mathrm{yr}^{-1}$. In the whole sample, the average contribution from a starburst component to the bolometric luminosity, as estimated from the PAH 7.7μm luminosity in the composite IR spectra, is ≤20% of the total bolometric luminosity.

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The Effect of 53 μm IR Radiation on 18 cm OH Megamaser Emission

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OH megamasers (OHMs) emit primarily in the main lines at 1667 and 1665 MHz, and differ from their Galactic counterparts due to their immense luminosities, large linewidths and 1667/1665 MHz flux ratios, which are always greater than one. We find that these maser properties result from strong 53 μm radiative pumping combined with line overlap effects caused by turbulent linewidths $\sim$ 20 $\mathrm{km\,s^{-1}}$; pumping calculations that do not include line overlap are unreliable. A minimum dust temperature of $\sim$ 45 K is needed for inversion, and maximum maser efficiency occurs for dust temperatures $\sim$ 80 – 140 K. We find that warmer dust can support inversion at lower IR luminosities, in agreement with observations. Our results are in good agreement with a clumpy model of OHMs, with clouds sizes $\sim$ 1 pc and OH column densities $\sim 5\times10^{16}$ cm^{-2}, that is able to explain both the diffuse and compact emission observed for OHMs. We suggest that *all* OH main line masers may be pumped by far-IR radiation, with the major differences between OHMs and Galactic OH masers caused by differences in linewidth produced by

line overlap. Small Galactic maser linewidths tend to produce stronger 1665 MHz emission. The large OHM linewidths lead to inverted ground state transitions having approximately the same excitation temperature, producing 1667/1665 MHz flux ratios greater than one and weak satellite line emission. Finally, the small observed ratio of pumping radiation to dense molecular gas, as traced by HCN and HCO^+, is a possible reason for the lack of OH megamaser emission in NGC 6240.

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The Discovery of Soft X-ray Loud Broad Absorption Line Quasars

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It is been known for more than a decade that BALQSOs (broad absorption line quasars) are highly attenuated in the X-ray regime compared to other quasars, especially in the soft band ($<$ 1 keV). Using X-ray selection techniques we have found **"soft X-ray loud"** BALQSOs that, by definition, have soft X-ray (0.3 keV) to UV (3000$\AA$) flux density ratios that are higher than typical nonBAL radio quiet quasars. Our sample of 3 sources includes one LoBALQSOs (low ionization BALQSO) which are generally considered to be the most highly attenuated in the X-rays. The three QSOs are the only known BALQSOs that have X-ray observations that are consistent with no intrinsic soft X-ray absorption. The existence of a large X-ray luminosity and the hard ionizing continuum that it presents to potential UV absorption gas is in conflict with the ionization states that are conducive to line driving forces within BAL winds (especially for the LoBALs).

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An X-ray view of absorbed INTEGRAL AGN

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We present a 0.2–200 keV broad-band study of absorbed AGN observed with *INTEGRAL*, *XMM-Newton*, *Chandra* and *ASCA* to investigate the continuum shape and the absorbing/reflecting medium properties. The sources are selected in the INTEGRAL AGN sample to have a 20–100 keV flux below 8×10^{-11} erg cm^{-2} s^{-1} (5 mCrab), and are characterized by a 2–10 keV flux in the range $(0.8\text{–}10)\times10^{-11}$ erg cm^{-2} s^{-1}. The good statistics allow us a detailed study of the intrinsic and reflected continuum components. In particular, the analysis performed on the combined broad-band spectra allow us to investigate the presence of Compton reflection features and high energy cut-off in these objects. The column density of the absorbing gas establishes the Compton thin nature for three sources in which a measure of the absorption was still missing. The Compton thin nature of all the sources in this small sample is also confirmed by the diagnostic ratios $F_x/F[OIII]$. The Compton reflection components we measure, reflection continuum and iron line, are not immediately compatible with a scenario in which the absorbing and reflecting media are one and the same, i.e. the obscuring torus. A possible solution is that the absorption is more effective than reflection, e.g. under the hypothesis that the absorbing/reflecting medium is not uniform, like a clumpy torus, or that the source is observed through a torus with a very shallow opening angle. The high energy cut-off (a lower limit in two cases) is found in all sources of our sample and the range of values is in good agreement with that found in type 1 Seyfert galaxies. At lower energies there is clear evidence of a soft component (reproduced with a thermal and/or scattering model), in six objects.

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Jobs

Postdoctoral Research Associate in Astrophysics
Jodrell Bank Centre for Astrophysics
The University of Manchester
Reference Number: EPS/8033/08
Deadline: March 03, 2008

The Jodrell Bank Centre for Astrophysics at the University of Manchester invites applications for a Research Associate to work on the STFC funded Astrophysic Research Programme at Jodrell Bank Observatory. The post will be based in the Alan Turing Building at the University of Manchester although some time will be spent at Jodrell Bank Observatory (20 miles south).

The Jodrell Bank Centre for AstroPhysics invites applications for a Research Associate. The eighteen month position has been awarded as part of the STFC Programme.

The successful candidate will be expected to investigate the properties of starburst galaxies, both in the nearby universe and at high redshift. Much of the research will be carried out at radiowavelengths (using e-MERLIN,VLBI) and largely involves the study of radio supernovae and supernova remnants. A PhD is required, together with a strong background in star formation and/or galaxy studies together with expertise in radio synthesis imaging.

Job Description:

The appointee will be required to undertake research into radio supernovae and supernova remnants in nearby starburst galaxies these studies can be used to infer the star formation rate of the galaxies. In addition the total synchrotron emission from distant galaxies will be studied and the star formation rate inferred compared with other indicators. The appointee therefore must have a PHD in Astrophysics and the majority of their doctoral research must be in the area of star formation and/ or galaxies.

ESSENTIAL SKILLS:

The person appointed will:

- Have, or be about to obtain, a PhD in Astrophysics
- Have a strong interest in experimental physics research, and be highly motivated to pursue it;
- Be able to demonstrate the ability to carry out research at a high level;
- Have experience in studies of galaxies and/ or star formation
- Be familiar with computer interfacing and up to date computer packages;
- Be able to demonstrate the ability to work independently;
- Be able to demonstrate the ability to work collaboratively as a member of a team;
- Have a willingness to travel both within the UK and internationally;
- Be expected be able to present research findings at collaboration meetings or conferences;
- Have the potential of, or have evidence of, the ability to contribute to research papers in the field;
- Have a desire to pass on skills and knowledge to PhD, MSc and project students.

DESIRABLE:

- Strong research record with publications
- Familiarity with radio synthesis techniques and experience with imaging software.
- Experience of observing at other wavebands

The post will be available from 1 April 2008 for up to 18 months, with continuation subject to ongoing funding applications. Salary - 26,666 to 27,466 p.a.

Further information can be found at http://www.jb.man.ac.uk and Informal enquiries should be directed to Professors Alan Pedlar (ap@jb.man.ac.uk) or Phil Diamond (phil.diamond@manchester.ac.uk).

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.