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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

Superluminal Radio Features in the M87 Jet and the Site of Flaring TeV Gamma-ray Emission

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Superluminal motion is a common feature of radio jets in powerful γ-ray emitting active galactic nuclei. Conventionally, the variable emission is assumed to originate near the central supermassive black-hole where the jet is launched on parsec scales or smaller. Here, we report the discovery of superluminal radio features within a distinct flaring X-ray emitting region in the jet of the nearby radio galaxy M87 with the *Very Long Baseline Array.* This shows that these two phenomenological hallmarks – superluminal motion and high-energy variability – are associated, and we place this activity much further (>120 pc) from the "central engine" in M87 than previously thought in relativistic jet sources. We argue that the recent excess very high-energy TeV emission from M87 reported by the H.E.S.S. experiment originates from this variable superluminal structure, thus providing crucial insight into the production region of γ-ray emission in more distant blazars.

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preprint available at http://arxiv.org/abs/0705.2448

Hard X-ray Variability of AGN

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Aims: Active Galactic Nuclei are known to be variable throughout the electromagnetic spectrum. An energy domain poorly studied in this respect is the hard X-ray range above 20 keV.
Methods: The first 9 months of the Swift/BAT all-sky survey are used to study the 14 – 195 keV variability of the 44 brightest AGN. The sources have been selected due to their detection significance of $> 10\sigma$. We tested the variability using a maximum likelihood estimator and by analysing the structure function.
Results: Probing different time scales, it appears that the absorbed AGN are more variable than the unabsorbed ones. The same applies for the comparison of Seyfert 2 and Seyfert 1 objects. As expected the blazars show stronger variability. 15% of the non-blazar AGN show variability of $> 20\%$ compared to the average flux on time scales of 20 days, and 30% show at least 10% flux variation. All the non-blazar AGN which show strong variability are low-luminosity objects with $L_{(14-195\,\mathrm{keV})} < 10^{44}\,\mathrm{erg\,s^{-1}}$.
Conclusions: Concerning the variability pattern, there is a tendency of unabsorbed or type 1 galaxies being less variable than the absorbed or type 2 objects at hardest X-rays. A more solid anti-correlation is found between variability and luminosity, which has been previously observed in soft X-rays, in the UV, and in the optical domain.

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preprint available at http://arxiv.org/abs/0709.2230

Discovery of the Narrow-Line Seyfert 1 galaxy Mkn 335 in an historical low X-ray flux state

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We report the discovery of the Narrow-Line Seyfert 1 galaxy Mkn 335 in an extremely low X-ray state. A comparison of Swift observations obtained in May and June/July 2007 with all previous X-ray observations between 1971 to 2006 show the AGN to have diminished in flux by a factor of more than 30, the lowest X-ray flux Mkn 335 has ever been observed in. The Swift observations show an extremely hard X-ray spectrum at energies above 2 keV. Possible interpretations include partial covering absorption or X-ray reflection from the disk. In this letter we consider the partial covering interpretation. The Swift observations can be well fit by a strong partial covering absorber with varying absorption column density ($N_{\mathrm{H}} = 1 - 4 \times 10^{23}$ cm^{-2}) and a covering fraction f_c=0.9 - 1. When corrected for intrinsic absorption, the X-ray flux of Mkn 335 varies by only factors of 4-6. In the UV Mkn 335 shows variability in the order of 0.2 mag. We discuss the similarity of Mkn 335 with the highly variable NLS1 WPVS007, and speculate about a possible link between NLS1 galaxies and broad-absorption line quasars.

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preprint available at arXiv:0709.0733

The Black Hole Mass of NGC 4151: Comparison of Reverberation Mapping and Stellar Dynamical Measurements

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We present a stellar dynamical estimate of the black hole (BH) mass in the Seyfert 1 galaxy, NGC 4151. We analyze ground-based spectroscopy as well as imaging data from the ground and space, and we construct 3-integral axisymmetric models in order to constrain the BH mass and mass-to-light ratio. The dynamical models depend on the assumed inclination of the kinematic symmetry axis of the stellar bulge. In the case where the bulge is assumed to be viewed edge-on, the kinematical data give only an upper limit to the mass of the BH of $\sim 4 \times 10^7$ M$_\odot$ (1σ). If the bulge kinematic axis is assumed to have the same inclination as the symmetry axis of the large-scale galaxy disk (i.e., 23° relative to the line of sight), a best-fit dynamical mass between $4 - 5 \times 10^7$ M$_\odot$ is obtained. However, because of the poor quality of the fit when the bulge is assumed to be inclined (as determined by the noisiness of the χ^2 surface and its minimum value), and because we lack spectroscopic data that clearly resolves the BH sphere of influence, we consider our measurements to be tentative estimates of the dynamical BH mass. With this preliminary result, NGC 4151 is now among the small sample of galaxies in which the BH mass has been constrained from two independent techniques, and the mass values we find for both bulge inclinations are in reasonable agreement with the recent estimate from reverberation mapping ($4.57^{+0.57}_{-0.47} \times 10^7$ M$_\odot$) published by Bentz et al.

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H I and OH absorption in the lensing galaxy of MG J0414+0534

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We report the detection of H I 21-cm absorption in the $z = 0.96$ early-type lensing galaxy towards MG J0414+0534 with the Green Bank Telescope. The absorption, with total $N_{\rm HI} = 1.6 \times 10^{18}\,(T_{\rm s}/f)$ cm^{-2}, is resolved into two strong components, probably due to the two strongest lens components, which are separated by 0.4″. Unlike the other three lenses which have been detected in H I, J0414+0534 does not exhibit strong OH absorption, giving a OH/H I column density ratio of $N_{\rm OH}/N_{\rm HI} \lesssim 10^{-6}$ (for $T_{\rm s}$ = 100 K, $T_{\rm x}$ = 10 K and $f_{\rm HI} = f_{\rm OH} = 1$). This underabundance of molecular gas may indicate that the extreme optical–near-IR colour ($V - K = 10.26$) along the line-of-sight is not due to the lens. We therefore suggest that despite the strong upper limits on molecular absorption at the quasar redshift, as traced by millimetre lines, the extinction occurs primarily in the quasar host galaxy.

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preprint available at http://www.phys.unsw.edu.au/~sjc/home/res.html

Relationships between the H I 21-cm line strength, Mg II equivalent width and metallicity in damped Lyman-α absorption systems

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We present the results of a survey for 21-cm absorption in four never previously searched damped Lyman-α absorption systems (DLAs) with the Westerbork Synthesis Radio Telescope. The one detection is presented and discussed in Curran et al. (2007b) and here we add our results to other recent studies in order to address the important issues regarding the detection of cold gas, through 21-cm absorption, in DLAs: Although, due to the DLAs identified with spiral galaxies, there is a mix of spin temperature/covering factor ratios at low redshift, two recent high redshift end points (Kanekar et al. 2006, 2007) confirm that this ratio does not generally rise much above $T_{\rm spin}/f \sim 10^3$ K over the whole redshift range searched (up to $z_{\rm abs} = 3.39$). That is, if the covering factors of many of these galaxies were a factor of ≥ 2 smaller than for the spirals (which span $120 \leq T_{\rm spin}/f \leq 520$ K), then no significant difference in the spin temperatures between these two classes would be required.

Furthermore, although it is difficult to separate the relative contributions of the spin temperature and covering factor, the new results confirm that 21-cm detections tend to occur at low angular diameter distances, where the coverage of a given absorption cross section is maximised. This indicates a dominant contribution by the covering factor. Indeed, the two new high redshift detections occur towards two extremely compact radio sources ($\leq 0.04''$), although the one other new detection, which may have an impact parameter in excess of 75 kpc, occurs towards one of the largest radio sources (Curran et al. 2007b).

Finally, we also find an apparent 21-cm line strength–Mg II equivalent width correlation, which appears to be due to a coupling of the velocity structure between the components that each species traces. That is, the gas seen in 21-cm absorption could be the same as that seen in optical absorption. Combined with the known equivalent width–metallicity relation, this may be manifest as a spin temperature–metallicity anti-correlation, which is non-evolutionary in origin.

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XMM-Newton observation of the deep minimum state of PG 2112+059: A spectrum dominated by reflection from the accretion disk?

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Highly ionised absorbers and the frequent occurrence of relativistically broad iron fluorescence lines characterize the 0.2-10 keV spectra of (soft) X-ray weak quasars. We constrain the physical conditions of the absorber and the broad iron line of the X-ray weak quasar PG 2112+059 in greater detail than in previous studies. We analyse a 75ks XMM-Newton observation of PG 2112+059 performed in November 2005 and compare it with a 15ks XMM-Newton observation taken in May 2003. PG 2112+059 was found in a deep minimum state as its 0.2-12 keV flux decreased by a factor of 10 in comparison to the May 2003 observation. During the deep minimum state the spectra show strong emission in excess of the continuum in the 3-6 keV region. The excess emission corresponds to an EW = 26.1keV whereas its shape resembles that of heavily absorbed objects.
The spectra of both observations of PG 2112+059 can be explained statistically by a combination of two absorbers where one shows a high column density, $N_{\rm H} \sim 4.5 \times 10^{23} {\rm cm}^{-2}$, and the other high ionisation parameters. As the ionisation parameter of the high flux state, $\xi \sim 34$ erg cm s^{-1}, is lower than the value found for the deep minimum state, $\xi \sim 110$ erg cm s^{-1} , either the absorbers are physically different or the absorbing material is moving with respect to the X-ray source.
The spectra can also be explained by a continuum plus X-ray ionised reflection on the accretion disk, seen behind a warm absorber. The ionisation parameter of the high state ($\xi \sim 5.6$ erg cm s^{-1}) is higher than the ionisation parameter of the deep minimum state ($\xi \sim 0.2$ erg cm s^{-1}), as expected for a stationary absorber. The values found for the ionisation parameters are in the range typical for AGNs. The spectra observed during the deep minimum state are reflection dominated and show no continuum emission. These can be understood in the context of light bending near the supermassive black hole as predicted by

Minutti and Fabian.
Light bending offers an alternative explanation for X-ray weak quasars and might challenge the suggestion that absorption is the primary cause of their X-ray weakness. If on a class level the weakness of X-ray weak quasars is caused by light bending then they offer unique possibilities to observe accretion disks near the supermassive black hole and even to test general relativity in the strong field.

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Thirty Years of Continuum and Emission-Line Variability in NGC 5548

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We analyze a total of 827 optical spectra of NGC 5548 obtained over the thirty-year period 1972- V2001 for the purpose of studying the long-term behavior of the broad Hβ line profile. The variability characteristics, such as mean continuum and emission-line fluxes, rms variability amplitude, autocorrelation functions, and cross-correlation results, are found to be similar for CCD spectra obtained during the period 1989 V-2001 and for archival pre-CCD spectra from 1972 to 1988. The only significant difference between these two sets of data is that the mean Hβ flux is higher for 1972- V1988. While the Hβ profile can vary dramatically on timescales of months to years, the mean profiles for these two periods are similar, although not identical. We searched for correlations among Hβ profile parameters (such as line width, line centroid, blue-to-red ratio of the line wing fluxes) and investigated their relationship to the continuum flux. Only trivial correlations were found, specifically the correlation between continuum and line fluxes and the anticorrelation between line width and line flux, the latter following from the former and from the inverse correlation between line time lag and line width expected for gravitationally dominated motion.

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Iron lines from transient and persisting hot spots on AGN accretion disks

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We model the X-ray reprocessing from a strong co-rotating flare above an accretion disk in active galactic nuclei. By performing detailed radiative transfer computations we explore the horizontal structure and evolution of the underlying hot spot. The main goal is to study how the resulting spectral features manifest themselves in short exposure time spectra. We analyze both the vertical and the horizontal spot structure and its dynamical reprocessed spectrum. To obtain the spectral evolution seen by a distant observer, we apply a general relativity ray-tracing technique. We concentrate on the energy band around the iron K-line, where the relativistic effects are most pronounced. Persistent flares lasting for a significant fraction of the orbital time scale and short, transient flares are considered. In our time-resolved analysis, the spectra recorded by a distant observer depend on the position of the flare/spot with respect to the central black hole. If the flare duration significantly exceeds the light travel time across the spot, then the spot horizontal stratification is unimportant. On the other hand, if the flare duration is comparable to the light travel time across the spot radius, the lightcurves exhibit a typical asymmetry in their time profiles. The sequence of dynamical spectra proceeds from more strongly to less strongly ionized re-emission. At all locations within the spot the spectral intensity increases towards edge-on emission angles, revealing the limb brightening effect. Future X-ray observatories with significantly larger effective collecting areas will enable to spectroscopically map out the azimuthal irradiation structure of the accretion disk and to localize persistent flares. If the hot spot is not located too close to the marginally stable orbit of the black hole, it will be possible to probe the reflecting medium via the sub-structure of the iron K-line. Indications for transient flares will only be obtained from analyzing the observed lightcurves on the gravitational time scale of the accreting supermassive black hole.

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Star formation in accretion discs : from the Galactic Center to Active Galactic Nuclei

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Keplerian accretion discs around massive black holes (MBHs) are gravitationally unstable beyond a few hundredths of parsec and should collapse to form stars. It was indeed shown recently that an accretion/star formation episode took place a few millions years ago in the Galactic Center (GC). This raises the question of how the disc can survive in AGN and quasars and continue to transport matter towards the black hole. We study the accretion/star formation process in quasars and AGN, with one aim in mind, to show that a spectrum similar to the observed one can be produced by the disc.We compute models of stationary accretion discs, both continuous and clumpy. Continuous discs must be maintained in a state of marginal stability so that the rate of star formation remains modest and the disc is not immediately destroyed. The disc then requires an additional heating and an additional transport of angular momentum. In clumpy discs the momentum transport is provided by cloud interactions. Non-viscous heating can be provided by stellar illumination, but in the case of continuous discs, even momentum transport by supernovae is insufficient to sustain a marginal state, except at the very periphery of the disc. In clumpy discs it is possible to account for the required accretion rate through interactions between clouds, but this model is unsatisfactory as its parameters are tightly constrained without any physical justification. So finally one must appeal to non-stationary discs with intermittent accretion episodes like those that occurred in the GC, but such a model is probably not applicable to luminous high redshift quasars neither to radio-loud quasars.

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preprint available at astro-ph 07093772

The Revealing Dust: Mid-Infrared Activity in Hickson Compact Group Galaxy Nuclei

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We present a sample of 46 galaxy nuclei from 12 nearby ($z < 4500$ km s^{-1}) Hickson Compact Groups (HCGs) with a complete suite of 1–24 μm 2MASS+*Spitzer* nuclear photometry. For all objects in the sample, blue emission from stellar photospheres dominates in the near-infrared through the 3.6 μm IRAC band. Twenty-five of 46 (54%) galaxy nuclei show red, mid-infrared continua characteristic of hot dust powered by ongoing star formation and/or accretion onto a central black hole. We introduce $\alpha_{\rm IRAC}$, the spectral index of a power-law fit to the 4.5–8.0 μm IRAC data, and demonstrate that it cleanly separates the mid-infrared active and non-active HCG nuclei. This parameter is more powerful for identifying low to moderate-luminosity mid-infrared activity than other measures which include data at rest-frame $\lambda < 3.6$ μm that may be dominated by stellar photospheric emission. While the HCG galaxies clearly have a bimodal distribution in this parameter space, a comparison sample from the *Spitzer* Nearby Galaxy Survey (SINGS) matched in J-band total galaxy luminosity is continuously distributed. A second diagnostic, the fraction of 24 μm emission in excess of that expected from quiescent galaxies, $f_{\rm 24D}$, reveals an additional three nuclei to be active at 24 μm. Comparing these two mid-infrared diagnostics of nuclear activity to optical spectroscopic identifications from the literature reveals some discrepancies, and we discuss the challenges of distinguishing the source of ionizing radiation in these and other lower luminosity systems. We find a significant correlation between the fraction of mid-infrared active galaxies and the total HI mass in a group, and investigate possible interpretations of these results in light of galaxy evolution in the highly interactive system of a compact group environment.

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preprint available at http://arxiv.org/abs/0710.0372

Jobs

Bolton Fellowship
Reference Number: 2007/759
Position Title: Bolton Fellowship
Deadline: October 31, 2007.
Contact: Dr. Baerbel Koribalski

Applications are invited for the Bolton Fellowship, a three year post-doctoral appointment at the ATNF, Australia's premier radio astronomical facility. Bolton Fellows are encouraged to undertake research and/or development in any area relevant to ATNF observational capabilities.

Bolton Fellowships may be held at any of the major ATNF locations: the Sydney Headquarters at the Radiophysics Laboratory, the Parkes 64m telescope, or the Narrabri Compact Array. The Parkes telescope has receivers that operate in bands between 70cm and 12mm, including multibeam receivers at 20-cm and 6 GHz. The AT Compact Array (ATCA) has a 6km east-west baseline with a 214m north-south spur and operates in seven bands between 20cm and 3mm; a new 2 GHz broad-band correlator will be commissioned in 2008. The Mopra 22-m telescope is now remotely operated from Narrabri; its 8 GHz broad-band correlator allows astronomers to observe multiple spectral lines in, eg., the 3mm window (83 to 118 GHz). The ATNF is also working on strategic Square Kilometre Array (SKA) research and is currently developing the Australian SKA Pathfinder (ASKAP) based on wide field focal plane arrays.

Applicants must have (or will shortly satisfy the requirements for) a PhD degree in astronomy, astrophysics or related disciplines.

A discretionary research allowance of about $24K over the three-year term will be available to the successful candidate together with assistance with relocation and other benefits.

For further details and application forms, please go to http://recruitment.csiro.au/ and select Division = ATNF.

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.