Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
No. 194 — December 2013	Editor: Megan Argo (agnews@manchester.ac.uk)

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

From the Editor

Welcome to all the new subscribers, and thanks to everyone who contributed to this issue of the Active Galaxies Newsletter.

After the summer break and a change of editor, normal service is now resumed, so please do continue to submit abstracts, meeting announcements, job adverts and other announcements which may be of interest to the active galaxy community.

This newsletter is produced monthly. The deadline for contributions is the last day 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, any suggestions or feedback regarding the newsletter are welcome.

Many thanks for your continued subscription.

Megan Argo

Abstracts of recently accepted papers

An ALMA Survey of Submillimeter Galaxies in the Extended Chandra Deep Field-South: The AGN Fraction and X-ray Properties of Submillimeter Galaxies

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The large gas and dust reservoirs of submm galaxies (SMGs) could potentially provide ample fuel to trigger an Active Galactic Nucleus (AGN), but previous studies of the AGN fraction in SMGs have been controversial largely due to the inhomogeneity and limited angular resolution of the available submillimeter surveys. Here we set improved constraints on the AGN fraction and X-ray properties of the SMGs with ALMA and Chandra observations in the Extended Chandra Deep Field-South (E-CDF-S). This study is the first among similar works to have unambiguously identified the X-ray counterparts of SMGs; this is accomplished using the fully submm-identified, statistically reliable SMG catalog with 99 SMGs from the ALMA LABOCA E-CDF-S Submillimeter Survey (ALESS). We found 10 X-ray sources associated with SMGs (median redshift $z = 2.3$), of which eight were identified as AGNs using several techniques that enable cross-checking. The other two X-ray detected SMGs have levels of X-ray emission that can be plausibly explained by their star-formation activity. Six of the eight SMG-AGNs are moderately/highly absorbed, with $N_{\rm H} > 10^{23}$ cm^{-2}. An analysis of the AGN fraction, taking into account the spatial variation of X-ray sensitivity, yields an AGN fraction of $17^{+16}_{-6}\%$ for AGNs with rest-frame 0.5–8 keV absorption-corrected luminosity $\geq 7.8 \times 10^{42}$ erg s^{-1}; we provide estimated AGN fractions as a function of X-ray flux and luminosity. ALMA's high angular resolution also enables direct X-ray stacking at the precise positions of SMGs for the first time, and we found four potential SMG-AGNs in our stacking sample.

Accepted by ApJ

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Preprint available at http://arxiv.org/abs/1310.6364

Ultraviolet variability of quasars: dependence on the accretion rate

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We compiled a catalogue of about 4000 SDSS quasars including individual estimators V for the variability strength, virial black hole masses M, and mass accretion rates $\dot{M}$ from the Davis-Laor scaling relation. We confirm significant anti-correlations between V and $\dot{M}$, the Eddington ratio ε, and the bolometric luminosity L, respectively. A weak, statistically not significant positive trend is indicated for the dependence of V on M. As a side product, we find a strong correlation of the radiative efficiency with M and show that this trend is most likely produced by selection effects in combination with the mass errors and the use of the scaling relation for $\dot{M}$. The anti-correlations found for V cannot be explained in such a way. The strongest anti-correlation is found with $\dot{M}$. However, it is difficult to decide which of the quantities $(L, \varepsilon, \dot{M})$ is intrinsically correlated with V and which of the observed correlations are produced by the relations between these quantities. A V - $\dot{M}$ anti-correlation is qualitatively expected for the strongly inhomogeneous accretion disks. We argue that several observed variability properties are not adequately explained by the simple multi-temperature black-body model of a standard disk and suggest to check whether the strongly inhomogeneous disk model is capable of reproducing these observations better.

Accepted by A&A

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Preprint available at http://arxiv.org/abs/1311.2759

Modelling the X-ray polarimetric signatures of complex geometry: the case study of the "changing look" AGN NGC 1365

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"Changing look" Active Galactic Nuclei (AGN) are a subset of Seyfert galaxies characterized by rapid transitions between Compton-thin and Compton-thick regimes. In their Compton-thin state, the central engine is less obscured, hence spectroscopy or timing observations can probe their innermost structures. However, it is not clear if the observed emission features and the Compton hump are associated with relativistic reflection onto the accretion disc, or complex absorption by distant, absorbing gas clouds passing by the observer's line-of-sight. Here, we investigate these two scenarios under the scope of X-ray polarimetry, providing the first polarisation predictions for an archetypal "changing look" AGN: NGC 1365. We explore the resulting polarisation emerging from lamp-post emission and scattering off an accretion disc in the immediate vicinity of a supermassive black hole. The computed polarisation signatures are compared to the results of an absorption-dominated model, where

high column density gas partially covers the central source. While the shape of the polarisation spectrum is similar, the two models differ in net polarisation percentage, with the relativistic reflection scenario producing significantly stronger polarisation. Additionally, the variation of the polarisation position angle is distinctly different between both scenarios: the reflection-dominated model produces smooth rotations of the polarisation angle with photon energy whereas circumnuclear absorption causes an orthogonal switch of the polarisation angle between the soft and the hard X-ray bands. By comparing the predicted polarisation of NGC 1365 to the detectability levels of X-ray polarimetry mission concepts proposed in the past, we demonstrate that with a large, soft X-ray observatory or a medium-sized mission equipped with a hard (6 – 35 keV) polarimeter, the correct interpretation would be unambiguous.

Accepted by MNRAS

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Preprint available at http://arxiv.org/abs/1309.1691

Bolometric luminosity black-hole growth time and slim accretion discs in active galactic nuclei

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We investigate the accretion rate, bolometric luminosity, black hole (BH) growth time and BH spin in a large AGN sample under the assumption that all such objects are powered via thin or slim accretion discs (ADs). We use direct estimates of the mass accretion rate, $\dot{M}$, to show that many currently used values of $L_{\rm bol}$ and L/L_{Edd} are either under estimated or over estimated because they are based on bolometric correction factors that are adjusted to the properties of moderately accreting active galactic nuclei (AGN) and do not take into account the correct combination of BH mass, spin and accretion rate. The consistent application of AD physics to our sample of Sloan Digital Sky Survey (SDSS) AGN leads to the following findings: 1. Even the most conservative assumption about the radiative efficiency of fast accreting BHs shows that many of these sources must contain slim ADs. We illustrate this by estimating the fraction of such objects at various redshifts. 2. Many previously estimated BH growth times are inconsistent with the AD theory. In particular, the growth times of the fastest accreting BHs were over estimated in the past by large factors with important consequences to AGN evolution. 3. Currently used bolometric correction factors for low accretion rate very massive SDSS BHs, are inconsistent with the AD theory. Applying the AD set of assumptions to such objects, combined with standard photoionization calculations of broad emission lines, leads to the conclusion that many such objects must contain fast spinning BHs.

Accepted by MNRAS

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Preprint available at http://arxiv.org/abs/1311.4215

Unveiling the nature of the unidentified gamma-ray sources IV: the *Swift* catalog of potential X-ray counterparts

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A significant fraction ($\sim 30\%$) of the high-energy gamma-ray sources listed in the second *Fermi* LAT (2FGL) catalog are still of unknown origin, being not yet associated with counterparts at lower energies. In order to investigate the nature of these enigmatic sources, we present here an extensive search of X-ray **sources lying in the positional uncertainty region** of a selected sample of these Unidentified Gamma-ray Sources (UGSs) that makes use of all available observations performed by the *Swift* X-ray Telescope before March 31, 2013, available for 205 UGSs. To detect the fainter sources, we merged all the observations covering the ***Fermi* LAT** positional uncertainty region at 95% level of confidence of each UGSs. This yields a catalog of 357 X-ray sources, finding **candidate** X-ray counterparts for $\sim 70\%$ of the selected sample. In particular, 25% of the UGSs feature a single X-ray source within their positional uncertainty region while 45% have multiple X-ray sources. For each X-ray source we also looked in the corresponding *Swift* UVOT merged images for optical and ultraviolet counterparts, also performing source photometry. We found ultraviolet-optical correspondences for $\sim 70\%$ of the X-ray sources. We searched several major radio, infrared, optical and ultraviolet surveys for possible counterparts within the positional error of the sources in the X-ray catalog to obtain additional information on their nature. Applying the kernel density estimator technique to infrared colors of WISE counterparts of our X-ray sources we select 6 γ-ray blazar candidates. In addition, comparing our results with previous analyses, we select 11 additional γ-ray blazar candidates.

Accepted by ApJS

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Uncovering the deeply embedded AGN activity in the nuclear regions of the interacting galaxy Arp 299

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We present mid-infrared (MIR) $8-13\,\mu$m spectroscopy of the nuclear regions of the interacting galaxy Arp 299 (IC 694+NGC 3690) obtained with CanariCam (CC) on the 10.4 m Gran Telescopio Canarias (GTC). The high angular resolution ($\sim 0.3-0.6$arcsec) of the data allows us to probe nuclear physical scales between 60 and 120 pc, which is a factor of 10 improvement over previous MIR spectroscopic observations of this system. The GTC/CC spectroscopy displays evidence of deeply embedded Active Galactic Nucleus (AGN) activity in both nuclei. The GTC/CC nuclear spectrum of NGC 3690/Arp 299-B1 can be explained as emission from AGN-heated dust in a clumpy torus with both a high covering factor and high extinction along the line of sight. The estimated bolometric luminosity of the AGN in NGC 3690 is $3.2 \pm 0.6 \times 10^{44}\,\mathrm{erg\,s^{-1}}$. The nuclear GTC/CC spectrum of IC 694/Arp 299-A shows $11.3\,\mu$m polycyclic aromatic hydrocarbon (PAH) emission stemming from a deeply embedded ($A_V \sim 24\,$mag) region of less than 120 pc in size. There is also a continuum-emitting dust component. If associated with the putative AGN in IC 694, we estimate that it would be approximately 5 times less luminous than the AGN in NGC 3690. The presence of dual AGN activity makes Arp 299 a good example to study such phenomenon in the early coalescence phase of interacting galaxies.

Accepted by Astrophysical Journal Letters

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Preprint available at http://arxiv.org/abs/1311.3446

The circumnuclear environment of NGC 613: a nuclear starburst caught in the act?

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We present near-infrared (H- and K-band) integral-field observations of the inner ∼700 pc of the active spiral galaxy NGC 613, obtained with SINFONI on the Very Large Telescope. We use emission-line ratios to determine the dominant excitation mechanisms in different regions within our field-of-view, in particular the active nucleus and the star-forming circum-nuclear ring. Diagnostic diagrams involving [Fe II] and H_2 fluxes indicate that the gas is not only photoionized by the AGN in the nucleus of NGC 613, but also shock-heated. On the other hand, the emission line ratios measured in the "hot spots" along the ring are fully consistent with them being young star forming regions. We find no sign of radial gas transport from the ring into the core region dominated by the AGN. The ring morphology appears disturbed by a radial outflow of material from the AGN, which is confirmed by the existence of a weak jet in archival radio maps. However, this jet does not seem to have any significant effect on the morphology of the large ($\sim 8\times10^7\ M_\odot$) reservoir of molecular gas that has accumulated inside the central ∼100 pc. Such a concentration of molecular gas around an AGN is unusual, and supports a scenario in which star formation is recurrent and episodic in spiral galaxies. In this context, NGC 613 appears to be in final stages of the gas accumulation phase, and is likely to undergo a nuclear starburst in the near future.

Accepted by MNRAS.

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Preprint available at http://arxiv.org/abs/1311.2041

Kinematics and excitation of the nuclear spiral in the active galaxy Arp 102B

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We present a two-dimensional analysis of the gaseous excitation and kinematics of the inner $2.5 \times 1.7\,\mathrm{kpc}^2$ of the LINER/Seyfert 1 galaxy Arp 102B, from optical spectra obtained with the GMOS integral field spectrograph on the Gemini North telescope at a spatial resolution of ≈ 250 pc. Emission-line flux maps show the same two-armed nuclear spiral we have discovered in previous observations with the HST-ACS camera. One arm reaches 1 kpc to the east and the other 500 pc to the west, with a 8.4 GHz VLA bent radio jet correlating with the former. Gas excitation along the arms is low, with line ratios typical of LINERs, and which rule out gas ionization by stars. The gas density is highest (≈ 500 - $900\,\mathrm{cm}^{-3}$) at the nucleus and in the northern border of the east arm, at a region where the radio jet seems to be deflected. Centroid velocity maps suggest that most gas is in rotation in an inclined disk with line of nodes along position angle $\approx 88^\circ$, redshifts to the west and blueshifts to the east, with lower blueshifts correlated with the eastern arm and radio jet. This correlation suggests that the jet is interacting with gas in the disk. This interaction is supported by the gas excitation as a function of distance from the nucleus, which requires the contribution from shocks. Channel maps show blueshifts but also some redshifts at the eastern arm and jet location which can be interpreted as originated in the front and back walls of an outflow pushed by the radio jet, suggesting also that the outflow is launched close to the plane of the sky. Principal Component Analysis applied to our data supports this interpretation. We estimate a mass outflow rate along the east arm of $0.26 - 0.32\,\mathrm{M}_\odot\,\mathrm{yr}^{-1}$ (depending on the assumed outflow geometry), which is between one and two orders of magnitude higher than the mass accretion rate to the active nucleus, implying that there is mass-loading of the nuclear outflow from circumnuclear gas. The power of this outflow is $0.06 - 0.3\,\%L_{bol}$. We propose a scenario in which gas has been recently captured by Arp 102B in an interaction with Arp 102A, settling in a disk rotating around the nucleus of Arp 102B and triggering its nuclear activity. A nuclear jet is pushing the circumnuclear gas, giving origin to the nuclear arms. A blueshifted emitting gas knot is observed at ≈ 300 pc south-east from the nucleus and can be interpreted as another (more compact) outflow, with a possible counterpart to the north-west.

Accepted by MNRAS

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Preprint available at http://adsabs.harvard.edu/abs/2013MNRAS.435.2982C

A new insight into the innermost jet regions: probing extreme jet variability with LOFT

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Blazars are highly variable sources over timescales that can be as low as minutes. This is the case of the High Energy Peaked BL Lac (HBL) objects showing strong variability in X-rays, which highly correlates with that of the TeV emission. The degree of this correlation is still debated, particularly when the flaring activity is followed down to very short time scales. This correlation could challenge the synchrotron-self-Compton scenario in which one relativistic electron population dominates the entire radiative output. We argue that the LOFT Large Area Detector (10 m^2, LAD), thanks to its unprecedented timing capability, will allow us to detect the X-ray counterpart (2-50 keV) of the very fast variability observed at TeV energies, sheding light on the nature of X-TeV connection. We will discuss the test case of PKS 2155-304, showing as it would be possible to look for any X-ray variability occurring at very short timescales, never explored so far. This will put strong constraints on the size and the location of any additional electron population in the multi-zone scenario. Under this perspective, LOFT and the CTA observatories, planned to operate in the same time frame, will allow us to investigate in depth the connection between X-ray and TeV emissions. We also discuss the potentialities of LOFT in measuring the change in spectral curvature of the synchrotron spectra in HBLs which will make possible to directly study the mechanism of acceleration of highly energetic electrons. LOFT timing capability will be also promising in the study of Flat Spectrum Radio Quasars (FSRQs) with flux ≥ 1 mCrab. Constraints to the location of the high energy emission will be provided by: a) temporal investigation on second timescale; b) spectral trend investigation on minute timescales. This represents a further link with CTA because of the rapid (unexpected) TeV emission recently detected in some FSRQs.

Proceedings of the meeeting "The Innermost Regions of Relativistic Jets and Their Magnetic Fields", Granada (Spain), to appear on EPJ Web of Conferences

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Preprint available at http://arxiv.org/abs/1310.6965

The production of strong broad He II emission after the tidal disruption of a main-sequence star by a supermassive black hole

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The tidal disruption event (TDE) PS1-10jh lacked strong Balmer lines but showed strong, broad, He II emission both before maximum light and for at least 8 months thereafter. Gezari et al. interpreted this as evidence for the disruption of a rare hydrogen-deficient star. However, Guillochon et al. have argued instead that the disrupted star was a normal main-sequence star and that the strength of the He II emission compared with the Balmer lines is a result the emission being similar to the broad-line region (BLR) of an AGN, but lacking the outer, lower-ionization BLR gas. We show that the profile of He II λ4686 in PS1-10jh is similar to the blueshifted profiles of high-ionization lines in AGNs. We find an He II λ4686/Hα ratio for PS1-10jh of ~ 3.7. We show that both the high-velocity gas of the inner BLR of normal AGNs and the spectra of type II-P supernovae right after shock break out also produce very high He II λ4686/Hα ratios. A high He II λ4686/Hα ratio can thus be produced with a solar H/He abundance ratio. We demonstrate from photoionization modelling that the estimated He II λ4686/Hα ratio can be produced with a BLR truncated before the He^{++} Strömgren length if the density is $\sim 10^{11}$ cm^{-3}. The similarity of the He II λ4686 emission in PS1-10jh to the emission from the inner BLRs of AGNs supports the idea that the emission after a TDE event is similar to that of normal AGNs.

MNRAS Letters in press.

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Preprint available at arXiv:1310.1104

Off-axis irradiation and the polarization of broad emission lines in active galactic nuclei

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The STOKES Monte Carlo radiative transfer code has been extended to model the velocity dependence of the polarization of emission lines. We use STOKES to present improved modelling of the velocity-dependent polarization of broad emission lines in active galactic nuclei. We confirm that off-axis continuum emission can produce observed velocity dependencies of both the degree and position angle of polarization. The characteristic features are a dip in the percentage polarization and an S-shaped swing in the position angle of the polarization across the line profile. Some differences between our STOKES results and previous modelling of polarization due to off-axis emission are noted. In particular we find that the presence of an offset between the maximum in line flux and the dip in the percentage of polarization or the central velocity of the swing in position angle does not necessarily imply that the scattering material is moving radially. Our model is an alternative scenario to the equatorial scattering disk described by Smith et al. 2005. We discuss strategies to discriminate between both interpretations and to constrain their relative contributions to the observed velocity-resolved line and polarization.

Advances in Space Research in press.

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Preprint available at arXiv:1311.2249

Meetings

Transformational Science with the SKA: Synergies with ALMA and other contemporary instruments

Stellenbosch, South Africa
17 to 21 February 2014

Webpage: `http://ska2014.ska.ac.za/`
Email: `conferences@ska.ac.za`

In 2014 it will be over twenty years since the first discussions of the SKA and the ambitious call for a radio telescope with a considerable increase in sensitivity (two orders of magnitude) over existing instruments. It will also be ten years since the publication of the rationale for the SKA in Science with the SKA (Carilli and Rawlings). These years have seen much progress in radio astronomy, especially in the development of instruments covering the full radio wavelength range from millimetres to metres (ALMA to LOFAR). In May 2012, the sites for the putative SKA were decided, with the bulk of the collecting area to be built in Africa.

This symposium will discuss progress in SKA science, as well as its relationship to scientific results from other contemporary instruments. Meeting sessions will encompass all aspects of contemporary radio astronomy, including the early Universe, HI in galaxies, star formation, galaxy evolution, pulsars and transients.

The symposium will include student poster presentations, as well as interaction with public audiences and high school learners.

Final registration date: 10th December