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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. This newsletter is intended to disseminate paper abstracts, meeting announcements, job adverts and other information which may be of interest to the active galaxies community. It is produced monthly and, whilst the deadline for contributions is the last day of the month, contributions may be submitted at any time.

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. Please note that the editor may reject submissions which do not use the template. As always, any suggestions or feedback regarding the newsletter are welcome.

Many thanks for your continued subscription.

Megan Argo

Abstracts of recently accepted papers

Active galactic nuclei at $z \sim 1.5$: I. Spectral energy distribution and accretion discs

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The physics of active super massive black holes (BHs) is governed by their mass (M_{BH}), spin (a_*) and accretion rate ($\dot{M}$). This work is the first in a series of papers with the aim of testing how these parameters determine the observable attributes of active galactic nuclei (AGN). We have selected a sample in a narrow redshift range, centered on z $\sim$ 1.55, that covers a wide range in M_{BH} and $\dot{M}$, and are observing them with *X-shooter*, covering rest wavelengths ∼1200–9800 Å. The current work covers 30 such objects and focuses on the origin of the AGN spectral energy distribution (SED). After estimating M_{BH} and $\dot{M}$ based on each observed SED, we use thin AD models and a Bayesian analysis to fit the observed SEDs in our sample. We are able to fit 22/30 of the SEDs. Out of the remaining 8 SEDs, 3 can be fit by the thin AD model by correcting the observed SED for reddening within the host galaxy and 4 can be fit by adding a disc wind to the model. In four of these 8 sources, Milky Way-type extinction, with the strong 2175Å feature, provides the best reddening correction. The distribution in spin parameter covers the entire range, from -1 to 0.998, and the most massive BHs have spin parameters greater than 0.7. This is consistent with the "spin-up" model of BH evolution. Altogether, these results indicate that thin ADs are indeed the main power houses of AGN, and earlier claims to the contrary are likely affected by variability and a limited observed wavelength range.

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Differences between CO- and calcium triplet-derived velocity dispersions in spiral galaxies: evidence for central star formation?

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We examine the stellar velocity dispersions (σ) of a sample of 48 galaxies, 35 of which are spirals, from the Palomar nearby galaxy survey. It is known that for ultra-luminous infrared galaxies (ULIRGs) and merger remnants the σ derived from the near-infrared CO band-heads is smaller than that measured from optical lines, while no discrepancy between these measurements is found for early-type galaxies. No such studies are available for spiral galaxies – the subject of this paper. We used cross-dispersed spectroscopic data obtained with the Gemini Near-Infrared Spectrograph (GNIRS), with spectral coverage from 0.85 to 2.5 μm, to obtain σ measurements from the 2.29 μm CO band-heads (σ_{CO}), and the 0.85 μm calcium triplet (σ_{CaT}). For the spiral galaxies in the sample, we found that $\sigma_{\rm CO}$ is smaller than $\sigma_{\rm CaT}$, with a mean fractional difference of 14.3 %. The best fit to the data is given by $\sigma_{\rm opt} = (46.0 \pm 18.1) + (0.85 \pm 0.12)\sigma_{\rm CO}$. This "$\sigma$ discrepancy" may be related to the presence of warm dust, as suggested by a slight correlation between the discrepancy and the infrared luminosity. This is consistent with studies that have found no $\sigma-$discrepancy in dust-poor early-type galaxies, and a much larger discrepancy in dusty merger remnants and ULIRGs. That $\sigma_{\rm CO}$ is lower than $\sigma_{\rm opt}$ may also indicate the presence of a dynamically cold stellar population component. This would agree with the spatial correspondence between low $\sigma_{\rm CO}$ and young/intermediate-age stellar populations that has been observed in spatially-resolved spectroscopy of a handful of galaxies.

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Triggering optical AGN: the need for cold gas, and the indirect roles of galaxy environment and interactions

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We present a study of the prevalence and luminosity of Active Galactic Nuclei (AGN; traced by optical spectra) as a function of both environment and galaxy interactions. For this study we used a sample of more than 250000 galaxies drawn from the Sloan Digital Sky Survey and, crucially, we controlled for the effect of both stellar mass and central star formation activity. Once these two factors are taken into account, the effect of the local density of galaxies and of one-on-one interactions is minimal in both the prevalence of AGN activity and AGN luminosity. This suggests that the level of nuclear activity depends primarily on the availability of cold gas in the nuclear regions of galaxies and that secular processes can drive the AGN activity in the majority of cases. Large scale environment and galaxy interactions only affect AGN activity in an indirect manner, by influencing the central gas supply.

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Feedback from Mass Outflows in Nearby Active Galactic Nuclei. II. Outflows in the Narrow-Line Region of NGC 4151

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We present a detailed study of AGN feedback in the narrow-line region (NLR) of the Seyfert 1 galaxy NGC 4151. We illustrate the data and techniques needed to determine the mass outflow rate ($\dot{M}_{out}$) and kinetic luminosity (L_{KE}) of the outflowing ionized gas as a function of position in the NLR. We find that $\dot{M}_{out}$ peaks at a value of 3.0 $M_\odot$ yr^{-1} at a distance of 70 pc from the central supermassive black hole (SMBH), which is about 10 times the outflow rate coming from inside 13 pc, and 230 times the mass accretion rate inferred from the bolometric luminosity of NGC 4151. Thus, most of the outflow must arise from "in situ" acceleration of ambient gas throughout the NLR. L_{KE} peaks at 90 pc and drops rapidly thereafter, indicating that most of the kinetic energy is deposited within about 100 pc from the SMBH. Both values exceed the $\dot{M}_{out}$ and L_{KE} determined for the UV/X-ray absorber outflows in NGC 4151, indicating the importance of NLR outflows in providing feedback on scales where circumnuclear star formation and bulge growth occur.

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An embedded active nucleus in the OH megamaser galaxy IRAS16399-0937

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We present a multiwavelength study of the OH Megamaser galaxy (OHMG) IRAS16399-0937, based on new HST/ACS F814W and Hα+[N II] images and archive data from HST, 2MASS, Spitzer, Herschel and the VLA. This system has a double nucleus, whose northern (IRAS16399N) and southern (IRAS16399S) components have a projected separation of $\sim$6" (3.4 kpc) and have previously been identified based on optical spectra as a Low Ionization Nuclear Emission Line Region (LINER) and starburst nucleus, respectively. The nuclei are embedded in a tidally distorted common envelope, in which star formation is mostly heavily obscured. The infrared spectrum is dominated by strong polycyclic aromatic hydrocarbon (PAH), but deep silicate and molecular absorption features are also present, and are strongest in the IRAS16399N nucleus. The 0.435-500μm SED was fitted with a model including stellar, ISM and AGN torus components using our new MCMC code, CLUMPYDREAM. The results indicate that the IRAS16399N contains an AGN ($L_{bol} \sim 10^{44}$ ergs/s) deeply embedded in a quasi-spherical distribution of optically-thick clumps with a covering fraction $\approx$ 1. We suggest that these clumps are the source of the OHM emission in IRAS16399-0937. The high torus covering fraction precludes AGN-photoionization as the origin of the LINER spectrum, however, the spectrum is consistent with shocks ($v \sim 100 - 200\,km\,s^{-1}$). We infer that the $\sim 10^8\,M_\odot$ black-hole in IRAS16399N is accreting at a small fraction ($\sim$ 1%) of its Eddington rate. The low accretion-rate and modest nuclear SFRs suggest that while the gas-rich major merger forming the IRAS 16399-0937 system has triggered widespread star formation, the massive gas inflows expected from merger simulations have not yet fully developed.

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The dust masses of powerful radio galaxies: clues to the triggering of their activity

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We use deep Herschel Space Observatory observations of a 90% complete sample of 32 intermediate-redshift 2Jy radio galaxies ($0.05 < z < 0.7$) with strong emission lines to estimate the dust masses of their host galaxies and thereby investigate the triggering mechanisms for their quasar-like AGN. The dust masses derived for the radio galaxies ($7.2 \times 10^5 < M_d < 2.6 \times 10^8$ M$_\odot$) are intermediate between those of quiescent elliptical galaxies on the one hand, and ultra luminous infrared galaxies (ULIRGs) on the other. Consistent with simple models for the co-evolution of supermassive black holes and their host galaxies, these results suggest that most radio galaxies represent the late time re-triggering of AGN activity via mergers between the host giant elliptical galaxies and companion galaxies with relatively low gas masses. However, a minority of the radio galaxies in our sample (∼20%) have high, ULIRG-like dust masses, along with evidence for prodigious star formation activity. The latter objects are more likely to have been triggered in major, gas-rich mergers that represent a rapid growth phase for both their host galaxies and their supermassive black holes.

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Extended warm gas in the ULIRG Mrk273: Galactic outflows and tidal debris

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We present new *HST* ACS medium- and narrow-band images and optical Isaac Newton Telescope (INT) long-slit spectra of the merging system Mrk273. The *HST* observations sample the [OIII]$\lambda\lambda$4959,5007 emission from the galaxy and the nearby continuum. These data were taken as a part of a larger study of ultraluminous infrared galaxies (ULIRGs) with the aim of investigating the importance of the warm, AGN induced outflows in such objects. The *HST* images show that the morphologies of the extended continuum and the ionised gas emission from the galaxy are decoupled, extending almost perpendicular to each other. In particular, we detect for the first time a spectacular structure of ionised gas in the form of filaments and clumps that extend ∼23kpc to the east of the nuclear region. The quiescent ionised gas kinematics at these locations suggests that these filaments are tidal debris left over from a secondary merger event that are illuminated by an AGN in the nuclear regions. The images also reveal a complex morphology in the nuclear region of the galaxy for both the continuum and the [OIII] emission. Consistent with this complexity, we find a wide diversity of emission line profiles in these regions. Kinematic disturbance in the form of broad (FWHM $>$ 500 km s^{-1}) and/or strongly shifted ($|\Delta$V$| >$150 km s^{-1}) emission line components is found at almost all locations in the nuclear regions, but confined to a radius of ∼4 kpc to the east and west of the northern nucleus. In most cases, we are able to fit the profiles of all the emission lines of different ionisation with a kinematic model using two or three Gaussian components. From these fits, we derive diagnostic line ratios that are used to investigate the ionisation mechanisms at the different locations in the galaxy. We show tha these line ratios are generally consistent with photoionisation by an AGN as the main ionisation mechanism. Finally, the highest surface brightness [OIII] emission is found in a compact region that is coincident with the so-called SE nuclear component. The compactness, kinematics, and emission line ratios of this component suggest that it is a separate nucleus with its own AGN. At this stage, further observations are required to confirm the dual (or multiple?) AGN nature of Mrk273.

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Imprints of the quasar structure in time-delay light curves: Microlensing-aided reverberation mapping

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The advent of large area photometric surveys has raised a great deal of interest in the possibility of using broadband photometric data, instead of spectra, to measure the size of the broad line region of active galactic nuclei. We describe here a new method that uses time-delay lensed quasars where one or several images are affected by microlensing due to stars in the lensing galaxy. Because microlensing decreases (or increases) the flux of the continuum compared to the broad line region, it changes the contrast between these two emission components. We show that this effect can be used to effectively disentangle the intrinsic variability of those two regions, offering the opportunity to perform reverberation mapping based on single-band photometric data. Based on simulated light curves generated using a damped random walk model of quasar variability, we show that measurement of the size of the broad line region can be achieved using this method, provided one spectrum has been obtained independently during the monitoring. This method is complementary to photometric reverberation mapping and could also be extended to multi-band data. Because the effect described above produces a variability pattern in difference light curves between pairs of lensed images that is correlated with the time-lagged continuum variability, it can potentially produce systematic errors in measurement of time delays between pairs of lensed images. Simple simulations indicate that time-delay measurement techniques that use a sufficiently flexible model for the extrinsic variability are not affected by this effect and produce accurate time delays.

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Short-Timescale monitoring of the X-ray, UV and broad double-peak emission line of the nucleus of NGC 1097

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Recent studies have suggested that the short-timescale ($\lesssim$ 7 days) variability of the broad ($\sim$10,000 km s^{-1}) double-peaked Hα profile of the LINER nucleus of NGC 1097 could be driven by a variable X-ray emission from a central radiatively inefficient accretion flow (RIAF). To test this scenario, we have monitored the NGC 1097 nucleus in X-ray and UV continuum with *Swift* and the Hα flux and profile in the optical spectrum using SOAR and Gemini-South from 2012 August to 2013 February. During the monitoring campaign, the Hα flux remained at a very low level — 3 times lower than the maximum flux observed in previous campaigns and showing only limited ($\sim$ 20%) variability. The X-ray variations were small, only $\sim$ 13% throughout the campaign, while the UV did not show significant variations. We concluded that the timescale of the Hα profile variation is close to the sampling interval of the optical observations, which results in only marginal correlation between the X-ray and Hα fluxes. We have caught the AGN in NGC 1097 in a very low activity state, in which the ionizing source was very weak and capable of ionizing just the innermost part of the gas in the disk. Nonetheless, the data presented here still support the picture in which the gas that emits the broad double-peaked Balmer lines is illuminated/ionized by a source of high-energy photons which is located interior to the inner radius of the line-emitting part of the disk.

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The host galaxies of X-ray selected Active Galactic Nuclei to z=2.5: Structure, star-formation and their relationships from CANDELS and Herschel/PACS

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We study the relationship between the structure and star-formation rate (SFR) of X-ray selected low and moderate luminosity active galactic nuclei (AGNs) in the two Chandra Deep Fields, using Hubble Space Telescope imaging from the Cosmic Assembly Near Infrared Extragalactic Legacy Survey (CANDELS) and deep far-infrared maps from the PEP+GOODS-Herschel survey. We derive detailed distributions of structural parameters and FIR luminosities from carefully constructed control samples of galaxies, which we then compare to those of the AGNs. At $z \sim 1$, AGNs show slightly diskier light profiles than massive inactive (non-AGN) galaxies, as well as modestly higher levels of gross galaxy disturbance (as measured by visual signatures of interactions and clumpy structure). In contrast, at $z \sim 2$, AGNs show similar levels of galaxy disturbance as inactive galaxies, but display a red central light enhancement, which may arise due to a more pronounced bulge in AGN hosts or due to extinguished nuclear light. We undertake a number of tests of these alternatives, but our results do not strongly favour one interpretation over the other. The mean SFR and its distribution among AGNs and inactive galaxies are similar at $z > 1.5$. At $z < 1$, however, clear and significant enhancements are seen in the SFRs of AGNs with bulge-dominated light profiles. These trends suggest an evolution in the relation between nuclear activity and host properties with redshift, towards a minor role for mergers and interactions at $z > 1.5$.

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X-ray polarization fluctuations induced by cloud eclipses in active galactic nuclei

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Context: A fraction of active galactic nuclei (AGN) show dramatic X-ray spectral changes on the day-to-week time scales associated with variation in the line of sight of the cold absorber. Aims: We intend to model the polarization fluctuations arising from an obscuration event, thereby offering a method of determining whether flux variations are due to occultation or extreme intrinsic emission variability. Methods: Undertaking 1 – 100 keV polarimetric simulations with the Monte Carlo code STOKES, we simulated the journey of a variety of cold gas clouds in front of an extended primary source. We varied the hydrogen column density n_{H} and size of the absorber, as well as the initial polarization state of the emitting source, to cover a wide range of scenarios. Results: Simulations indicate that different results are expected according to the initial polarization of the extended continuum source. For unpolarized primary fluxes, large ($\sim 50°$) variations of the polarization position angle ψ are expected before and after an occultation event, which is associated with very low residual polarization degrees ($P \ll 1\%$). In the case of an emitting disk with intrinsic, position-independent polarization, and for a given range of parameters, X-ray eclipses significantly alter the observed polarization spectra, with most of the variations seen in ψ. Finally, non-uniformly polarized emitting regions produce very distinctive polarization variations due to the successive covering and uncovering of different portions of the disk. Plotted against time, variations in P and ψ form detectable P Cygni type profiles that are distinctive signatures of non-axisymmetric emission. Conclusions: We find that X-ray polarimetry is particularly adapted to probing X-ray eclipses due to Compton-thin and Compton-thick gas clouds. Polarization measurements would distinguish between intrinsic intensity fluctuations and external eclipsing events, constrain the geometry of the covering medium, and test the hypothesis of non-uniformly emitting disks predicted by general relativity.

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Selection of AGN candidates in the GOODS-South Field through SPITZER/MIPS 24 μm variability

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We present a study of galaxies showing mid-infrared variability in data taken in the deepest *Spitzer/MIPS* 24 μm surveys in the GOODS-South field. We divide the dataset in epochs and subepochs to study the long-term (months-years) and the short-term (days) variability. We use a χ^2-statistics method to select AGN candidates with a probability $\leq 1\%$ that the observed variability is due to statistical errors alone. We find 39 (1.7% of the parent sample) sources that show long-term variability and 55 (2.2% of the parent sample) showing short-term variability. That is, 0.03 sources $\times$ arcmin^{-2} for both, long-term and short-term variable sources. After removing the expected number of false positives inherent to the method, the estimated percentages are 1.0% and 1.4% of the parent sample for the long-term and short-term respectively. We compare our candidates with AGN selected in the X-ray and radio bands, and AGN candidates selected by their IR emission. Approximately, 50% of the MIPS 24 μm variable sources would be identified as AGN with these other methods. Therefore, MIPS 24 μm variability is a new method to identify AGN candidates, possibly dust obscured and low luminosity AGN, that might be missed by other methods. However, the contribution of the MIPS 24 μm variable identified AGN to the general AGN population is small ($\leq$ 13%) in GOODS-South.

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X-ray constraints on the local supermassive black hole occupation fraction

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Distinct seed formation mechanisms are imprinted upon the fraction of dwarf galaxies currently containing a central supermassive black hole. Seeding by Pop III remnants is expected to produce a higher occupation fraction than is generated with direct gas collapse precursors. *Chandra* observations of nearby early-type galaxies can directly detect even low-level supermassive black hole activity, and the active fraction immediately provides a firm lower limit to the occupation fraction. Here, we use the volume-limited AMUSE surveys of $\sim$200 optically-selected early-type galaxies to characterize simultaneously, for the first time, the occupation fraction and the scaling of $L_{\rm X}$ with $M_{\rm star}$, accounting for intrinsic scatter, measurement uncertainties, and X-ray limits. For early-type galaxies with $M_{\rm star} < 10^{10} M_{\odot}$, we obtain a lower limit to the occupation fraction of >20% (at 95% confidence), but full occupation cannot be excluded. The preferred dependence of $\log L_{\rm X}$ upon $\log M_{\rm star}$ has a slope of $\sim$0.7–0.8, consistent with the "downsizing" trend previously identified from the AMUSE dataset, and a uniform Eddington efficiency is disfavored at $\sim 2\sigma$. We provide guidelines for the future precision with which these parameters may be refined with larger or more sensitive samples.

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Compton Thick AGN in the XMM-COSMOS survey

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Heavily obscured, Compton Thick (CT, $N_H > 10^{24}$ cm^{-2}) Active Galactic Nuclei (AGN) may represent an important phase in AGN/galaxy co-evolution and are expected to provide a significant contribution to the cosmic X-ray background at its peak. However, unambiguously identifying CT AGN beyond the local Universe is a challenging task even in the deepest X-ray surveys, and given the expected low spatial density of these sources in the 2-10 keV band, large area surveys are needed to collect sizable samples. Through direct X-ray spectra analysis, we selected 39 heavily obscured AGN ($N_H > 3\times10^{23}$ cm^{-2}) at bright xray fluxes ($F_{2-10} \gtrsim 10^{-14}$ erg s^{-1} cm^{-2}) in the 2 deg^2 XMM-COSMOS survey. After selecting CT AGN based on the fit of a simple absorbed two power law model to the shallow XMM data, the presence of *bona-fide* CT AGN was confirmed in 80% of the sources using deeper Chandra data and more complex models. The final sample comprises 10 CT AGN (6 of them also have a detected Fe Kα line with EW$\sim$ 1 keV), spanning a large range of redshift (z$\sim 0.1 - 2.5$) and luminosity ($L_{2-10} \sim 10^{43.5} - 10^{45}$ ergs) and is complemented by 29 heavily obscured AGN spanning the same redshift and luminosity range. We collected the rich multi-wavelength information available for all these sources, in order to study the distribution of SMBH and host properties, such as BH mass (M_{BH}), Eddington ratio (λ_{Edd}), stellar mass (M_*), specific star formation rate (sSFR) in comparison with a sample of unobscured AGN. We find that highly obscured sources tend to have significantly smaller M_{BH} and higher λ_{Edd} with respect to unobscured sources, while a weaker evolution in M_* is observed. The sSFR of highly obscured sources is consistent with the one observed in the main sequence of star forming galaxies, at all redshift. We also present and briefly discuss optical spectra, broad band spectral energy distribution (SED) and morphology for the sample of 10 CT AGN. Both the optical spectra and SED agree with the classification as highly obscured sources: all the available optical spectra are dominated by the stellar component of the host galaxy, and to reproduce the broad band SED, an highly obscured torus component is needed for all the CT sources. Exploiting the high resolution *Hubble*-ACS images available, we are able to show that these highly obscured sources have a significantly larger merger fraction with respect to other xray selected samples of AGN. Finally we discuss the implications of our findings in the context of AGN/galaxy co-evolutionary models, and compare our results with the predictions of xray background synthesis models.

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Jobs

Postdoctoral Research Associate in AGN Triggering and Feedback
Department of Physics & Astronomy, University of Sheffield
Deadline: 12th January 2015

Email contact: c.tadhunter@sheffield.ac.uk
Further Information: http://www.sheffield.ac.uk/jobs/

Applications are invited for a 3 year postdoctoral position to carry forward a broad-based programme of research that aims to accurately quantify the feedback effect of the AGN in some of the most rapidly evolving galaxies in the local Universe, and also to investigate the triggering of the AGN activity. The project will involve the analysis and interpretation of existing high-quality data obtained using the HST/ACS, VLT/XSHOOTER and WHT/ISIS instruments. Observations with ALMA are also anticipated.

The successful applicant will join the Astrophysics Group at the University of Sheffield, which has research interests in the fields of active galaxies, quasars, galaxy evolution, massive stars, star clusters, star formation, supernovae, interacting binary star systems and time domain astrophysics.

Applicants should have (or be about to obtain) a PhD in astrophysics or a related area. Experience in the analysis of optical/IR spectroscopic data is essential, and background knowledge of the AGN field is desirable.

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Applications (application form, CV including publication list, brief research statement, and contact details for up to 3 referees) should be submitted via the online application system at http://www.sheffield.ac.uk/jobs/ by 15th January 2015.