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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.

Thanks for your continued subscription.

Megan Argo

Abstracts of recently submitted papers

Evidence that most type 1 AGN are reddened by dust

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The typical optical-UV continuum slopes observed in many type 1 active galactic nuclei (AGN) are redder than expected from thin accretion disk models. A possible resolution to this conundrum is that many AGN are reddened by dust along the line of sight. To explore this possibility, we stack 5000 SDSS AGN with luminosity $L \approx 10^{45}\,\mathrm{erg\ s^{-1}}$ and redshift $z \sim 0.4$ in bins of optical continuum slope $\alpha_{\rm opt}$ and width of the broad Hβ emission line. We measure the equivalent width (EW) of the NaID absorption feature in each stacked spectrum. We find a linear relation between $\alpha_{\rm opt}$ and EW(NaID), such that EW(NaID) increases as $\alpha_{\rm opt}$ becomes redder. In the bin with the smallest Hβ width, objects with the bluest slopes that are similar to accretion disk predictions are found to have EW(NaID) = 0, supporting the line-of-sight dust hypothesis. This conclusion is also supported by the dependence of the Hα/Hβ line ratio on $\alpha_{\rm opt}$. The implied relationship between continuum slope and dust reddening is given by $E_{\rm B-V} \approx 0.2 \cdot (-0.1 - \alpha_{\rm opt})$, and the implied reddening of a typical type 1 AGN with $\alpha_{\rm opt} = -0.5$ is $E_{\rm B-V} \approx 0.08\,\mathrm{mag}$.

The relation between $E_{\rm B-V}$ and NaI column is similar to the relation in the Milky-Way found in previous studies. Combining this fact with photoionization calculations, we argue that the line-of-sight dusty gas is the interstellar medium of the host galaxy, and that the sodium absorption arises in regions shielded from the AGN radiation, along the line of sight to the stars.

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DRAFT is available at http://arxiv.org/abs/1603.06948

Comments welcome!

Abstracts of recently accepted papers

The dust covering factor in active galactic nuclei

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The primary source of emission of active galactic nuclei (AGN), the accretion disk, is surrounded by an optically and geometrically thick dusty structure ("the so-called dusty torus"). The infrared radiation emitted by the dust is nothing but a reprocessed fraction of the accretion disk emission, so the ratio of the torus to the AGN luminosity (L_{torus}/L_{AGN}) should correspond to the fraction of the sky obscured by dust, i.e. the covering factor. We undertook a critical investigation of the L_{torus}/L_{AGN} as the dust covering factor proxy. Using state-of-the-art 3D Monte Carlo radiative transfer code, we calculated a grid of SEDs emitted by the clumpy two-phase dusty structure. With this grid of SEDs, we studied the relation between L_{torus}/L_{AGN} and the dust covering factor for different parameters of the torus. We found that in case of type 1 AGNs the torus anisotropy makes L_{torus}/L_{AGN} underestimate low covering factors and overestimate high covering factors. In type 2 AGNs L_{torus}/L_{AGN} always underestimates covering factors. Our results provide a novel easy-to-use method to account for anisotropy and obtain correct covering factors. Using two samples from the literature, we demonstrated the importance of our result for inferring the obscured AGN fraction. We found that after the anisotropy is properly accounted for, the dust covering factors show very weak dependence on L_{AGN}, with values in the range of $\approx 0.6 - 0.7$. Our results also suggest a higher fraction of obscured AGNs at high luminosities than those found by X-ray surveys, in part owing to the presence of a Compton-thick AGN population predicted by population synthesis models.

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No evidence for large-scale outflows in the extended ionised halo of ULIRG Mrk273

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We present deep new GTC/OSIRIS narrow-band images and optical WHT/ISIS long-slit spectroscopy of the merging system Mrk273 that show a spectacular extended halo of warm ionised gas out to a radius of ~ 45 kpc from the system nucleus. Outside of the immediate nuclear regions (r > 6 kpc), there is no evidence for kinematic disturbance in the ionised gas: in the extended regions covered by our spectroscopic slits the emission lines are relatively narrow (FWHM $\lesssim 350$ kms^{-1}) and velocity shifts small ($|\Delta V| \lesssim 250$ kms^{-1}). This is despite the presence of powerful near-nuclear outflows (FWHM > 1000 kms^{-1}; $|\Delta V| > 400$ kms^{-1}; r < 6 kpc). Diagnostic ratio plots are fully consistent with Seyfert 2 photo-ionisation to the NE of the nuclear region, however to the SW the plots are more consistent with low-velocity radiative shock models. The kinematics of the ionised gas, combined with the fact that the main structures are aligned with low-surface-brightness tidal continuum features, are consistent with the idea that the ionised halo represents tidal debris left over from a possible triple-merger event, rather than a reservoir of outflowing gas.

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Mid-infrared imaging- and spectro-polarimetric subarcsecond observations of NGC 1068

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We present sub-arcsecond 7.5−13 μm imaging- and spectro-polarimetric observations of NGC 1068 using CanariCam on the 10.4-m Gran Telescopio CANARIAS. At all wavelengths, we find: *(1)* A 90 × 60 pc extended polarized feature in the northern ionization cone, with a uniform $\sim$44° polarization angle. Its polarization arises from dust and gas emission in the ionization cone, heated by the active nucleus and jet, and further extinguished by aligned dust grains in the host galaxy. The polarization spectrum of the jet-molecular cloud interaction at $\sim$24 pc from the core is highly polarized, and does not show a silicate feature, suggesting that the dust grains are different from those in the interstellar medium. *(2)* A southern polarized feature at $\sim$9.6 pc from the core. Its polarization arises from a dust emission component extinguished by a large concentration of dust in the galaxy disc. We cannot distinguish between dust emission from magnetically aligned dust grains directly heated by the jet close to the core, and aligned dust grains in the dusty obscuring material surrounding the central engine. Silicate-like grains reproduce the polarized dust emission in this feature, suggesting different dust compositions in both ionization cones. *(3)* An upper limit of polarization degree of 0.3 per cent in the core. Based on our polarization model, the expected polarization of the obscuring dusty material is $<$0.1 per cent in the 8−13 μm wavelength range. This low polarization may be arising from the passage of radiation through aligned dust grains in the shielded edges of the clumps.

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Insights into Quasar UV Spectra Using Unsupervised Clustering Analysis

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Machine learning techniques can provide powerful tools to detect patterns in multidimensional parameter space. We use K-means - a simple yet powerful unsupervised clustering algorithm which picks out structure in unlabeled data - to study a sample of quasar UV spectra from the Quasar Catalog of the 10^{th} Data Release of the Sloan Digital Sky Survey (SDSS-DR10) of Paris et al. (2014). Detecting patterns in large datasets helps us gain insights into the physical conditions and processes giving rise to the observed properties of quasars. We use K-means to find clusters in the parameter space of the equivalent width (EW), the blue- and red-half-width at half-maximum (HWHM) of the Mg II 2800Å line, the C IV 1549Å line, and the C III] 1908Å blend in samples of Broad Absorption-Line (BAL) and non-BAL quasars at redshift 1.6-2.1. Using this method, we successfully recover correlations well-known in the UV regime such as the anti-correlation between the EW and blueshift of the C IV emission line and the shape of the ionizing Spectra Energy distribution (SED) probed by the strength of He II and the Si III]/C III] ratio. We find this to be particularly evident when the properties of C III] are used to find the clusters, while those of Mg II proved to be less strongly correlated with the properties of the other lines in the spectra such as the width of C IV or the Si III]/C III] ratio. We conclude that unsupervised clustering methods (such as K-means) are powerful methods for finding "natural" binning boundaries in multidimensional datasets and discuss caveats and future work.

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The thermal instability of the warm absorber in NGC 3783

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We model the observed X-ray spectral continuum shape, ionic column densities, and absorption measure distribution (AMD) of the warm absorber in the Seyfert galaxy NGC 3783. We assume a photo-ionized medium with a uniform total (gas+radiation) pressure. The irradiation causes the wind to be radiation pressure compressed (RPC). We compare the observational characteristics derived from the 900 ksec Chandra observation to radiative transfer computations in pressure equilibrium using the radiative transfer code TITAN. We explore different values of the ionization parameter xi of the incident flux and adjust the hydrogen-equivalent column density, N_{H0} of the warm absorber to match the observed soft X-ray continuum. We derive theoretical column densities for a broad range of ionic species of iron and neon and an AMD that we compare to the observations. We find an extension of the degeneracy between xi and N_{H0} for the constant pressure models previously discussed for NGC 3783. Including the ionic column densities of iron and neon in the comparison between observations and data we conclude that a range of ionization parameters between 4000 and 8000 ergs cm/s is preferred. For the first time, we present theoretical AMD for a constant pressure wind in NGC 3783 that correctly reproduces the observed level and is in approximate agreement with the observational appearance of an instability region. Using a variety of observational indicators, we confirm that the X-ray outflow of NGC 3783 can be described as an RPC medium in pressure equilibrium. The observed AMD agrees with a uniformly hot or a uniformly cold thermal state. The measured ionic column densities suggest that the wind tends to the uniformly cold thermal state. The occurrence of thermal instability in the warm absorber model may depend on the computational method and the spatial scale on which the radiative transfer is solved.

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Space Telescope and Optical Reverberation Mapping Project. III. Optical Continuum Emission and Broad-Band Time Delays in NGC 5548

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We present ground-based optical photometric monitoring data for NGC 5548, part of an extended multi-wavelength reverberation mapping campaign. The light curves have nearly daily cadence from 2014 January to July in nine filters ($BVRI$ and $ugriz$). Combined with ultraviolet data from the *Hubble Space Telescope* and *Swift*, we confirm significant time delays between the continuum bands as a function of wavelength, extending the wavelength coverage from 1158 Å to the z band ($\sim$9160 Å). We find that the lags at wavelengths longer than the V band are equal to or greater than the lags of high-ionization-state emission lines (such as He II λ1640 and λ4686), suggesting that the continuum-emitting source is of a physical size comparable to the inner broad-line region (BLR). The trend of lag with wavelength is broadly consistent with the prediction for continuum reprocessing by an accretion disk with $\tau \propto \lambda^{4/3}$. However, the lags also imply a disk radius that is 3 times larger than the prediction from standard thin-disk theory, assuming that the bolometric luminosity is 10% of the Eddington luminosity ($L = 0.1L_{\rm Edd}$). Using optical spectra from the Large Binocular Telescope, we estimate the bias of the interband continuum lags due to BLR emission observed in the filters. We find that the bias for filters with high levels of BLR contamination ($\sim$20%) can be important for the shortest continuum lags, and likely has a significant impact on the u and U bands owing to Balmer continuum emission.

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How well can we measure supermassive black hole spin?

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Being one of only two fundamental properties black holes possess, the spin of supermassive black holes (SMBHs) is of great interest for understanding accretion processes and galaxy evolution. However, in these early days of spin measurements, consistency and reproducibility of spin constraints have been a challenge. Here we focus on X-ray spectral modelling of active galactic nuclei (AGN), examining how well we can truly return known reflection parameters such as spin under standard conditions. We have created and fit over 4000 simulated Seyfert 1 spectra each with 375±1k counts. We assess the fits with reflection fraction of $R = 1$ as well as reflection-dominated AGN with $R = 5$. We also examine the consequence of permitting fits to search for retrograde spin. In general, we discover that most parameters are over-estimated when spectroscopy is restricted to the 2.5 – 10.0 keV regime and that models are insensitive to inner emissivity index and ionization. When the bandpass is extended out to 70 keV, parameters are more accurately estimated. Repeating the process for $R = 5$ reduces our ability to measure photon index (∼3 to 8 per cent error and overestimated), but increases precision in all other parameters — most notably ionization, which becomes better constrained ($\pm 45\,\mathrm{erg\,cm\,s^{-1}}$) for low ionization parameters ($\xi < 200\,\mathrm{erg\,cm\,s^{-1}}$). In all cases, we find the spin parameter is only well measured for the most rapidly rotating supermassive black holes (i.e. $a > 0.8$ to about ±0.10) and that inner emissivity index is never well constrained. Allowing our model to search for retrograde spin did not improve the results.

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Compton-thick Accretion in the local Universe

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Heavily obscured accretion is believed to represent an important stage in the growth of supermassive black holes, and to play an important role in shaping the observed spectrum of the Cosmic X-ray Background (CXB). Hard X-ray (E>10 keV) selected samples are less affected by absorption than samples selected at lower energies, and are therefore one of the best ways to detect and identify Compton-thick (CT, $\log N_{\rm H} \geq 24$) Active Galactic Nuclei (AGN). In this letter we present the first results of the largest broad-band (0.3–150 keV) X-ray spectral study of hard X-ray selected AGN to date, focusing on the properties of heavily obscured sources. Our sample includes the 834 AGN (728 non-blazar, average redshift $z \simeq 0.055$) reported in the 70-months catalog of the all-sky hard X-ray *Swift*/BAT survey. We find 55 CT AGN, which represent $7.6^{+1.1}_{-2.1}\%$ of our non-blazar sample. Of these, 26 are reported as candidate CT AGN for the first time. We correct for selection bias and derive the intrinsic column density distribution of AGN in the local Universe in two different luminosity ranges. We find a significant decrease in the fraction of obscured Compton-thin AGN for increasing luminosity, from $46 \pm 3\%$ (for $\log L_{14-195} = 40 - 43.7$) to $39 \pm 3\%$ (for $\log L_{14-195} = 43.7 - 46$). A similar trend is also found for CT AGN. The intrinsic fraction of CT AGN with $\log N_{\rm H} = 24 - 25$ normalised to unity in the $\log N_{\rm H} = 20 - 25$ range is $27 \pm 4\%$, and is consistent with the observed value obtained for AGN located within 20 Mpc.

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Discovery of extreme [OIII]λ5007Å outflows in high-redshift red quasars

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Black hole feedback is now a standard component of galaxy formation models. These models predict that the impact of black hole activity on its host galaxy likely peaked at $z = 2-3$, the epoch of strongest star formation activity and black hole accretion activity in the Universe. We used XShooter on the Very Large Telescope to measure rest-frame optical spectra of four $z \sim 2.5$ extremely red quasars with infrared luminosities $\sim 10^{47}$ erg s^{-1}. We present the discovery of very broad (full width at half max= $2600-5000$ km s^{-1}), strongly blue-shifted (by up to 1500 km s^{-1}) [OIII]λ5007Å emission lines in these objects. In a large sample of type 2 and red quasars, [OIII] kinematics are positively correlated with infrared luminosity, and the four objects in our sample are on the extreme end both in [OIII] kinematics and infrared luminosity. We estimate that at least 3% of the bolometric luminosity in these objects is being converted into the kinetic power of the observed wind. Photo-ionization estimates suggest that the [OIII] emission might be extended on a few kpc scales, which would suggest that the extreme outflow is affecting the entire host galaxy of the quasar. These sources may be the signposts of the most extreme form of quasar feedback at the peak epoch of galaxy formation, and may represent an active "blow-out" phase of quasar evolution.

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Unveiling the physics of low luminosity AGN through X-ray variability: LINER versus Seyfert 2

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X-ray variability is very common in active galactic nuclei (AGN), but these variations may not occur similarly in different families of AGN. We aim to disentangle the structure of low ionization nuclear emission line regions (LINERs) compared to Seyfert 2s by the study of their spectral properties and X-ray variations. We assembled the X-ray spectral parameters and variability patterns, which were obtained from simultaneous spectral fittings. Major differences are observed in the X-ray luminosities, and the Eddington ratios, which are higher in Seyfert 2s. Short-term X-ray variations were not detected, while long-term changes are common in LINERs and Seyfert 2s. Compton-thick sources generally do not show variations, most probably because the AGN is not accesible in the 0.5–10 keV energy band. The changes are mostly related with variations in the nuclear continuum, but other patterns of variability show that variations in the absorbers and at soft energies can be present in a few cases. We conclude that the X-ray variations may occur similarly in LINERs and Seyfert 2s, i.e., they are related to the nuclear continuum, although they might have different accretion mechanisms. Variations at UV frequencies are detected in LINER nuclei but not in Seyfert 2s. This is suggestive of at least some LINERs having an unobstructed view of the inner disc where the UV emission might take place, being UV variations common in them. This result might be compatible with the disappeareance of the torus and/or the broad line region in at least some LINERs.

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The Sloan Digital Sky Survey Reverberation Mapping Project: An Investigation of Biases in C IV Emission-Line Properties

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We investigate the dependence on data quality of quasar properties measured from the C IV emission line region at high redshifts. Our measurements come from 32 epochs of Sloan Digital Sky Survey (SDSS) Reverberation Mapping Project spectroscopic observations of 482 $z > 1.46$ quasars. We compare the differences between measurements made from the single-epoch and coadded spectra, focusing on the C IV λ1549 emission line because of its importance for studies of high-redshift quasar demographics and physical properties, including black hole masses. In addition to statistical errors increasing (by factors of $\sim$2−4), we find increasing systematic offsets with decreasing S/N. The systematic difference (measurement uncertainty) in our lowest S/N (<5) subsample between the single-epoch and coadded spectrum (i) C IV equivalent width is 17Å (31Å), (ii) centroid wavelength is <1Å (2Å), and fractional velocity widths, $\Delta V/V$, characterized by (iii) the line dispersion, σ_l, is 0.104 (0.12), and (iv) the mean absolute deviation (MAD) is 0.072 (0.11). These remain smaller than the 1σ measurement uncertainties for all subsamples considered. The MAD is found to be the most robust line-width characterization. Offsets in the C IV full-width at half maximum (FWHM) velocity width and the C IV profile characterized by FWHM/σ_l are only smaller than the statistical uncertainties when S/N>10, although offsets in lower S/N spectra exceed the statistical uncertainties by only a factor of $\sim$1.5 and may depend on the type of functional fit to the line. Characterizing the C IV line profile by the kurtosis is the least robust property investigated, as the median systematic coadded–single-epoch measurement differences are larger than the statistical uncertainties for all S/N subsamples.

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Preprint available at http://arxiv.org/abs/1601.05425

Meetings

Hidden Monsters: Obscured AGN and Connections to Galaxy Evolution in the Era of NuSTAR and WISE

Dartmouth College in Hanover, NH, USA
August 8-12th 2016

Webpage: `http://www.dartmouth.edu/∼hiddenmonsters`
Email: `hidden.monsters.2016@dartmouth.edu`

We are pleased to announce an international workshop at Dartmouth College in Hanover, NH, USA on August 8-12th 2016:

"Hidden Monsters: Obscured AGN and Connections to Galaxy Evolution in the Era of NuSTAR and WISE"

See below for more details. If you are interested in attending the workshop then please submit an abstract by April 22nd at http://www.dartmouth.edu/∼hiddenmonsters. Registration will be open soon. The majority of the scientific program will be based on submitted talk abstracts and will be announced in May.

A great success of extragalactic astronomy over the past decades has been the ability to trace the growth of supermassive black holes over cosmic time, through observations of powerful AGN to high redshifts. However, it is increasingly clear that most black hole growth is "hidden" from traditional AGN selection methods (e.g., optical surveys) due to obscuring clouds of gas and dust. New observatories, particularly the Wide-Field Infrared Survey Explorer (WISE) and the NuSTAR hard X-ray mission, are now allowing us to uncover these obscured AGN (the "hidden monsters" in galaxies). Recent observations and simulations are providing hints that obscured AGN are both more common, and more heavily buried, and perhaps more closely connected to galaxy evolution processes than previously believed.

The objective of this international workshop is to bring together observers and theorists to discuss the physical nature and cosmological importance of obscured AGN. We will specifically focus on the following key questions:

- What are the most effective techniques for identifying heavily obscured and Compton-thick AGN?
- How applicable is the "unified model" of AGN, and what is the physical nature of the obscuring torus?
- How does obscuration of AGN fit into black hole-galaxy evolutionary models, and what are the connections between obscuration and star formation?
- How can we use abnormal sources (for example with conflicting classifications in different wavebands or variable obscuration) to shed light on the nature of obscured AGN?
- What are the connections between obscured AGN activity, cosmology, and the physics of black hole accretion?

SOC includes: Ryan Hickox, David Alexander, Eilat Glikman, Luis Ho, Michaela Hirschmann, Masatoshi Imanishi, Stephanie LaMassa, Andrea Merloni, Desika Narayanan, Guido Risaliti, Marc Schartmann

LOC: Adlyka Annuar, McKinley Brumback, Chris Carroll, Mike DiPompeo, Christopher Harrison, Mackenzie Jones, George Lansbury, and David Rosario

The deadline for abstracts is April 22nd 2016 to allow the workshop program to be announced in May.

A registration fee of $300 will cover the five days of the workshop, five lunches, coffee/snack breaks, and the workshop dinner. There will be an afternoon devoted to fun activities near Hanover, such as hiking in the gorgeous mountains of the upper valley, canoeing on the Connecticut River, or exploring Dartmouth's Hood Museum of Art.

For more details see the workshop web site at http://www.dartmouth.edu/∼hiddenmonsters

Please address email enquiries to hidden.monsters.2016@dartmouth.edu