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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 accepted papers

Galaxy gas as obscurer: II. Separating the galaxy-scale and nuclear obscurers of Active Galactic Nuclei

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The "torus" obscurer of Active Galactic Nuclei (AGN) is poorly understood in terms of its density, substructure and physical mechanisms. Large X-ray surveys provide model boundary constraints, for both Compton-thin and Compton-thick levels of obscuration, as obscured fractions are mean covering factors $f_{\rm cov}$. However, a major remaining uncertainty is host galaxy obscuration. In Paper I we discovered a relation of $N_H \propto M_\star^{1/3}$ for the obscuration of galaxy-scale gas. Here we apply this observational relation to the AGN population, and find that galaxy-scale gas is responsible for a luminosity-independent fraction of Compton-thin AGN, but does not produce Compton-thick columns. With the host galaxy obscuration understood, we present a model of the remaining, nuclear obscurer which is consistent with a range of observations. Our radiation-lifted torus model consists of a Compton-thick component ($f_{\rm cov} \sim 35\%$) and a Compton-thin component ($f_{\rm cov} \sim 40\%$), which depends on both black hole mass and luminosity. This provides a useful summary of observational constraints for torus modellers who attempt to reproduce this behaviour. It can also be employed as a sub-grid recipe in cosmological simulations which do not resolve the torus. We also investigate host-galaxy X-ray obscuration inside cosmological, hydro-dynamic simulations (EAGLE, Illustris). The obscuration from ray-traced galaxy gas can agree with observations, but is highly sensitive to the chosen feedback assumptions.

Submitted to MNRAS

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Preprint available at https://arxiv.org/abs/1610.09380

The *Chandra* Deep Field-South Survey: 7 Ms Source Catalogs

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We present X-ray source catalogs for the $\approx$ 7 Ms exposure of the *Chandra* Deep Field-South (CDF-S), which covers a total area of 484.2 arcmin^2. Utilizing WAVDETECT for initial source detection and ACIS Extract for photometric extraction and significance assessment, we create a main source catalog containing 1008 sources that are detected in up to three X-ray bands: 0.5–7.0 keV, 0.5–2.0 keV, and 2–7 keV. A supplementary source catalog is also provided including 47 lower-significance sources that have bright ($K_s \leq 23$) near-infrared counterparts. We identify multiwavelength counterparts for 992 (98.4%) of the main-catalog sources, and we collect redshifts for 986 of these sources, including 653 spectroscopic redshifts and 333 photometric redshifts. Based on the X-ray and multiwavelength properties, we identify 711 active galactic nuclei (AGNs) from the main-catalog sources. Compared to the previous $\approx$ 4 Ms CDF-S catalogs, 291 of the main-catalog sources are new detections. We have achieved unprecedented X-ray sensitivity with average flux limits over the central $\approx$ 1 arcmin^2 region of $\approx 1.9 \times 10^{-17}$, 6.4×10^{-18}, and 2.7×10^{-17} erg cm^{-2} s^{-1} in the three X-ray bands, respectively. We provide cumulative number-count measurements observing, for the first time, that normal galaxies start to dominate the X-ray source population at the faintest 0.5–2.0 keV flux levels. The highest X-ray source density reaches $\approx 50\,500$ deg^{-2}, and $47\% \pm 4\%$ of these sources are AGNs ($\approx 23\,900$ deg^{-2}).

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A large sample of Kohonen selected E+A (post-starburst) galaxies from the Sloan Digital Sky Survey

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We aim to create a large sample of local post-starburst (PSB) galaxies to study their characteristic properties, particularly morphological features indicative of gravitational distortions and indications for active galactic nuclei (AGNs). The selection is based on a huge Kohonen self-organising map (SOM) of about one million SDSS spectra. The SOM is made fully available, in combination with an interactive user interface, for the astronomical community. We compiled a catalogue of 2665 PSB galaxies with redshifts $z < 0.4$. In the colour-mass diagram, the PSB sample is found to be clearly concentrated towards the region between the red and the blue cloud, in agreement with the idea that PSB galaxies represent the transitioning phase between actively and passively evolving galaxies. The relative frequency of distorted PSB galaxies is at least 57%, significantly higher than in a comparison sample. The search for AGNs based on conventional selection criteria in the radio and MIR results in a low AGN fraction of 2 - 3%. We confirm an MIR excess in the mean SED of the PSB galaxy sample that may indicate hidden AGNs, though other sources are also possible.

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The complex, dusty narrow-line region of NGC 4388: Gas-jet interactions, outflows, and extinction revealed by near-IR spectroscopy

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We present Gemini/GNIRS spectroscopy of the Seyfert 2 galaxy NGC 4388, with simultaneous coverage from 0.85 - 2.5 μm. Several spatially-extended emission lines are detected for the first time, both in the obscured and unobscured portion of the optical narrow line region (NLR), allowing us to assess the combined effects of the central continuum source, outflowing gas and shocks generated by the radio jet on the central 280 pc gas. The H I and [Fe II] lines allow us to map the extinction affecting the NLR. We found that the nuclear region is heavily obscured, with E(B-V) $\sim$1.9 mag. To the NE of the nucleus and up to $\sim$150 pc, the extinction remains large, $\sim$1 mag or larger, consistent with the system of dust lanes seen in optical imaging. We derived position-velocity diagrams for the most prominent lines as well as for the stellar component. Only the molecular gas and the stellar component display a well-organized pattern consistent with disk rotation. Other emission lines are kinematically perturbed or show little evidence of rotation. Extended high-ionization emission of sulfur, silicon and calcium is observed to distances of at least 200 pc both NE and SW of the nucleus. We compared flux ratios between these lines with photoionization models and conclude that radiation from the central source alone cannot explain the observed high-ionization spectrum. Shocks between the radio-jet and the ambient gas are very likely an additional source of excitation. We conclude that NGC 4388 is a prime laboratory to study the interplay between all these mechanisms.

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Chemical evolution of the Universe at $0.7 < z < 1.6$ derived from abundance diagnostics of the broad-line region of quasars

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We present an analysis of Mg II λ2798 and Fe II UV emission lines for archival Sloan Digital Sky Survey (SDSS) quasars to explore diagnostics of the magnesium-to-iron abundance ratio in a broad-line region cloud. Our sample consists of 17,432 quasars selected from the SDSS Data Release 7 with a redshift range of $0.72 < z < 1.63$. A strong anticorrelation between Mg II equivalent width (EW) and the Eddington ratio is found, while only a weak positive correlation is found between Fe II EW and the Eddington ratio. To investigate the origin of these differing behaviors of Mg II and Fe II emission lines, we have performed photoionization calculations using the CLOUDY code, where constraints from recent reverberation mapping studies are considered. We find from calculations that (i) Mg II and Fe II emission lines are created at different regions in a photoionized cloud, and (ii) their EW correlations with the Eddington ratio can be explained by just changing the cloud gas density. These results indicate that the Mg II/Fe II flux ratio, which has been used as a first-order proxy for the Mg/Fe abundance ratio in chemical evolution studies with quasar emission lines, depends largely on the cloud gas density. By correcting this density dependence, we propose new diagnostics of the Mg/Fe abundance ratio for a broad line region cloud. Comparing the derived Mg/Fe abundance ratios with chemical evolution models, we suggest that α-enrichment by mass loss from metal-poor intermediate-mass stars occurred at $z \sim 2$ or earlier.

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Host galaxies of luminous z∼0.6 quasars: Major mergers are not prevalent at the highest AGN luminosities

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Galaxy interactions are thought to be one of the main triggers of Active Galactic Nuclei (AGN), especially at high luminosities, where the accreted gas mass during the AGN lifetime is substantial. Evidence for a connection between mergers and AGN, however, remains mixed. Possible triggering mechanisms remain particularly poorly understood for luminous AGN, which are thought to require triggering by major mergers, rather than secular processes. We analyse the host galaxies of a sample of 20 optically and X-ray selected luminous AGN (log(L_{bol} [erg/s]) $>$ 45) at z $\sim$ 0.6 using HST WFC3 data in the F160W/H band. 15/20 sources have resolved host galaxies. We create a control sample of mock AGN by matching the AGN host galaxies to a control sample of non-AGN galaxies. Visual signs of disturbances are found in about 25% of sources in both the AGN hosts and control galaxies. Using both visual classification and quantitative morphology measures, we show that the levels of disturbance are not enhanced when compared to a matched control sample. We find no signs that major mergers play a dominant role in triggering AGN at high luminosities, suggesting that minor mergers and secular processes dominate AGN triggering up to the highest AGN luminosities. The upper limit on the enhanced fraction of major mergers is $\leq$20%. While major mergers might increase the incidence of (luminous AGN), they are not the prevalent triggering mechanism in the population of unobscured AGN.

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The long-term centimeter variability of active galactic nuclei: A new relation between variability timescale and accretion rate

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We study the long-term (≈30 years) radio variability of 43 radio bright AGNs by exploiting the data base of the University of Michigan Radio Astronomy Observatory (UMRAO) monitoring program. We model the periodograms (temporal power spectra) of the observed lightcurves as simple power-law noise (red noise, spectral power $P(f) \propto f^{-\beta}$) using Monte Carlo simulations, taking into account windowing effects (red-noise leak, aliasing). The power spectra of 39 (out of 43) sources are in good agreement with the models, yielding a range in power spectral index (β) from ≈1 to ≈3. We fit a Gaussian function to each flare in a given lightcurve to obtain the flare duration. We discover a correlation between β and the median duration of the flares. We use the derivative of a lightcurve to obtain a characteristic variability timescale which does not depend on the assumed functional form of the flares, incomplete fitting, and so on. We find that, once the effects of relativistic Doppler boosting are corrected for, the variability timescales of our sources are proportional to the accretion rate to the power of 0.25 ± 0.03 over five orders of magnitude in accretion rate, regardless of source type. We further find that modelling the periodograms of four of our sources requires the assumption of broken powerlaw spectra. From simulating lightcurves as superpositions of exponential flares we conclude that strong overlap of flares leads to featureless simple power-law periodograms of AGNs at radio wavelengths in most cases.

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Spectral variability of the 3C 390.3 nucleus for more than twenty years. I. Variability of the broad and narrow emission-line fluxes

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We summarize results of the analysis of the optical variability of the continuum and emission-line fluxes in the 3C 390.3 nucleus during 1992–2014. The [O III] λ5007 flux increases monotonically by $\approx$ 30 per cent in 2003–2014. The narrow Balmer lines show similar monotonic increase, while the variability patterns of the [O I] λ6300 narrow line are completely different from that of [O III]. The reverberation lags are found to be 88.6 ± 8.4, 161 ± 15, and 113 ± 14 d for the Hβ, Hα, and Hγ broad emission-lines, respectively. The reverberation mass of the central black hole equals to $(1.87 \pm 0.26) \times 10^9\, M_\odot$ and $(2.81 \pm 0.38) \times 10^9\, M_\odot$, for the H$\beta$ and Hα lines and assuming a scaling factor that converts the virial product to a mass to be $f = 5.5$. A difference between both masses can point to a difference between kinematics of the Hα and Hβ emission regions. We show that the reverberation mapping can only be applied to the entire period of observations of the 3C 390.3 nucleus after removing a long-term trend. This trend has been expressed by a slowly varying scale factor $c(t)$ in the power-law relationship between the line and continuum fluxes: $F_{line} \propto c(t)\, F^{a}_{cont}$. We find the power-law index a equals to 0.77 and 0.54 for the Hβ and Hα lines, respectively. The observed relationship between the Balmer decrement and the optical continuum flux is as follows: $F(H\alpha)/F(H\beta) \propto F^{-0.20}_{cont}$ and $F(H\beta)/F(H\gamma) \propto F^{-0.18}_{cont}$. The 3C 390.3 nucleus is an 'outsider' in the relationship between optical luminosity and black hole mass. Its Eddington ratio is $E_{bol}/E_{Edd} = 0.0037$.

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Optical variability of AGN in the PTF/iPTF survey

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We characterize the optical variability of quasars in the intermediate Palomar Transient Factory (iPTF) and Palomar Transient Factory (PTF) surveys. We re-calibrate the r-band light curves for $\sim$28,000 luminous, broad-line AGNs from the SDSS, producing a total of $\sim$2.4 million photometric data points. We utilize both the structure function (SF) and power spectrum density (PSD) formalisms to search for links between the optical variability and the physical parameters of the accreting supermassive black holes that power the quasars. The excess variance (SF^2) of the quasar sample tends to zero at very short time separations, validating our re-calibration of the time-series data. We find that the the amplitude of variability at a given time-interval, or equivalently the time-scale of variability to reach a certain amplitude, is most strongly correlated with luminosity with weak or no dependence on black hole mass and redshift. For a variability level of SF(τ)=0.07 mag, the time-scale has a dependency of $\tau \propto L^{0.4}$. This is broadly consistent with the expectation from a simple Keplerian accretion disk model, which provides $\tau \propto L^{0.5}$. The PSD analysis also reveals that many quasar light curves are steeper than a damped random walk. We find a correlation between the steepness of the PSD slopes, specifically the fraction of slopes steeper than 2.5, and black hole mass, although we cannot exclude the possibility that luminosity or Eddington ratio are the drivers of this effect. This effect is also seen in the SF analysis of the (i)PTF data, and in a PSD analysis of quasars in the SDSS Stripe 82.

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Attenuation from the optical to the extreme ultraviolet by dust associated with broad absorption line quasars: the driving force for outflows

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We use mid-IR to UV observations to derive a mean attenuation curve out to the rest-frame extreme ultraviolet (EUV) for 'BAL dust' – the dust causing the additional extinction of active galactic nuclei (AGNs) with broad absorption lines (BALQSOs). In contrast to the normal, relatively flat, mean AGN attenuation curve, BAL dust is well fit by a steeply rising, SMC-like curve. We confirm the shape of the theoretical Weingartner & Draine SMC curve out to 700 Å but the drop in attenuation at still shorter wavelengths is less than predicted. The identical attenuation curve for low-ionization BALQSOs (LoBALs) does not support them being a "break out" phase in the life of AGNs. Although attenuation in the optical due to BAL dust is low ($E(B-V) \sim 0.03 - 0.05$), the attenuation rises to one magnitude in the EUV because of the steep extinction curve. Here the dust optical depth is at the optimum value for radiative acceleration of dusty gas. Because the spectral energy distribution of AGNs peaks in the EUV where the optical depth is highest, the force on the dust dominates the acceleration of BAL gas. For LoBALs we get a negative attenuation curve in the optical. This is naturally explained if there is more light scattered into our line of sight in LoBALs compared with non-BALQSOs. We suggest that this and partial covering are causes when attenuation curves appear to be steeper in the UV that an SMC curve.

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Preprint is available at *http://adsabs.harvard.edu/abs/2016arXiv161103733G*

Ionization and feedback in Lyα halos around two radio galaxies at z$\sim$2.5

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We present new spectroscopic observations of two high redshift radio galaxies, TXS 0211-122 (z=2.34) and TXS 0828+193 (z=2.57), known to be associated with large Lyα halos. The observations were taken with the slits placed perpendicularly to the radio axis. With access to pre-existing Keck II observations taken with the slit placed along the radio axis we are able to compare the properties of the gas in different regions of the galaxies. In both objects we detect spatially extended Lyα emission perpendicularly to the radio axis. In TXS 0211-122, the flux and velocity profiles of Lyα are strongly affected by HI absorption/scattering. In line with previous studies, we find evidence for outflowing gas along the radio axis which may be the result of jet-gas interactions. In the slit oriented perpendicularly to the radio axis we find less perturbed gas kinematics, suggesting outflows of ionized gas in this object are focused along the radio jet axis. Additionally, we find evidence for a giant, UV-emitting arc or shell-like structure surrounding the radio galaxy Lyα halo, possibly resulting from feedback activity. In TXS 0828+193 a large Lyα halo ($\sim$56 kpc) is detected perpendicularly to the radio axis. Along both slit position angles we find evidence for outflowing gas, which we argue is part of an approximately spherical, expanding shell or bubble of gas powered by feedback activity in the central regions of the galaxy. Our results suggest a diversity in the spatial distribution of ionized outflows in powerful radio galaxies at z$\sim$2.5.

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The Complete Infrared View of Active Galactic Nuclei from the 70-month Swift/BAT Catalog

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We systematically investigate the near- (NIR) to far-infrared (FIR) photometric properties of a nearly complete sample of local active galactic nuclei (AGN) detected in the *Swift*/Burst Alert Telescope (BAT) all-sky ultra hard X-ray (14–195 keV) survey. Out of 606 non-blazar AGN in the *Swift*/BAT 70-month catalog at high galactic latitude of $|b| > 10^{\circ}$, we obtain IR photometric data of 604 objects by cross-matching the AGN positions with catalogs from the *WISE*, *AKARI*, *IRAS*, and *Herschel* infrared observatories. We find a good correlation between the ultra-hard X-ray and mid-IR (MIR) luminosities over five orders of magnitude ($41 < \log(L_{14-195}/\mathrm{erg\ s^{-1}}) < 46$). Informed by previous measures of the intrinsic spectral energy distribution of AGN, we find FIR pure-AGN candidates whose FIR emission is thought to be AGN-dominated with low starformation activity. We demonstrate that the dust covering factor decreases with the bolometric AGN luminosity, confirming the luminosity-dependent unified scheme. We also show that the completeness of the *WISE* color-color cut in selecting *Swift*/BAT AGN increases strongly with 14–195 keV luminosity.

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Meetings

Quasars at all cosmic epochs

Padova, Italy
April, 2-7, 2017

Webpage: https://www.ict.inaf.it/indico/event/338/
Email: quasar_loc@oapd.inaf.it

Quasars have been discovered slightly more than 50 years ago. The times are ripe for a critical assessment of our present knowledge of quasars as accreting systems and of their evolution across cosmic time. The aim of this meeting is to review the main observational scenarios following an empirical approach, to present and discuss theories, and then to analyze how a closer connection between theory and observation can be achieved, identifying those aspects of our understanding that are still on a shaky terrain and are therefore uncertain knowledge. The meeting will cover topics ranging from the systematic organization of observational properties of quasars to accretion processes in the nearest environment of the quasars black holes, from feedback effects on host galaxies and environmental effects that are relevant for improving our still-lacunose understanding of galaxy evolution. Further information on the scientific rationale are provided at the Meeting web page. The meeting will be held in downtown Padova, whose University and Observatory host one of the largest communities of professional astronomers in Europe, with a large school and a long tradition in teaching of physics and astronomy. It will be part of the events meant to celebrate the 250th anniversary of the foundation of the Padova Observatory.

Key Topics Day 1: Observational properties of quasars as luminous active galactic nuclei. Day 2: Accretion processes on supermassive black holes. Day 3: Contextualization and connection between theory and observation for the emitting region of quasars. Day 4: Quasar evolution over cosmic time and quasars as cosmological tools. Day 5: Feedback and environment of active galaxies and quasars.

Confirmed invited speakers: Moshe Elitzur (University of Kentucky, USA) – Yair Krongold (UNAM, Mexico) – Isabel Marquez (IAA, Spain) – Raffaella Morganti (NIRA, the Netherlands) – Paolo Padovani (ESO) – Gordon Richards (Drexel University, USA) – Thaisa Storchi-Bergmann (UFRGS, Brazil) – Jack Sulentic (IAA, Spain) – Final remarks: Hagai Netzer (Tel Aviv University, Israel)