Active Galaxies Newsletter	*An electronic publication dedicated to the observation and theory of active galaxies*
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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

The MIXR sample: AGN activity versus star formation across the cross-correlation of WISE, 3XMM, and FIRST/NVSS.

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We cross-correlate the largest available Mid-Infrared (WISE), X-ray (3XMM) and Radio (FIRST+NVSS) catalogues to define the MIXR sample of AGN and star-forming galaxies. We pre-classify the sources based on their positions on the WISE colour/colour plot, showing that the MIXR triple selection is extremely effective to diagnose the star formation and AGN activity of individual populations, even on a flux/magnitude basis, extending the diagnostics to objects with luminosities and redshifts from SDSS DR12. We recover the radio/mid-IR star formation correlation with great accuracy, and use it to classify our sources, based on their activity, as radio-loud and radio-quiet AGN, LERGs/LINERs, and non-AGN galaxies. These diagnostics can prove extremely useful for large AGN and galaxy samples, and help develop ways to efficiently triage sources when data from the next generation of instruments becomes available. We study bias in detail, and show that while the widely-used WISE colour selections for AGN are very successful at cleanly selecting samples of luminous AGN, they miss or misclassify a substantial fraction of AGN at lower luminosities and/or higher redshifts. MIXR also allows us to test the relation between radiative and kinetic (jet) power in radio-loud AGN, for which a tight correlation is expected due to a mutual dependence on accretion. Our results highlight that long-term AGN variability, jet regulation, and other factors affecting the Q/L_{bol} relation, are introducing a vast amount of scatter in this relation, with dramatic potential consequences on our current understanding of AGN feedback and its effect on star formation.

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Preprint available at https://arxiv.org/abs/1607.06471

The Geometry of the Infrared and X-ray Obscurer in a Dusty Hyperluminous Quasar

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We study the geometry of the AGN obscurer in *IRAS*, an IR-luminous, radio-intermediate FR-I source at z=0.442, using infrared data from *Spitzer* and *Herschel*, X-ray data from *NuSTAR*, *Swift*, *Suzaku*, and *Chandra*, and an optical spectrum from Palomar. The infrared data imply a total rest-frame 1-1000μm luminosity of 5.5×10^{46} erg s^{-1} and require both an AGN torus and starburst model. The AGN torus has an anisotropy-corrected IR luminosity of 4.9×10^{46} erg s^{-1}, and a viewing angle and half opening angle both of approximately 36 deg from pole-on. The starburst has a star formation rate of (110 ± 34) M$_\odot$ yr^{-1} and an age of < 50 Myr. These results are consistent with two epochs of luminous activity in IRAS: one approximately 150 Myr ago, and one ongoing. The X-ray data suggest a photon index of $\Gamma \simeq 1.8$ and a line-of-sight column of $N_{\rm H} \simeq 5 \times 10^{23}$ cm^{-2}. This argues against a reflection-dominated hard X-ray spectrum, which would have implied a much higher $N_{\rm H}$ and luminosity. The X-ray and infrared data are consistent with a bolometric AGN luminosity of $L_{\rm bol} \sim (0.5 - 2.5) \times 10^{47}$ erg s^{-1}. The X-ray and infrared data are further consistent with coaligned AGN obscurers in which the line of sight 'skims' the torus. This is also consistent with the optical spectra, which show both coronal iron lines and broad lines in polarized but not direct light. Combining constraints from the X-ray, optical, and infrared data suggests that the AGN obscurer is within a vertical height of 20 pc, and a radius of 125 pc, of the nucleus.

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Preprint available at http://lanl.arxiv.org/abs/1606.05649

Far-infrared line spectra of active galaxies from the *Herschel*/PACS Spectrometer: the complete database

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We present a coherent database of spectroscopic observations of far-IR fine-structure lines from the *Herschel*/PACS archive for a sample of 170 local AGN, plus a comparison sample of 20 starburst galaxies and 43 dwarf galaxies. Published *Spitzer*/IRS and *Herschel*/SPIRE line fluxes are included to extend our database to the full 10–600 μm spectral range. The observations are compared to a set of CLOUDY photoionisation models to estimate the above physical quantities through different diagnostic diagrams. We confirm the presence of a stratification of gas density in the emission regions of the galaxies, which increases with the ionisation potential of the emission lines. The new $[\mathrm{O\,IV}]_{25.9\,\mu\mathrm{m}}/[\mathrm{O\,III}]_{88\,\mu\mathrm{m}}$ *vs* $[\mathrm{Ne\,III}]_{15.6\,\mu\mathrm{m}}/[\mathrm{Ne\,II}]_{12.8\,\mu\mathrm{m}}$ diagram is proposed as the best diagnostic to separate: *i)* AGN activity from any kind of star formation; and *ii)* low-metallicity dwarf galaxies from starburst galaxies. Current stellar atmosphere models fail to reproduce the observed $[\mathrm{O\,IV}]_{25.9\,\mu\mathrm{m}}/[\mathrm{O\,III}]_{88\,\mu\mathrm{m}}$ ratios, which are much higher when compared to the predicted values. Finally, the $([\mathrm{Ne\,III}]_{15.6\,\mu\mathrm{m}}+[\mathrm{Ne\,II}]_{12.8\,\mu\mathrm{m}})/([\mathrm{S\,IV}]_{10.5\,\mu\mathrm{m}}+[\mathrm{S\,III}]_{18.7\,\mu\mathrm{m}})$ ratio is proposed as a promising metallicity tracer to be used in obscured objects, where optical lines fail to accurately measure the metallicity. The diagnostic power of mid- to far-infrared spectroscopy shown here for local galaxies will be of crucial importance to study galaxy evolution during the dust-obscured phase at the peak of the star formation and black-hole accretion activity ($1 < z < 4$). This study will be addressed by future deep spectroscopic surveys with present and forthcoming facilities such as *JWST*, ALMA, and *SPICA*.

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Preprint available at http://arxiv.org/abs/1607.02511

LOFAR/H-ATLAS: A deep low-frequency survey of the *Herschel*-ATLAS North Galactic Pole field

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We present LOFAR High-Band Array (HBA) observations of the *Herschel*-ATLAS North Galactic Pole survey area. The survey we have carried out, consisting of four pointings covering around 142 square degrees of sky in the frequency range 126–173 MHz, does not provide uniform noise coverage but otherwise is representative of the quality of data to be expected in the planned LOFAR wide-area surveys, and has been reduced using recently developed 'facet calibration' methods at a resolution approaching the full resolution of the datasets ($\sim 10 \times 6$ arcsec) and an rms off-source noise that ranges from 100 μJy beam^{-1} in the centre of the best fields to around 2 mJy beam^{-1} at the furthest extent of our imaging. We describe the imaging, cataloguing and source identification processes, and present some initial science results based on a 5-σ source catalogue. These include (i) an initial look at the radio/far-infrared correlation at 150 MHz, showing that many *Herschel* sources are not yet detected by LOFAR; (ii) number counts at 150 MHz, including, for the first time, observational constraints on the numbers of star-forming galaxies; (iii) the 150-MHz luminosity functions for active and star-forming galaxies, which agree well with determinations at higher frequencies at low redshift, and show strong redshift evolution of the star-forming population; and (iv) some discussion of the implications of our observations for studies of radio galaxy life cycles.

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Ensemble X-ray variability of active galactic nuclei. II. Excess variance and updated structure function

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Most investigations of the X-ray variability of active galactic nuclei (AGN) have been concentrated on the detailed analyses of individual, nearby sources. A relatively small number of studies have treated the ensemble behaviour of the more general AGN population in wider regions of the luminosity-redshift plane. We want to determine the ensemble variability properties of a rich AGN sample, called Multi-Epoch XMM Serendipitous AGN Sample (MEXSAS), extracted from the 5th release of the XMM-Newton Serendipitous Source Catalogue (XMMSSC-DR5), with redshift between ~ 0.1 and ~ 5, and X-ray luminosities in the 0.5-4.5 keV band between $\sim 10^{42}$ erg/s and $\sim 10^{47}$ erg/s. We urge caution on the use of the normalised excess variance (NXS), noting that it may lead to underestimate variability if used improperly. We use the structure function (SF), updating our previous analysis for a smaller sample. We propose a correction to the NXS variability estimator, taking account of the light curve duration in the rest frame on the basis of the knowledge of the variability behaviour gained by SF studies. We find an ensemble increase of the X-ray variability with the rest frame time lag τ, given by $SF \propto \tau^{0.12}$. We confirm an inverse dependence on the X-ray luminosity, approximately as $SF \propto L_X^{-0.19}$. We analyse the SF in different X-ray bands, finding a dependence of the variability on the frequency as $SF \propto \nu^{-0.15}$, corresponding to a "softer when brighter" trend. In turn, this dependence allows us to parametrically correct the variability estimated in observer frame bands to that in the rest frame, resulting in a moderate ($< 15\%$) shift upwards (V-correction). Ensemble X-ray variability of AGNs is best described by the structure function. An improper use of the normalised excess variance may lead to an underestimate of the intrinsic variability, so that appropriate corrections to the data or the models must be applied to prevent these effects.

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No Signatures of Black-Hole Spin in the X-ray Spectrum of the Seyfert 1 Galaxy Fairall 9

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Fairall 9 is one of several type 1 active galactic nuclei for which it has been claimed that the angular momentum (or spin) of the supermassive black hole can be robustly measured, using the Fe Kα emission line and Compton-reflection continuum in the X-ray spectrum. The method rests upon the interpretation of the Fe Kα line profile and associated Compton-reflection continuum in terms of relativistic broadening in the strong gravity regime in the innermost regions of an accretion disc, within a few gravitational radii of the black hole. Here, we re-examine a Suzaku X-ray spectrum of Fairall 9 and show that a face-on toroidal X-ray reprocessor model involving only nonrelativistic and mundane physics provides an excellent fit to the data. The Fe Kα line emission and Compton reflection continuum are calculated self-consistently, the iron abundance is solar, and an equatorial column density of $\sim 10^{24}$ cm^{-2} is inferred. In this scenario, neither the Fe Kα line, nor the Compton-reflection continuum provide any information on the black-hole spin. Whereas previous analyses have assumed an infinite column density for the distant-matter reprocessor, the shape of the reflection spectrum from matter with a finite column density eliminates the need for a relativistically broadened Fe Kα line. We find a 90 per cent confidence range in the Fe Kα line FWHM of 1895-6205 km s^{-1}, corresponding to a distance of $\sim$ 3100 to 33,380 gravitational radii from the black hole, or 0.015-0.49 pc for a black-hole mass of $\sim 1 - 3 \times 10^8$ $M_\odot$.

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Constraints on the Broad Line Region Properties and Extinction in Local Seyferts

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We use high spectral resolution (R$\,>\,$8000) data covering 3800–13000Å to study the physical conditions of the broad line region (BLR) of nine nearby Seyfert 1 galaxies. Up to six broad H I lines are present in each spectrum. A comparison – for the first time using simultaneous optical to near-infrared observations – to photoionisation calculations with our devised simple scheme yields the extinction to the BLR at the same time as determining the density and photon flux, and hence distance from the nucleus, of the emitting gas. This points to a typical density for the H I emitting gas of 10^{11} cm^{-3} and shows that a significant amount of this gas lies at regions near the dust sublimation radius, consistent with theoretical predictions. We also confirm that in many objects the line ratios are far from case B, the best-fit intrinsic broad-line Hα/Hβ ratios being in the range 2.5–6.6 as derived with our photoionization modeling scheme. The extinction to the BLR, based on independent estimates from H I and He II lines, is $A_V \leq 3$ for Seyfert 1–1.5s, while Seyfert 1.8–1.9s have A_V in the range 4–8. A comparison of the extinction towards the BLR and narrow line region (NLR) indicates that the structure obscuring the BLR exists on scales smaller than the NLR. This could be the dusty torus, but dusty nuclear spirals or filaments could also be responsible. The ratios between the X-ray absorbing column N_H and the extinction to the BLR are consistent with the Galactic gas-to-dust ratio if N_H variations are considered.

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Star formation and AGN activity in the most luminous LINERs in the local universe

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This work presents the properties of 42 objects in the group of the most luminous, highest star formation rate LINERs at $z = 0.04$ - 0.11. We obtained long-slit spectroscopy of the nuclear regions for all sources, and FIR data (Herschel and IRAS) for 13 of them. We measured emission line intensities, extinction, stellar populations, stellar masses, ages, AGN luminosities, and star-formation rates. We find considerable differences from other low-redshift LINERs, in terms of extinction, and general similarity to star forming (SF) galaxies. We confirm the existence of such luminous LINERs in the local universe, after being previously detected at $z \sim 0.3$ by Tommasin et al. (2012). The median stellar mass of these LINERs corresponds to $6\text{-}7 \times 10^{10}\,M_\odot$ which was found in previous work to correspond to the peak of relative growth rate of stellar populations and therefore for the highest SFRs. Other LINERs although showing similar AGN luminosities have lower SFR. We find that most of these sources have LAGN $\sim$ LSF suggesting co-evolution of black hole and stellar mass. In general the fraction of local LINERs on the main-sequence of SF galaxies is related to their AGN luminosity.

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Extreme star formation events in quasar hosts over $0.5 < z < 4$

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We explore the relationship between active galactic nuclei and star formation in a sample of 513 optically luminous type 1 quasars up to redshifts of $\sim$4 hosting extremely high star formation rates (SFRs). The quasars are selected to be individually detected by the *Herschel* SPIRE instrument at $> 3\sigma$ at $250\,\mu$m, leading to typical SFRs of order of $1000\,M_\odot yr^{-1}$. We find the average SFRs to increase by almost a factor 10 from $z \sim 0.5$ to $z \sim 3$, mirroring the rise in the comoving SFR density over the same epoch. However, we find that the SFRs remain approximately constant with increasing accretion luminosity for accretion luminosities above $10^{12}\,L_\odot$. We also find that the SFRs do not correlate with black hole mass. Both of these results are most plausibly explained by the existence of a self-regulation process by the starburst at high SFRs, which controls SFRs on time-scales comparable to or shorter than the AGN or starburst duty cycles. We additionally find that SFRs do not depend on Eddington ratio at any redshift, consistent with no relation between SFR and black hole growth rate per unit black hole mass. Finally, we find that high-ionisation broad absorption line (HiBAL) quasars have indistinguishable far-infrared properties to those of classical quasars, consistent with HiBAL quasars being normal quasars observed along a particular line of sight, with the outflows in HiBAL quasars not having any measurable effect on the star formation in their hosts.

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Growth of supermassive black holes, galaxy mergers and supermassive binary black holes

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The study of galaxy mergers and supermassive binary black holes (SMBBHs) is central to our understanding of the galaxy and black hole assembly and (co-)evolution at the epoch of structure formation and throughout cosmic history. Galaxy mergers are the sites of major accretion episodes, they power quasars, grow supermassive black holes (SMBHs), and drive SMBH-host scaling relations. The coalescing SMBBHs at their centers are the loudest sources of gravitational waves (GWs) in the universe, and the subsequent GW recoil has a variety of potential astrophysical implications which are still under exploration.Future GW astronomy will open a completely new window on structure formation and galaxy mergers, including the direct detection of coalescing SMBBHs, high-precision measurements of their masses and spins, and constraints on BH formation and evolution in the high-redshift universe.

Astronomy in Focus. Proceedings of the XXIXth IAU General Assembly, P. Benvenuti (ed).

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The location of the dust causing internal reddening of active galactic nuclei

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We use the Balmer decrements of the broad-line regions (BLRs) and narrow-line regions (NLRs) of active galactic nuclei (AGNs) as reddening indicators to investigate the location of the dust for four samples of AGNs with reliable estimates of the NLR contribution to the Balmer lines. Intercomparison of the NLR and BLR Balmer decrements indicates that the reddening of the NLR sets a lower limit to the reddening of the BLR. Almost no objects have high NLR reddening but low BLR reddening. The reddening of the BLR is often substantially greater than the reddening of the NLR. The BLR reddening is correlated with the equivalent widths of [O III] lines and the intensity of the [O III] lines relative to broad Hβ. We find these relationships to be consistent with the predictions of a simple model where the additional dust reddening the BLR is interior to the NLR. We thus conclude that the dust causing the additional reddening of the accretion disc and BLR is mostly located at a smaller radius than the NLR.

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Preprint available at http://adsabs.harvard.edu/abs/2016arXiv160608914H

Special Announcements

Nature Astronomy is now open for submissions

August 2016

Nature Astronomy is a truly multidisciplinary journal, launching in January 2017. It will represent and foster closer interaction between all of the key astronomy-relevant disciplines. As a Nature Research journal, it will publish the most significant research, review and comment at the cutting edge of astronomy, astrophysics, cosmology and planetary science.

Nature Astronomy will offer a range of content types including original research, Review Articles, Perspectives, Commentaries, News & Views and Research Highlights to explore topical issues as well as showcasing significant advances in the field.

Publication in Nature Astronomy is free of charge, and its publication policy allows the posting of submitted manuscripts on preprint servers, and the self-archiving of the published versions of papers six months after publication.

Please visit the Nature Astronomy website for more information and to submit a manuscript: http://go.nature.com/2a1RXzV

Jobs

ESA Research Fellowship in Space Science
Noordwijk (NL) and Madrid (E)
Deadline: 1 October 2015

Email contact: fellowship@cosmos.esa.int
Further Information: http://cosmos.esa.int/fellowship

The European Space Agency awards several postdoctoral fellowships each year.

The aim of these fellowships is to provide young scientists, holding a PhD or the equivalent degree, with the means of performing space science research in fields related to the ESA Science and Robotic Exploration Programmes. Areas of research include planetary science, astronomy and astrophysics, solar and solar-terrestrial science, plasma physics and fundamental physics. The fellowships have a duration of two years and are tenable at the European Space Research and Technology Centre (ESTEC) in Noordwijk, Netherlands, or at the European Space Astronomy Centre (ESAC) in Villafranca del Castillo, near Madrid, Spain.

Applications are now solicited for fellowships in space science to begin in the fall of 2017. Preference will be given to applications submitted by candidates within five years of receiving their PhD. Candidates not holding a PhD yet are encouraged to apply, but they must provide evidence of receiving their degree before starting the fellowship.

ESA fellows are enrolled in ESA's Social Security Scheme, which covers medical expenses, invalidity and death benefits. A monthly deduction covers these short-term and long-term risks.

The deadline for applications is 29 September 2016.

More information on the ESA Research Fellowship programme in Space Science, on the conditions and eligibility, as well as the application form can retrieved from http://cosmos.esa.int/fellowship

Questions on the scientific aspects of the ESA Fellowship in Space Science not answered in the above pages can be sent by e-mail to the fellowship coordinators, Dr.Oliver Jennrich or Dr.Bruno Altieri at the address fellowship@cosmos.esa.int