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From the Editor

The Active Galaxies Newsletter is produced monthly. The deadline for contributions is the last day of the month. The Latex macros for submitting abstracts and dissertation abstracts are appended to each issue of the newsletter and are also available on the web page.

As always as editor of the newsletter I am very interested to hear any suggestions or feedback regarding the newsletter. So do not hesitate in emailing me your suggestions.

Many thanks for your continued subscription.

Melanie Gendre

Abstracts of recently accepted papers

Microlensing of the broad line region in 17 lensed quasars

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When an image of a strongly lensed quasar is microlensed, the different components of its spectrum are expected to be differentially magnified owing to the different sizes of the corresponding emitting region. Chromatic changes are expected to be observed in the continuum while the emission lines should be deformed as a function of the size, geometry and kinematics of the regions from which they originate. Microlensing of the emission lines has been reported only in a handful of systems so far. In this paper we search for microlensing deformations of the optical spectra of pairs of images in 17 lensed quasars with bolometric luminosities between $10^{44.7-47.4}$ erg/s and black hole masses $10^{7.6-9.8} M_{\odot}$. This sample is composed of 13 pairs of previously unpublished spectra and four pairs of spectra from literature. Our analysis is based on a simple spectral decomposition technique which allows us to isolate the microlensed fraction of the flux independently of a detailed modeling of the quasar emission lines. Using this technique, we detect microlensing of the continuum in 85% of the systems. Among them, 80% show microlensing of the broad emission lines. Focusing on the most common emission lines in our spectra (C III and Mg II) we detect microlensing of either the blue or the red wing, or of both wings with the same amplitude. This observation implies that the broad line region is not in general spherically symmetric. In addition, the frequent detection of microlensing of the blue and red wings independently but not simultaneously with a different amplitude, does not support existing microlensing simulations of a biconical outflow. Our analysis also provides the intrinsic flux ratio between the lensed images and the magnitude of the microlensing affecting the continuum. These two quantities are particularly relevant for the determination of the fraction of matter in clumpy form in galaxies and for the detection of dark matter substructures via the identification of flux ratio anomalies.

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E-mail contact: dsluse@astro.uni-bonn.de preprint available at ArXiv:1206.0731

GOODS-*Herschel*: Ultra-deep *XMM-Newton* observations reveal AGN/star-formation connection

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Models of galaxy evolution assume some connection between the AGN and star formation activity in galaxies. We use the multi-wavelength information of the CDFS to assess this issue. We select the AGNs from the 3 Ms *XMM-Newton* survey and measure the star-formation rates of their hosts using data that probe rest-frame wavelengths longward of 20 μm, predominantly from deep 100 μm and 160 μm *Herschel* observations, but also from *Spitzer* MIPS-70 μm. Star-formation rates are obtained from spectral energy distribution fits, identifying and subtracting an AGN component. Our sample consists of sources in the $z \approx 0.5 - 4$ redshift range, with star-formation rates SFR $\approx 10^1 - 10^3\,\mathrm{M}_\odot\,\mathrm{yr}^{-1}$ and stellar masses $M_\star \approx 10^{10} - 10^{11.5}\,\mathrm{M}_\odot$. We divide the star-formation rates by the stellar masses of the hosts to derive specific star-formation rates (sSFR) and find evidence for a positive correlation between the AGN activity (proxied by the X-ray luminosity) and the sSFR for the most active systems with X-ray luminosities exceeding $L_\mathrm{x} \simeq 10^{43}\,\mathrm{erg\,s^{-1}}$ and redshifts $z > 1$. We do not find evidence for such a correlation for lower luminosity systems or those at lower redshifts, consistent with previous studies. We do not find any correlation between the SFR (or the sSFR) and the X-ray absorption derived from high-quality *XMM-Newton* spectra either, showing that the absorption is likely to be linked to the nuclear region rather than the host, while the star-formation is not nuclear. Comparing the sSFR of the hosts to the characteristic sSFR of star-forming galaxies at the same redshift (the so-called "main sequence") we find that the AGNs reside mostly in main-sequence and starburst hosts, reflecting the AGN - sSFR connection; however the infrared selection might bias this result. Limiting our analysis to the highest X-ray luminosity AGNs (X-ray QSOs with $L_\mathrm{x} > 10^{44}\,\mathrm{erg\,s^{-1}}$), we find that the highest-redshift QSOs (with $z > 2$) reside predominantly in starburst hosts, with an average sSFR more than double that of the "main sequence", and we find a few cases of QSOs at $z \approx 1.5$ with specific star-formation rates compatible with the main-sequence, or even in the "quiescent" region. Finally, we test the reliability of the colour-magnitude diagram (plotting the rest-frame optical colours against the stellar mass) in assessing host properties, and find a significant correlation between rest-frame colour (without any correction for AGN contribution or dust extinction) and sSFR excess relative to the "main sequence" at a given redshift. This means that the most "starbursty" objects have the bluest rest-frame colours.

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Broad Absorption Line Disappearance on Multi-Year Timescales in a Large Quasar Sample

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We present 21 examples of C IV Broad Absorption Line (BAL) trough disappearance in 19 quasars selected from systematic multi-epoch observations of 582 bright BAL quasars ($1.9 < z < 4.5$) by the Sloan Digital Sky Survey-I/II (SDSS-I/II) and SDSS-III. The observations span 1.1–3.9 yr rest-frame timescales, longer than have been sampled in many previous BAL variability studies. On these timescales, $\approx 2.3\%$ of C IV BAL troughs disappear and $\approx 3.3\%$ of BAL quasars show a disappearing trough. These observed frequencies suggest that many C IV BAL absorbers spend on average at most a century along our line of sight to their quasar. Ten of the 19 BAL quasars showing C IV BAL disappearance have apparently transformed from BAL to non-BAL quasars; these are the first reported examples of such transformations. The BAL troughs that disappear tend to be those with small-to-moderate equivalent widths, relatively shallow depths, and high outflow velocities. Other non-disappearing C IV BALs in those nine objects having multiple troughs tend to weaken when one of them disappears, indicating a connection between the disappearing and non-disappearing troughs, even for velocity separations as large as 10000–15000 km s^{-1}. We discuss possible origins of this connection including disk-wind rotation and changes in shielding gas.

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The Effects of Disc Winds on the Spectrum and Black Hole Growth Rate of Active Galactic Nuclei

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Several properties of the standard α-disc model for active galactic nuclei (AGN) are not entirely consistent with AGN observations. As well as such discrepencies, observations show evidence for the existence of high mass outflow winds originating from the vicinity of the active black hole (BH). Such winds may originate from various parts of the disc and could change the local accretion rate which should alter the emitted spectral energy distribution (SED) and affect the global disc luminosity and the BH growth rate. The new calculations presented here show the effects of several types of winds on the observed and inferred disc properties. Some wind profiles can have a profound effect on the observed SED and can perhaps explain the poorly understood deviations of AGN spectra from standard disc spectra. We show a factor ~ 2 possible error in estimating the disc luminosity and larger deviations in estimating L/L_{Edd}. The BH growth rate computed without taking the effects of wind into account may be significantly over-estimated. We also suggest a practical way to use the observed SED in order to make first order corrections to BH growth rate and account for the effects of disc winds.

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X-ray polarimetry as a new tool to discriminate reflection from absorption scenarios – Predictions for MCG-6-30-15

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We present modelling of X-ray polarisation spectra emerging from the two competing scenarios that are proposed to explain the broad Fe Kα line in the Seyfert 1 galaxy MCG-6-30-15. The polarisation signature of complex absorption is studied for a partial covering scenario using a clumpy wind and compared to a reflection model based on the lamp-post geometry. The shape of the polarisation percentage and angle as a function of photon energy are found to be distinctly different between the reflection and the absorption case. Relativistic reflection produces significantly stronger polarisation in the 1–10 keV energy band than absorption. The spectrum of the polarisation angle adds additional constraints: in the absorption case it shows a constant shape, whereas the relativistic reflection scenario typically leads to a smooth rotation of the polarisation angle with photon energy. Based on this work, we conclude that a soft X-ray polarimeter on-board a small X-ray satellite may already discriminate between the absorption and the reflection scenario. A promising opportunity may arise with the *X-ray Imaging Polarimetry Explorer (XIPE)* mission, which has been proposed to ESA in response to a small-size (S-class) mission call due for launch in 2017.

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The central structure of Broad Absorption Line QSOs: observational characteristics in the cm-mm wavelength domain

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Accounting for ∼20% of the total QSO population, Broad Absorption Line QSOs are still an unsolved problem in the AGN context. They present wide troughs in the UV spectrum, due to material with velocities up to 0.2 c toward the observer. The two models proposed in literature try to explain them as a particular phase of the evolution of QSOs or as normal QSOs, but

seen from a particular line of sight.
We built a statistically complete sample of Radio-Loud BAL QSOs, and carried out an observing campaign to piece together the whole spectrum in the cm wavelength domain, and highlight all the possible differences with respect to a comparison sample of Radio-Loud non-BAL QSOs. VLBI observations at high angular resolution have been performed, to study the pc-scale morphology of these objects. Finally, we tried to detect a possible dust component with observations at mm-wavelengths.
Results do not seem to indicate a young age for all BAL QSOs. Instead a variety of orientations and morphologies have been found, constraining the outflows foreseen by the orientation model to have different possible angles with respect to the jet axis.

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Measuring the jet power of flat spectrum radio quasars

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We use frequency-dependent position shifts of flat spectrum radio cores to estimate the kinetic power of AGN jets. We find a correlation between the derived jet powers and AGN narrow-line luminosity, consistent with the well-known relation for radio galaxies and steep spectrum quasars. This technique can be applied to intrinsically weak jets even at high redshift.

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BL LAC PKS B1144−379: an extreme scintillator

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Rapid variability in the radio flux density of the BL Lac object PKS B1144−379 has been observed at four frequencies, ranging from 1.5 to 15 GHz, with the VLA and the University of Tasmania's Ceduna antenna. Intrinsic and line of sight effects were examined as possible causes of this variability, with interstellar scintillation best explaining the frequency dependence of the variability timescales and modulation indices. This scintillation is consistent with a compact source 12–25 μas, or 0.1–0.2 pc in size. The inferred brightness temperature for PKS B1144−379 (assuming that the observed variations are due to scintillation) is 1.3×10^{14} K at 4.9 GHz, with approximately 10 percent of the total flux in the scintillating component. We show that scintillation surveys aimed at identifying variability timescales of days to weeks are an effective way to identify the AGN with the highest brightness temperatures.

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Thesis Abstracts

Cosmological Evolution of Supermassive Black Holes in the Centres of Galaxies.

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Thesis work conducted at: School of Physics & Astronomy, University of Southampton, U.K. Current address: Institute of Cosmology & Gravitation, University of Portsmouth,
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Ph.D dissertation directed by: Dr. Christian R. Kaiser, Dr. Phil Uttley, Dr. Thomas J. Maccarone

Ph.D degree awarded: June 2012

Radio galaxies and quasars are among the largest and most powerful single objects known and are believed to have had a significant impact on the evolving Universe and its large scale structure. Their jets inject a significant amount of energy into the surrounding medium, hence they can provide useful information in the study of the density and evolution of the intergalactic and intracluster medium. The jet activity is also believed to regulate the growth of massive galaxies via the AGN feedback.

In this thesis I explore the intrinsic and extrinsic physical properties of the population of Fanaroff-Riley II (FR II) objects, i.e. their kinetic luminosities, lifetimes, and central densities of their environments. In particular, the radio and kinetic luminosity functions of these powerful radio sources are investigated using the complete, flux limited radio catalogues of 3CRR and BRL. I construct multidimensional Monte Carlo simulations using semi-analytical models of FR II source time evolution to create artificial samples of radio galaxies. Unlike previous studies, I compare radio luminosity functions found with both the observed and simulated data to explore the best-fitting fundamental source parameters. The Monte Carlo method presented here allows one to: (i) set better limits on the predicted fundamental parameters of which confidence intervals estimated over broad ranges are presented, and (ii) generate the most plausible underlying parent populations of these radio sources. Moreover, I allow the source physical properties to co-evolve with redshift, and I find that all the investigated parameters most likely undergo cosmological evolution; however these parameters are strongly degenerate, and independent constraints are necessary to draw more precise conclusions. Furthermore, since it has been suggested that low luminosity FR IIs may be distinct from their powerful equivalents, I attempt to investigate fundamental properties of a sample of low redshift, low radio luminosity density radio galaxies. Based on SDSS-FIRST-NVSS radio sample I construct a low frequency (325 MHz) sample of radio galaxies and attempt to explore the fundamental properties of these low luminosity radio sources. The results are discussed through comparison with the results from the powerful radio sources of the 3CRR and BRL samples.

Finally, I investigate the total power injected by populations of these powerful radio sources at various cosmological epochs and discuss the significance of the impact of these sources on the evolving Universe. Remarkably, sets of two degenerate fundamental parameters, the kinetic luminosity and maximum lifetimes of radio sources, despite the degeneracy provide particularly robust estimates of the total power produced by FR IIs during their lifetimes. This can be also used for robust estimations of the quenching of the cooling flows in cluster of galaxies.

Full text available at http://eprints.soton.ac.uk and ADS

Meetings

Nuclei of Seyfert galaxies and QSOs - Central engine & conditions of star formation

Bonn, Germany
6-8 Nov. 2012

Webpage: http://astro.uni-koeln.de/Seyfert2012
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Supermassive black holes (SMBHs) are ubiquitous in the Universe. It is widely accepted that most or all massive galaxies harbors a central SMBH. Apparent correlations between the black hole mass and host galaxy structural/dynamical properties, such as the M/σ relation, give rise to the notion of an intimate link between the growth of SMBHs and their host galaxies. Active galactic nuclei (AGN) represent a phase (phases) in the life of a galaxy, during which the SMBH growth is directly observable. The question is, whether such episodes provide a window onto the relevant aspects of the regulation of the growth of the bulges and the SMBHs. The focus of this workshop is on understanding the conditions of star formation in AGN and the interplay between star formation, the active nuclei, and the host galaxies - especially of intermediate redshift ($z < 0.1$) systems - in order to bridge the gap between local, well-studied AGN and their hosts and marginally resolved high redshift AGN and their hosts.