| 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

## Discovery of a Highly Polarized Optical Microflare in the Blazar S5 0716+714 During 2014 WEBT Campaign

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The occurrence of low-amplitude flux variations in blazars on hourly timescales, commonly known as microvariability, is still a widely debated subject in high-energy astrophysics. Several competing scenarios have been proposed to explain such occurrences, including various jet plasma instabilities leading to the formation of shocks, magnetic reconnection sites, and turbulence. In this letter we present the results of our detailed investigation of a prominent, five-hour-long optical microflare detected during recent WEBT campaign in 2014, March 2-6 targeting the blazar 0716+714. After separating the flaring component from the underlying base emission continuum of the blazar, we find that the microflare is highly polarized, with the polarization degree $\sim (40-60)\% \pm (2-10)\%$, and the electric vector position angle $\sim (10-20)\,\mathrm{deg} \pm (1-8)\,\mathrm{deg}$ slightly misaligned with respect to the position angle of the radio jet. The microflare evolution in the $(Q, U)$ Stokes parameter space exhibits a looping behavior with a counter-clockwise rotation, meaning polarization degree decreasing with the flux (but higher in the flux decaying phase), and approximately stable polarization angle. The overall very high polarization degree of the flare, its symmetric flux rise and decay profiles, and also its structured evolution in the $Q-U$ plane, all imply that the observed flux variation corresponds to a single emission region characterized by a highly ordered magnetic field. As discussed in the paper, a small-scale but strong shock propagating within the outflow, and compressing a disordered magnetic field component, provides a natural, though not unique, interpretation of our findings.

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Preprint available at http://arxiv.org/abs/1507.08424

## An evolutionary missing link? A modest-mass early-type galaxy hosting an over-sized nuclear black hole

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SAGE1C J053634.78−722658.5 is a galaxy at redshift $z = 0.14$, discovered behind the Large Magellanic Cloud in the *Spitzer* Space Telescope "Surveying the Agents of Galaxy Evolution" Spectroscopy survey (SAGE-Spec). It has very strong silicate emission at 10 $\mu$m but negligible far-IR and UV emission. This makes it a candidate for a bare AGN source in the IR, perhaps seen pole-on, without significant IR emission from the host galaxy. In this paper we present optical spectra taken with the Southern African Large Telescope (SALT) to investigate the nature of the underlying host galaxy and its AGN. We find broad H$\alpha$ emission characteristic of an AGN, plus absorption lines associated with a mature stellar population (> 9 Gyr), and refine its redshift determination to $z = 0.1428 \pm 0.0001$. There is no evidence for any emission lines associated with star formation. This remarkable object exemplifies the need for separating the emission from any AGN from that of the host galaxy when employing infrared diagnostic diagrams. We estimate the black hole mass, $M_{\rm BH} = 3.5 \pm 0.8 \times 10^8$ M$_\odot$, host galaxy mass, $M_{\rm stars} = 2.5^{2.5}_{1.2} \times 10^{10}$ M$_\odot$, and accretion luminosity, $L_{\rm bol}({\rm AGN}) = 5.3 \pm 0.4 \times 10^{45}$ erg s$^{-1}$ ($\approx 12$ per cent of the Eddington luminosity) and find the AGN to be more prominent than expected for a host galaxy of this modest size. The old age is in tension with the downsizing paradigm in which this galaxy would recently have transformed from a star-forming disc galaxy into an early-type, passively evolving galaxy.

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## The Sloan Digital Sky Survey Reverberation Mapping Project: Ensemble Spectroscopic Variability of Quasar Broad Emission Lines

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We explore the variability of quasars in the Mg II and H$\beta$ broad emission lines and UV/optical continuum emission using the Sloan Digital Sky Survey Reverberation Mapping project (SDSS-RM). This is the largest spectroscopic study of quasar variability to date: our study includes 29 spectroscopic epochs from SDSS-RM over 6 months, containing 357 quasars with Mg II and 41 quasars with H$\beta$. On longer timescales, the study is also supplemented with two-epoch data from SDSS-I/II. The SDSS-I/II data include an additional 2854 quasars with Mg II and 572 quasars with H$\beta$. The Mg II emission line is significantly variable ($\Delta f/f \sim 10\%$ on $\sim 100$-day timescales), a necessary prerequisite for its use for reverberation mapping studies. The data also confirm that continuum variability increases with timescale and decreases with luminosity, and the continuum light curves are consistent with a damped random-walk model on rest-frame timescales of $\geq 5$ days. We compare the emission-line and continuum variability to investigate the structure of the broad-line region. Broad-line variability shows a shallower increase with timescale compared to the continuum emission, demonstrating that the broad-line transfer function is not a $\delta$-function. H$\beta$ is more variable than Mg II (roughly by a factor of $\sim 1.5$), suggesting different excitation mechanisms, optical depths and/or geometrical configuration for each emission line. The ensemble spectroscopic variability measurements enabled by the SDSS-RM project have important consequences for future studies of reverberation mapping and black hole mass estimation of $1 < z < 2$ quasars.

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Preprint available at http://arxiv.org/abs/1506.07886

## The Sloan Digital Sky Survey Reverberation Mapping Project: Post-Starburst Signatures in Quasar Host Galaxies at $z < 1$

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Quasar host galaxies are key for understanding the relation between galaxies and the supermassive black holes (SMBHs) at their enters. We present a study of 191 broad-line quasars and their host galaxies at $z < 1$, using high signal-to-noise ratio (SNR) spectra produced by the Sloan Digital Sky Survey Reverberation Mapping project. Clear detection of stellar absorption lines allows a reliable decomposition of the observed spectra into nuclear and host components, using spectral models of quasar and stellar radiations as well as emission lines from the interstellar medium. We estimate age, mass $M_*$, and velocity dispersion $\sigma_*$ of the host stars, the star formation rate (SFR), quasar luminosity, and SMBH mass $M_\bullet$, for each object. The quasars are preferentially hosted by massive galaxies with $M_* \sim 10^{11} M_\odot$ characterized by stellar ages around a billion years, which coincides with the transition phase of normal galaxies from the blue cloud to the red sequence. The host galaxies have relatively low SFRs and fall below the main sequence of star-forming galaxies at similar redshifts. These facts suggest that the hosts have experienced an episode of major star formation sometime in the past billion years, which was subsequently quenched or suppressed. The derived $M_\bullet - \sigma_*$ and $M_\bullet - M_*$ relations agree with our past measurements and are consistent with no evolution from the local Universe. The present analysis demonstrates that reliable measurements of stellar properties of quasar host galaxies are possible with high-SNR fiber spectra, which will be acquired in large numbers with future powerful instruments such as the Subaru Prime Focus Spectrograph.

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## Magnetically Driven Accretion Disk Winds and Ultra-fast Outflows in PG 1211+143

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We present a study of X-ray ionization of magnetohydrodynamic (MHD) accretion-disk winds in an effort to constrain the physics underlying the highly-ionized ultra-fast outflows (UFOs) inferred by X-ray absorbers often detected in various subclasses of Seyfert active galactic nuclei (AGNs). Our primary focus is to show that magnetically-driven outflows are indeed physically plausible candidates for the observed outflows accounting for the AGN absorption properties of the present X-ray spectroscopic observations. Employing a stratified MHD wind launched across the entire AGN accretion disk, we calculate its X-ray ionization and the ensuing X-ray absorption line spectra. Assuming an appropriate ionizing AGN spectrum, we apply our MHD winds to model the absorption features in an *XMM-Newton*/EPIC spectrum of the narrow-line Seyfert, PG 1211+143. We find, through identifying the detected features with Fe K$\alpha$ transitions, that the absorber has a characteristic ionization parameter of $\log(\xi_c[\text{erg cm s}^{-1}]) \simeq 5 - 6$ and a column density on the order of $N_H \simeq 10^{23}$ cm$^{-2}$, outflowing at a characteristic velocity of $v_c/c \simeq 0.1 - 0.2$ (where $c$ is the speed of light). The best-fit model favors its radial location at $r_c \simeq 200 R_o$ ($R_o$ is the black hole innermost stable circular orbit), with an inner wind truncation radius at $R_t \simeq 30 R_o$. The overall K-shell feature in the data is suggested to be dominated by fexxv with very little contribution from fexxvi and weakly-ionized iron, which is in a good agreement with a series of earlier analysis of the UFOs in various AGNs including PG 1211+143.

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## Quasar Classification Using Color and Variability

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We conduct a pilot investigation to determine the optimal combination of color and variability information to identify quasars in current and future multi-epoch optical surveys. We use a Bayesian quasar selection algorithm (Richards et al. 2004) to identify 35,820 type 1 quasar candidates in a 239 deg$^2$ field of the Sloan Digital Sky Survey (SDSS) Stripe 82, using a combination of optical photometry and variability. Color analysis is performed on 5-band single- and multi-epoch SDSS optical photometry to a depth of $r \sim 22.4$. From these data, variability parameters are calculated by fitting the structure function of each object in each band with a power law model using 10 to $> 100$ observations over timescales from $\sim 1$ day to $\sim 8$ years. Selection was based on a training sample of 13,221 spectroscopically-confirmed type-1 quasars, largely from the SDSS. Using variability alone, colors alone, and combining variability and colors we achieve 91%, 93%, and 97% quasar completeness and 98%, 98%, and 97% efficiency respectively, with particular improvement in the selection of quasars at $2.7 < z < 3.5$ where quasars and stars have similar optical colors. The 22,867 quasar candidates that are not spectroscopically confirmed reach a depth of $i \sim 22.0$; 21,876 (95.7%) are dimmer than coadded $i$-band magnitude of 19.9, the cut off for spectroscopic follow-up for SDSS on Stripe 82. Brighter than 19.9, we find 5.7% more quasar candidates without confirming spectra in sky regions otherwise considered complete. The resulting quasar sample has sufficient purity (and statistically correctable incompleteness) to produce a luminosity function comparable to those determined by spectroscopic investigations. We discuss improvements that can be made to the process in preparation for performing similar photometric selection and science on data from post-SDSS sky surveys.

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## AGN Broad Line Regions Scale with Bolometric Luminosity

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The masses of supermassive black holes in active galactic nuclei (AGN) can be derived spectroscopically via virial mass estimators based on selected broad optical/ultraviolet emission lines. These estimates commonly use the line width as a proxy for the gas speed and the monochromatic continuum luminosity, $\lambda L_\lambda$, as a proxy for the radius of the broad line region. However, if the size of the broad line region scales with the *bolometric* AGN luminosity rather than $\lambda L_\lambda$, mass estimates based on different emission lines will show a systematic discrepancy which is a function of the color of the AGN continuum. This has actually been observed in mass estimates based on H$\alpha$/H$\beta$ and Civ lines, indicating that AGN broad line regions indeed scale with bolometric luminosity. Given that this effect seems to have been overlooked as yet, currently used single-epoch mass estimates are likely to be biased.

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Open access article: http://jkas.kas.org/journals/2015v48n3/v48n3p203_trippe4.pdf

## Restarting radio activity and dust emission in radio-loud broad absorption line quasars

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Broad absorption line quasars (BAL QSOs) are objects that show absorption from relativistic outflows that have velocities up to 0.2c. In about 15% of quasars, these manifest as absorption troughs on the blue side of UV emission lines, such as $C_{IV}$ and $Mg_{II}$. The launching mechanism and duration of these outflows is not clear yet. In this work, we complement the information collected in the cm band for our previously presented sample of radio loud BAL QSOs (25 objects with redshifts $1.7<z<3.6$) with new observations in the m and mm bands. Our aim is to verify the presence of old, extended radio components in the MHz range and probe the emission of dust (linked to star formation) in the mm domain. We observed 5 sources from our sample, that already presented hints of low-frequency emission, with the GMRT at 235 and 610 MHz. Another 17 sources (more than half the sample) were observed with bolometer cameras at IRAM-30m (MAMBO2, 250 GHz) and APEX (LABOCA and SABOCA, 350 and 850 GHz, respectively). All sources observed with the GMRT present extended emission on a scale of tens of kpc. In some cases these measurements allow us to identify a second component in the SED at frequencies below 1.4 GHz, beyond the one already studied in the GHz domain. In the mm band, only one source shows emission clearly ascribable to dust, detached from the synchrotron tail. Upper limits were obtained for the remaining targets. These findings confirm that BAL QSOs can also be present in old radio sources or even in restarting ones where favourable conditions for the outflow launching or acceleration are present. A suggestion that these outflows could be precursors of the jet comes from the possibility that $\sim$70% of our sample is in a GigaHertz Peaked Spectrum (GPS) or Compact Steep Spectrum (CSS)+GPS phase. This would confirm the idea proposed by other authors that these outflows could be recollimated to form the jet. Compared with previous works in the literature, dust emission seems to be weaker than what is expected in 'normal' QSOs (both radio loud and radio quiet ones), suggesting that a feedback mechanism could inhibit star formation in radio-loud BAL QSOs.

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## Polarimetric imaging of NGC 1068 at high angular resolution in the near infrared. Direct evidence for an extended nuclear torus

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Context. To investigate the central regions of active galactic nuclei (AGN) at short wavelengths, high angular resolution and high contrast observations are mandatory. Aims. One of the main observational challenge is the direct detection of the circumnuclear optically thick material hiding the central core emission when viewed edge-on. The lack of direct evidence is limiting our understanding of AGN and several scenarios have been proposed to cope for the diverse observed aspects of activity in a unified approach. Methods. Observations in the near-infrared spectral range have shown powerful to provide essential hints because of the reduced optical depth of the obscuring material. Moreover, it is possible to trace this material through light scattered from the central engine closest environment, polarimetric observations thus being the ideal tool to disentangle it from purely thermal and stellar emissions. Results. Here we show strong evidence for an extended nuclear torus at the center of NGC 1068 thanks to new adaptive optics assisted polarimetric observations in the near-infrared. The orientation of the polarization vectors clearly evidences the presence of a structured hourglass-shaped bicone and a compact elongated (20 x 60 pc) nuclear structure perpendicular to the bicone axis. The linearly polarized emission in the bicone is dominated by a centro-symmetric pattern, but the central compact region shows a clear deviation from the latter with linear polarization aligned along a direction perpendicular to the bicone axis.

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## A Variable-Density Absorption Event in NGC 3227 mapped with *Suzaku* and *Swift*

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The morphology of the circumnuclear gas accreting onto supermassive black holes in Seyfert galaxies remains a topic of much debate. As the innermost regions of Active Galactic Nuclei (AGN) are spatially unresolved, X-ray spectroscopy, and in particular line-of-sight absorption variability, is a key diagnostic to map out the distribution of gas. Observations of variable X-ray absorption in multiple Seyferts and over a wide range of timescales indicate the presence of clumps/clouds of gas within the circumnuclear material. Eclipse events by clumps transiting the line of sight allow us to explore the properties of the clumps over a wide range of radial distances from the optical/UV Broad Line Region (BLR) to beyond the dust sublimation radius. Time-resolved absorption events have been extremely rare so far, but suggest a range of density profiles across Seyferts. We resolve a weeks-long absorption event in the Seyfert NGC 3227. We examine six *Suzaku* and twelve *Swift* observations from a 2008 campaign spanning 5 weeks. We use a model accounting for the complex spectral interplay of three differently-ionized absorbers. We perform time-resolved spectroscopy to discern the absorption variability behavior. We also examine the IR-to-X-ray spectral energy distribution (SED) to test for reddening by dust. The 2008 absorption event is due to moderately-ionized ($\log \xi \sim 1.2$–$1.4$) gas covering 90% of the line of sight. We resolve the density profile to be highly irregular, in contrast to a previous symmetric and centrally-peaked event mapped with RXTE in the same object. The UV data do not show significant reddening, suggesting that the cloud is dust-free. The 2008 campaign has revealed a transit by a filamentary, moderately-ionized cloud of variable density that is likely located in the BLR, and possibly part of a disk wind.

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## AGN Evolution from a Galaxy Evolution Viewpoint

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We explore the connections between the evolving galaxy and AGN populations. We present a simple phenomenological model that links the evolving galaxy mass function and the evolving quasar luminosity function, which makes specific and testable predictions for the distribution of host galaxy masses for AGN of different luminosities. We show that the $\phi^*$ normalisations of the galaxy mass function and of the AGN luminosity function closely track each other over a wide range of redshifts, implying a constant "duty cycle" of AGN activity. The strong redshift evolution in the AGN $L^*$ can be produced by either an evolution in the distribution of Eddington ratios, or in the $m_{bh}/m_*$ mass ratio, or both. To try to break this degeneracy we look at the distribution of AGN in the SDSS $(m_{bh}, L)$ plane, showing that an evolving ratio $m_{bh}/m_* \propto (1+z)^2$ reproduces the observed data and also reproduces the local relations which connect the black hole population with the host galaxies for both quenched and star-forming populations. We stress that observational studies that compare the masses of black holes in active galaxies at high redshift with those in quiescent galaxies locally will always see much weaker evolution. Evolution of this form would produce, or could be produced by, a redshift-independent $m_{bh} - \sigma$ relation and could explain why the local $m_{bh} - \sigma$ relation is tighter than $m_{bh} - m_*$ even if $\sigma$ is not directly linked to black hole growth. Irrespective of the evolution of $m_{bh}/m_*$, the model reproduces both the appearance of "downsizing' and the so-called "sub-Eddington boundary' without any mass-dependence in the evolution of black hole growth rates.

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Preprint available at http://arxiv.org/abs/1411.3719

# Special Announcements

## Fizeau exchange visitors program - call for applications

2015-02-13

The Fizeau exchange visitors program in optical interferometry funds (travel and accommodation) visits of researchers to an institute of his/her choice (within the European Community) to perform collaborative work and training on one of the active topics of the European Interferometry Initiative. The visits will typically last for one month, and strengthen the network of astronomers engaged in technical, scientific and training work on optical/infrared interferometry. The program is open for all levels of astronomers (Ph.D. students to tenured staff). non-EU based missions will only be funded if considered essential by the Fizeau Committee. Applicants are strongly encouraged to seek also partial support from their home or host institutions.

The **deadline for applications is September 15**. Fellowships can be awarded for missions starting in November.

Further informations and application forms can be found at http://www.european-interferometry.eu

The program is funded by OPTICON/FP7.

Please distribute this message also to potentially interested colleagues outside of your community!

Looking forward to your applications,
Josef Hron & Laszlo Mosoni
(for the European Interferometry Initiative)

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