| 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.

Many thanks for your continued subscription.

Megan Argo

## Abstracts of recently accepted papers

### A Variable P V Broad Absorption Line and Quasar Outflow Energetics

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Broad absorption lines (BALs) in quasar spectra identify high velocity outflows that might exist in all quasars and could play a major role in feedback to galaxy evolution. The viability of BAL outflows as a feedback mechanism depends on their kinetic energies, as derived from the outflow velocities, column densities, and distances from the central quasar. We estimate these quantities for the quasar, Q1413+1143 (redshift $z_e = 2.56$), aided by the first detection of P V $\lambda\lambda$1118, 1128 BAL variability in a quasar. In particular, P V absorption at velocities where the C IV trough does not reach zero intensity implies that the C IV BAL is saturated and the absorber only partially covers the background continuum source (with characteristic size <0.01 pc). With the assumption of solar abundances, we estimate that the total column density in the BAL outflow is $\log N_H \geq 22.3$ cm$^{-2}$. Variability in the P V and *saturated* C IV BALs strongly disfavors changes in the ionization as the cause of the BAL variability, but supports models with high-column density BAL clouds moving across our lines of sight. The observed variability time of 1.6 yr in the quasar rest frame indicates crossing speeds >750 km s$^{-1}$ and a radial distance from the central black hole of $\lesssim$3.5 pc, if the crossing speeds are Keplerian. The total outflow mass is $\sim$4100 $M_\odot$, the kinetic energy $\sim 4 \times 10^{54}$ erg, and the ratio of the outflow kinetic energy luminosity to the quasar bolometric luminosity is $\sim$0.02 (at the minimum column density and maximum distance), which might be sufficient for important feedback to the quasar's host galaxy.

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Preprint available at http://arxiv.org/abs/1407.7532

## A mid-infrared view of the inner parsecs of the Seyfert galaxy Mrk 1066 using CanariCam/GTC

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We present mid-infrared (MIR) imaging and spectroscopic data of the Seyfert 2 galaxy Mrk 1066 obtained with CanariCam (CC) on the 10.4 m Gran Telescopio CANARIAS (GTC). The galaxy was observed in imaging mode with an angular resolution of 0.24" (54 pc) in the Si-2 filter (8.7 $\mu$m). The image reveals a series of star-forming knots within the central ∼400 pc, after subtracting the dominant active galactic nucleus (AGN) component. We also subtracted this AGN unresolved component from the 8–13 $\mu$m spectra of the knots and the nucleus, and measured equivalent widths (EWs) of the 11.3 $\mu$m Polycyclic Aromatic Hydrocarbon (PAH) feature which are typical of pure starburst galaxies. This EW is larger in the nucleus than in the knots, confirming that, at least in the case of Mrk 1066, the AGN dilutes, rather than destroys, the molecules responsible for the 11.3 $\mu$m PAH emission. By comparing the nuclear GTC/CC spectrum with the *Spitzer*/IRS spectrum of the galaxy, we find that the AGN component that dominates the continuum emission at $\lambda$ <15 $\mu$m on scales of ∼60 pc (90–100%) decreases to 35–50% when the emission of the central ∼830 pc is considered. On the other hand, the AGN contribution dominates the 15–25 $\mu$m emission (75%) on the scales probed by *Spitzer*/IRS. We reproduced the nuclear infrared emission of the galaxy with clumpy torus models, and derived a torus gas mass of $2\times10^5$ $M_\odot$, contained in a clumpy structure of ∼2 pc radius and with a column density compatible with Mrk 1066 being a Compton-thick candidate, in agreement with X-ray observations. We find a good match between the MIR morphology of Mrk 1066 and the extended Pa$\beta$, Br$\gamma$ and [O III]$\lambda$5007 emission. This coincidence implies that the 8.7 $\mu$m emission is probing star formation, dust in the narrow-line region, and the oval structure previously detected in the near-infrared. On the other hand, the *Chandra* soft X-ray morphology does not match any of the previous, contrary to what it is generally assumed for Seyfert galaxies. A thermal origin for the soft X-ray emission, rather than AGN photoionization, is suggested by the different data analyzed here.

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## A Census of Gas Outflows in Type 2 Active Galactic Nuclei

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We perform a census of ionized gas outflows using a sample of ∼23,000 type 2 active galactic nuclei (AGNs) out to z∼0.1. By measuring the velocity offset of narrow emission lines, i.e., [O III] $\lambda$5007 and H$\alpha$, with respect to the systemic velocity measured from the stellar absorption lines, we find that 47% of AGNs display an [O III] line-of-sight velocity offset $\geq$ 20 km s$^{-1}$. The fraction of the [O III] velocity offset in type 2 AGNs is comparable to that in type 1 AGNs after considering the projection effect. AGNs with a large [O III] velocity offset preferentially have a high Eddington ratio, implying that the detected velocity offsets are related to black hole activity. The distribution of the host galaxy inclination is clearly different between the AGNs with blueshifted [O III] and the AGNs with redshifted [O III], supporting the combined model of the biconical outflow and dust obscuration. In addition, for ∼3% of AGNs, [O III] and H$\alpha$ show comparable large velocity offsets, indicating a more complex gas kinematics than decelerating outflows in a stratified narrow-line region.

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## The Mass of the Central Black Hole in the Nearby Seyfert Galaxy NGC 5273

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We present the results of a reverberation-mapping program targeting NGC 5273, a nearby early-type galaxy with a broad-lined active galactic nucleus. Over the course of the monitoring program, NGC 5273 showed strong variability that allowed us to measure time delays in the responses of the broad optical recombination lines to changes in the continuum flux. A weighted average of these measurements results in a black hole mass determination of $M_{\rm BH} = (4.7 \pm 1.6) \times 10^6$ $M_\odot$. An estimate of the size of the black hole sphere of influence in NGC 5273 puts it just at the limit of the resolution achievable with current ground-based large aperture telescopes. NGC 5273 is therefore an important future target for a black hole mass determination from stellar dynamical modeling, especially because it is the only nearby early-type galaxy hosting an AGN with a reverberation-based mass, allowing the best comparison for the masses determined from these two techniques.

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## Time-correlation between the radio and gamma-ray activity in blazars and the production site of the gamma-ray emission

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In order to determine the location of the gamma-ray emission site in blazars, we investigate the time-domain relationship between their radio and gamma-ray emission. Light-curves for the brightest detected blazars from the first 3 years of the mission of the *Fermi Gamma-ray Space Telescope* are cross-correlated with 4 years of 15 GHz observations from the OVRO 40-m monitoring program. The large sample and long light-curve duration enable us to carry out a statistically robust analysis of the significance of the cross-correlations, which is investigated using Monte Carlo simulations including the uneven sampling and noise properties of the light-curves. Modeling the light-curves as red noise processes with power-law power spectral densities, we find that only one of 41 sources with high quality data in both bands shows correlations with significance larger than $3\sigma$ (AO 0235+164), with only two more larger than even $2.25\sigma$ (PKS 1502+106 and B2 2308+34). Additionally, we find correlated variability in Mrk 421 when including a strong flare that occurred in July-September 2012. These results demonstrate very clearly the difficulty of measuring statistically robust multiwavelength correlations and the care needed when comparing light-curves even when many years of data are used. This should be a caution. In all four sources the radio variations lag the gamma-ray variations, suggesting that the gamma-ray emission originates upstream of the radio emission. Continuous simultaneous monitoring over a longer time period is required to obtain high significance levels in cross-correlations between gamma-ray and radio variability in most blazars.

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## The host-galaxy of the gamma-ray Narrow-line Seyfert 1 galaxy 1H 0323+342

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We present optical and near infrared (NIR) imaging data of the radio-loud Narrow-line Seyfert 1 galaxy 1H 0323+342, which shows intense and variable gamma-ray activity discovered by the *Fermi* satellite with the Large Area Telescope. NIR and optical images are used to investigate the structural properties of the host galaxy of 1H 0323+342; this together with optical spectroscopy allowed us to examine its black hole mass. Based on the 2D multiwavelength surface brightness modeling, we find that, statistically, the best model fit is a combination of a nuclear component and a Sérsic profile ($n \sim 2.8$). However, the presence of a disc component (with a small bulge $n \sim 1.2$) remains also a possibility and cannot be ruled out with the present data. Although at first glance a spiral-arm like structure is revealed in our images, a 2D Fourier analysis of the imagery suggests that such structure corresponds to an asymmetric ring, likely associated to a recent violent dynamical interaction. We discuss our results on the context of relativistic jets production and galaxy evolution.

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## AKARI IRC 2.5–5 $\mu$m Spectroscopy of Infrared Galaxies Over a Wide Luminosity Range

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We present the result of a systematic infrared 2.5–5 $\mu$m spectroscopic study of 22 nearby infrared galaxies over a wide infrared luminosity range ($10^{10}L_\odot < L_{\rm IR} < 10^{13}L_\odot$) obtained from *AKARI* Infrared Camera (IRC). The unique band of the *AKARI* IRC spectroscopy enables us to access both the 3.3 $\mu$m polycyclic aromatic hydrocarbon (PAH) emission feature from star forming activity and the continuum of torus-dust emission heated by an active galactic nucleus (AGN). Applying our AGN diagnostics to the *AKARI* spectra, we discover 14 buried AGNs. The large fraction of buried AGNs suggests that AGN activity behind the dust is almost ubiquitous in ultra-/luminous infrared galaxies (U/LIRGs). We also find that both the fraction and energy contribution of buried AGNs increase with infrared luminosity from $10^{10}L_\odot$ to $10^{13}L_\odot$, including normal infrared galaxies with $L_{\rm IR} < 10^{11}L_\odot$. The energy contribution from AGNs in the total infrared luminosity is only $\sim$ 7% in LIRGs and $\sim$ 20% in ULIRGs, suggesting that the majority of the infrared luminosity originates from starburst activity. We investigate the luminosity relation between star formation and AGN. We find that these infrared galaxies exhibit higher star formation rates than optically selected Seyfert galaxies with the same AGN luminosities, implying that infrared galaxies could be an early evolutionary phase of AGN.

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## *Suzaku* observation of IRAS 00521−7054, a peculiar type-II AGN with a very broad feature at 6 keV

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IRAS 00521−7054 is the first Seyfert 2 in which the presence of an extremely large Fe K$\alpha$ line has been claimed. We report here on the analysis of a 100 ks *Suzaku* observation of the source. We confirm the existence of a very strong excess over the power-law X-ray continuum at $E \sim 6$ keV ($EW \simeq 800$ eV), extending down to $\sim 4.5$ keV, and found that the X-ray spectrum of the source can be explained by two different models. i) An absorption scenario, in which the X-ray source is obscured by two fully-covering ionized absorbers, with a strong reflection component from neutral material ($R \sim 1.7$), a black body component and four narrow Gaussian lines (corresponding to Fe K$\alpha$, Fe K$\beta$, Fe XXV and Fe XXVI). ii) A reflection scenario, in which the X-ray spectrum is dominated by an obscured ($\log N_{\rm H} \sim 22.9$) blurred reflection produced in an ionized disk around a rotating supermassive black hole with a spin of $a \geq 0.73$, and affected by light-bending ($R \sim 2.7$), plus two narrow Gaussian lines (corresponding to Fe K$\alpha$ and Fe K$\beta$). The narrow Fe K$\alpha$ and K$\beta$ lines are consistent with being produced by ionized iron, and in particular by Fe XIV–Fe XVI and Fe XII–Fe XVI for the absorption and reflection scenario, respectively. While the X-ray continuum varies significantly during the observation, the intensity of the broad feature appears to be constant, in agreement with both the absorption and reflection scenarios. For both scenarios we obtained a steep power-law emission ($\Gamma \sim 2.2 - 2.3$), and we speculate that the source might be an obscured narrow-line Seyfert 1.

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## C IV and C III] reverberation mapping of the luminous quasar PG 1247+267

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So far the masses of about 50 active galactic nuclei have been measured through the reverberation mapping technique (RM). Most measurements have been performed for objects of moderate luminosity and redshift, based on H$\beta$, which is also used to calibrate the scaling relation which allows single-epoch (SE) mass determination based on AGN luminosity and the width of different emission lines. The SE mass obtained from C IV(1549Å) line shows a large spread around mean values, due to complex structure and gas dynamics of the relevant emission region. Direct RM measures of C IV exist for only 6 AGNs of low luminosity and redshift, and only one luminous quasar (Kaspi et al. 2007). We have collected since 2003 photometric and spectroscopic observations of PG1247+267, the most luminous quasar ever analyzed for RM. We provide light curves for the continuum and for C IV(1549Å) and C III](1909Å), and measures of the reverberation time lags based on the SPEAR method (Zu et al. 2011). The sizes of the line emission regions are in a ratio $R_{CIII]}/R_{CIV} \sim 2$, similar to the case of Seyfert galaxies, indicating for the first time a similar ionization stratification in a luminous quasar and low luminosity nuclei. Due to relatively small broad line region size and relatively narrow line widths, we estimate a small mass and an anomalously high Eddington ratio. We discuss the possibility that either the shape of the emission region or an amplification of the luminosity caused by gravitational lensing may be in part responsible of the result.

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## AGN Type-casting: Mrk 590 No Longer Fits the Role

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We present multi-wavelength observations that trace more than 40 years in the life of the active galactic nucleus (AGN) in Mrk 590, traditionally known as a classic Seyfert 1 galaxy. From spectra recently obtained from *HST*, *Chandra*, and the Large Binocular Telescope, we find that the activity in the nucleus of Mrk 590 has diminished so significantly that the continuum luminosity is a factor of 100 lower than the peak luminosity probed by our long baseline observations. Furthermore, the broad emission lines, once prominent in the UV/optical spectrum, have all but disappeared. Since AGN type is defined by the presence of broad emission lines in the optical spectrum, our observations demonstrate that Mrk 590 has now become a "changing look" AGN. If classified by recent optical spectra, Mrk 590 would be a Seyfert $\sim$1.9$-$2, where the only broad emission line still visible in the optical spectrum is a weak component of H$\alpha$. As an additional consequence of this change, we have definitively detected UV narrow-line components in a Type 1 AGN, allowing an analysis of these emission-line components with high-resolution COS spectra. These observations challenge the historical paradigm that AGN type is only a consequence of the line of sight viewing angle toward the nucleus in the presence of a geometrically-flattened, obscuring medium (i.e., the torus). Our data instead suggest that the current state of Mrk 590 is a consequence of the change in luminosity, which implies the black hole accretion rate has significantly decreased.

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## Brightest *Fermi*-LAT Flares of PKS 1222+216: Implications on Emission and Acceleration Processes

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We present a high time resolution study of the two brightest $\gamma$-ray outbursts from a blazar PKS 1222+216 observed by the *Fermi* Large Area Telescope (LAT) in 2010. The $\gamma$-ray light-curves obtained in four different energy bands: 0.1–3, 0.1–0.3, 0.3–1 and 1–3 GeV, with time bin of 6 hr, show asymmetric profiles with a similar rise time in all the bands but a rapid decline during the April flare and a gradual one during the June. The light-curves during the April flare show $\sim$ 2 days long plateau in 0.1–0.3 GeV emission, erratic variations in 0.3–1 GeV emission, and a daily recurring feature in 1–3 GeV emission until the rapid rise and decline within a day. The June flare shows a monotonic rise until the peak, followed by a gradual decline powered mainly by the multi-peak 0.1–0.3 GeV emission. The peak fluxes during both the flares are similar except in the 1–3 GeV band in April which is twice the corresponding flux during the June flare. Hardness ratios during the April flare indicate spectral hardening in the rising phase followed by softening during the decay. We attribute this behavior to the development of a shock associated with an increase in acceleration efficiency followed by its decay leading to spectral softening. The June flare suggests hardening during the rise followed by a complicated energy dependent behavior during the decay. Observed features during the June flare favor multiple emission regions while the overall flaring episode can be related to jet dynamics.

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Preprint available at http://arxiv.org/abs/1409.8201

## Postdoctoral Position in Galaxy and Black Hole Astrophysics
## ETH Zurich
## Deadline: 1st November 2014

**Email contact:kevin.schawinski@phys.ethz.ch**
**Further Information: http://www.astro.ethz.ch/schawinski**

The Institute for Astronomy of the ETH Zurich invites applications for a postdoctoral position in the new research group of Prof. Schawinski to work on active galaxies, galaxy-black hole co-evolution and the origin of black holes.

The successful candidate will be involved in the planning, execution and analysis of observational projects. Experience with survey data, optical/NIR spectroscopy and radio/sub-mm data would be a particular asset. There are also opportunities to get involved in Zooniverse citizen science projects and in the mentoring of students.

The position is initially for two years, but can be extended to a third year subject to funding. The salary scale is attractive and there is substantial support for travel (observing, conference, collaboration), computing and publication charges. Switzerland is a full member of ESO and ESA. Zurich is regularly rated one of the top 10 cities of the world in terms of quality of life.

Applicants should have a PhD in astronomy or related field and should send a CV, publication list and a brief (3 pages max.) summary of past research and future research interests as a single PDF to eth-astro-blackhole-postdoc@phys.ethz.ch and arrange three letters of reference to be sent to the same address, by 1 November 2014. For further information, please contact Prof. Schawinski (kevin.schawinski@phys.ethz.ch).

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