| 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

After a hiatus of a few months, I am pleased to distribute a bumper edition of the Active Galaxies Newsletter. Please do continue to submit abstracts, meeting announcements, job adverts and other announcements which may be of interest to the active galaxy community.

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, any suggestions or feedback regarding the newsletter are welcome.

Many thanks for your continued subscription.

Megan Argo

## Abstracts of recently accepted papers

### LINE SHIFTS, BROAD-LINE REGION INFLOW, AND THE FEEDING OF AGNS

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Velocity-resolved reverberation mapping suggests that the broad-line regions (BLRs) of AGNs can have significant net inflow. We use the *STOKES* radiative transfer code to show that electron and Rayleigh scattering off the BLR and torus naturally explains the blueshifted profiles of high-ionization lines and the ionization dependence of the blueshifts. This result is insensitive to the geometry of the scattering region. If correct, this model resolves the long-standing conflict between the absence of outflow implied by velocity-resolved reverberation mapping and the need for outflow if the blueshifting is the result of obscuration. The accretion rate implied by the inflow is sufficient to power the AGN. We suggest that the BLR is part of the outer accretion disk and that similar MHD processes are operating. In the scattering model the blueshifting is proportional to the accretion rate so high-accretion-rate AGNs will show greater high-ionization line blueshifts as is observed. Scattering can lead to systematically too high black hole mass estimates from the C IV line. We note many similarities between narrow-line region (NLR) and BLR blueshiftings, and suggest that NLR blueshiftings have a similar explanation. Our model explains the higher blueshifts of broad absorption line QSOs if they are more highly inclined. Rayleigh scattering from the BLR and torus could be more important in the UV than electron scattering for predominantly neutral material around AGNs. The importance of Rayleigh scattering versus electron scattering can be assessed by comparing line profiles at different wavelengths arising from the same emission-line region.

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## The Broad Line Region in NGC 4051: An Inflow Illuminated by a $10^5$ K Accretion Disk

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Adopting a spherically symmetric steady-state ballistic inflow as the kinematic model for the gas distribution responsible for producing the H$\alpha$ emission line, and a central black hole (BH) mass of $1.7 \times 10^6$ M$_\odot$ determined from prior reverberation mapping, leads to the following dimensions for the size of the broad line region (BLR) in NGC 4051; an inner radius $\sim$ 3 lt-days and a lower limit to the outer radius $\sim$ 475 lt-days. Thus, the previously determined reverberation size for the BLR marks just the inner radius of a much *larger* volume of ionized gas. The number of ionizing photons required to sustain the H$\alpha$ emission line luminosity exceeds the number *observed* to be available from the central AGN by a factor of 3 – 4. Such a large ionizing deficit can be reconciled if the BLR is ionized by a $10^5$ K accretion disk that is hidden from direct view by the high opacity of intervening H gas. A new definition is introduced for the *ionization parameter* that acknowledges the fact that H opacity significantly attenuates the flux of ionizing photons in the *large*, partially ionized, nebula surrounding the AGN. Collectively, the results have important implications for BH masses estimated using reverberation radii and the structure of the BLR inferred from velocity-delay maps.

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DRAFT is available at http://adsabs.harvard.edu/abs/2013arXiv1302.7049D

## A high Eddington–ratio, true Seyfert 2 galaxy candidate: implications for broad–line–region models

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A bright, soft X–ray source was detected on 2010 July 14 during an *XMM–Newton* slew at a position consistent with the galaxy GSN 069 ($z = 0.018$). Previous *ROSAT* observations failed to detect the source and imply that GSN 069 is now $\geq 240$ times brighter than it was in 1994 in the soft X–ray band. Optical spectra (from 2001 and 2003) are dominated by unresolved emission lines with no broad components, classifying GSN 069 as a Seyfert 2 galaxy. We report here results from a $\sim$ 1 yr monitoring with *Swift* and *XMM–Newton*, as well as from new optical spectroscopy. GSN 069 is an unabsorbed, ultra–soft source in X–rays, with no flux detected above $\sim$1 keV. The soft X–rays exhibit significant variability down to timescales of hundreds of seconds. The UV–to–X–ray spectrum of GSN 069 is consistent with a pure accretion disc model which implies an Eddington ratio $\lambda \simeq 0.5$ and a black hole mass of $\simeq 1.2 \times 10^6$ $M_\odot$. A new optical spectrum, obtained $\sim$ 3.5 months after the *XMM–Newton* slew detection, is consistent with earlier spectra and lacks any broad line component. The lack of cold X–ray absorption and the short timescale variability in the soft X–rays rule out a standard Seyfert 2 interpretation of the source. The present Eddington ratio of GSN 069 exceeds the critical value below which no emitting broad–line–region (BLR) forms, according to popular models, so that GSN 069 can be classified as a bona–fide high Eddington–ratio true Seyfert 2 galaxy. We discuss our results within the framework of two possible scenarios for the BLR in AGN, namely the two–phase model (cold BLR clouds in pressure equilibrium with a hotter medium), and models in which the BLR is part of an outflow, or disc–wind. Finally, we point out that GSN 069 may be a member of a population of super–soft AGN whose SED is completely dominated by accretion disc emission, as it is the case in some black hole X–ray binary transients during their outburst evolution. The disc emission for a typical AGN with black hole mass of $10^7 - 10^8$ $M_\odot$ does not enters the soft X–ray band, so that GSN 069–like objects with larger black hole mass (i.e. the bulk of the AGN population) are missed by current X–ray surveys, or mis–classified as Compton–thick candidates. If the analogy between black hole X–ray binary transients and AGN holds, the lifetime of these super–soft states in AGN may be longer than $10^4$ years, implying that the actual population of super–soft AGN may not be negligible, possibly contaminating the estimated fraction of heavily obscured AGN from current X–ray surveys.

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## A fourth H I 21-cm absorption system in the sight-line of MG J0414+0534: a record for intervening absorbers

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We report the detection of a strong H I 21-cm absorption system at $z = 0.5344$, as well as a candidate system at $z = 0.3389$, in the sight-line towards the $z = 2.64$ quasar MG J0414+0534. This, in addition to the absorption at the host redshift and the other two intervening absorbers, takes the total to four (possibly five). The previous maximum number of 21-cm absorbers detected along a single sight-line is two and so we suspect that this number of gas-rich absorbers is in some way related to the very red colour of the background source. Despite this, no molecular gas (through OH absorption) has yet been detected at any of the 21-cm redshifts, although, from the population of 21-cm absorbers as a whole, there is evidence for a weak correlation between the atomic line strength and the optical–near-infrared colour. In either case, the fact that so many gas-rich galaxies (likely to be damped Lyman-$\alpha$ absorption systems) have been found along a single sight-line towards a highly obscured source may have far reaching implications for the population of faint galaxies not detected in optical surveys, a possibility which could be addressed through future wide-field absorption line surveys with the Square Kilometre Array.

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## Weak Hard X-ray Emission from Two Broad Absorption Line Quasars Observed with NuSTAR: Compton-thick Absorption or Intrinsic X-ray Weakness?

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We present *NuSTAR* hard X-ray observations of two X-ray weak broad absorption line (BAL) quasars, PG 1004+130 (radio loud) and PG 1700+518 (radio quiet). Many BAL quasars appear X-ray weak, probably due to absorption by the shielding gas between the nucleus and the accretion-disk wind. The two targets are among the optically brightest BAL quasars, yet they are known to be significantly X-ray weak at rest-frame 2–10 keV (16–120 times fainter than typical quasars). We would expect to obtain $\approx$ 400–600 hard X-ray ($\gtrsim$ 10 keV) photons with *NuSTAR*, provided that these photons are not significantly absorbed ($N_{\rm H} \lesssim 10^{24}$ cm$^{-2}$). However, both BAL quasars are only detected in the softer *NuSTAR* bands (e.g., 4–20 keV) but not in its harder bands (e.g., 20–30 keV), suggesting that either the shielding gas is highly Compton-thick or the two targets are intrinsically X-ray weak. We constrain the column densities for both to be $N_{\rm H} \approx 7 \times 10^{24}$ cm$^{-2}$ if the weak hard X-ray emission is caused by obscuration from the shielding gas. We discuss a few possibilities for how PG 1004+130 could have Compton-thick shielding gas without strong Fe K$\alpha$ line emission; dilution from jet-linked X-ray emission is one likely explanation. We also discuss the intrinsic X-ray weakness scenario based on a coronal-quenching model relevant to the shielding gas and disk wind of BAL quasars. Motivated by our *NuSTAR* results, we perform a *Chandra* stacking analysis with the Large Bright Quasar Survey BAL quasar sample and place statistical constraints upon the fraction of intrinsically X-ray weak BAL quasars; this fraction is likely 17–40%.

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## The roles of star formation and AGN activity of IRS sources in the HerMES fields

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In this work we explore the impact of the presence of an active galactic nucleus (AGN) on the mid- and far-infrared (IR) properties of galaxies as well as the effects of simultaneous AGN and starburst activity in these same galaxies. To do this we apply a multi-component, multi-band spectral synthesis technique to a sample of 250 $\mu$m selected galaxies of the *Herschel* Multi-tiered Extragalactic Survey (HerMES), with IRS spectra available for all galaxies. Our results confirm that the inclusion of the IRS spectra plays a crucial role in the spectral analysis of galaxies with an AGN component improving the selection of the best-fit hot dust (torus) model.

N1) of the *Herschel* Multi-tiered Extragalactic Survey (HerMES) with available *Spitzer*/IRS spectra and study how representative it is with respect to the HerMES population. We evaluate the importance of the inclusion of IRS spectra in the spectral analysis of galaxies with an AGN component and conclude that they improve the selection of the best-fit hot dust (torus) model. the IRS spectra, we find justifiable the frequent use in the literature of the equivalent width of the PAH features at 11.3 or 6.2 $\mu$m to separate between AGN- and starburst-dominated objects in the mid-infrared (MIR). We find a correlation between the obscured star formation rate (SFR) derived from the IR luminosity of the starburst component, $\rm SFR_{IR}$ and $\rm SFR_{PAH}$, derived from the luminosity of the PAH features, $\rm L_{PAH}$, with $\rm SFR_{FIR}$ taking higher values than $\rm SFR_{PAH}$. The correlation is different for AGN- and starburst-dominated objects. The ratio of $\rm L_{PAH}$ to that of the starburst component, $\rm L_{PAH}/L_{SB}$, is almost constant

for AGN-dominated objects but decreases with increasing $L_{SB}$ for starburst-dominated objects. $SFR_{FIR}$ increases with the accretion luminosity, $L_{acc}$, with the increase less prominent for the very brightest, unobscured AGN-dominated sources.

We find no correlation between the masses of the hot (AGN-heated) and cold (starburst-heated) dust components. We interpret this as a non-constant fraction of gas driven by the gravitational effects to the AGN while the starburst is ongoing. We also find no evidence of the AGN affecting the temperature of the cold dust component, though this conclusion is mostly based on objects with a non-dominant AGN component. We conclude that our findings do not provide evidence that the presence of AGN affects the star formation process in the host galaxy, but rather that the two phenomena occur simultaneously over a wide range of luminosities.

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## Vertical broad-line region structure in nearby active galactic nuclei

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Broad emission lines are emitted in the surroundings of supermassive black holes in the centers of active galactic nuclei (AGN). This region is spatially not resolved. We intend to get information on the structure and geometry of this broad emitting line region (BLR) based on line profile observations. We model the rotational and turbulent velocities in the line-emitting regions based on observed full-width at half maximum line values (FWHM) and $\sigma_{\rm line}$ of the variable broad emission lines in four nearby AGN: NGC 3783, NGC 7469, NGC 5548, and 3C 390.3. On the basis of these velocities, we estimate the height of the line-emitting regions above the midplane in context with their distances from the center. The H$\beta$ lines are emitted in a more flattened configuration above the midplane in comparison to the highly ionized lines. The H$\beta$ lines originate at heights of 0.7 to 1.6 light-days and at distances of 1.4 to 24 light-days with height/distance ($H/R$) ratios of only 0.07 to 0.5. The highly ionized lines originate at smaller radii than the H$\beta$ lines and/or at greater distances above the midplane with $H/R$ values of 0.2 to 1.7. In total, the emission lines do not originate in a thin atmosphere of an accretion disk but rather at very extended regions above an accretion disk. The observed geometries of the line-emitting regions resemble the geometries of accretion disk wind models. Furthermore, the angle of the central opening cone (generated by the emitting regions of the highly ionized lines) is small for those galaxies with slow rotational velocities and increases with the rotation velocity of the central region. The derived geometries of the line-emitting regions of all four AGN are consistent with the geometries that are predicted in outflowing disk wind models.

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## The environments of luminous radio galaxies and type-2 quasars

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We present the results of a comparison between the environments of 1) a complete sample of 46 southern 2Jy radio galaxies at intermediate redshifts ($0.05 < z < 0.7$), 2) a complete sample of 20 radio-quiet type-2 quasars ($0.3 \leq z \leq 0.41$), and 3) a control sample of 107 quiescent early-type galaxies at $0.2 \leq z < 0.7$ in the Extended Groth Strip (EGS). The environments have been quantified using angular clustering amplitudes ($B_{gq}$) derived from deep optical imaging data. Based on these comparisons, we discuss the role of the environment in the triggering of powerful radio-loud and radio-quiet quasars. When we compare the $B_{gq}$ distributions of the type-2 quasars and quiescent early-type galaxies, we find no significant difference between them. This is consistent with the radio-quiet quasar phase being a short-lived but ubiquitous stage in the formation of all massive early-type galaxies. On the other hand, PRGs are in denser environments than the quiescent population, and this difference between distributions of $B_{gq}$ is significant at the 3$\sigma$ level. This result supports a physical origin of radio loudness, with high density gas environments favouring the transformation of AGN power into radio luminosity, or alternatively, affecting the properties of the

supermassive black holes themselves. Finally, focussing on the radio-loud sources only, we find that the clustering of weak-line radio galaxies (WLRGs) is higher than the strong-line radio galaxies (SLRGs), constituting a $3\sigma$ result. 82% of the 2Jy WLRGs are in clusters, according to our definition ($B_{gq} \geq 400$) versus only 31% of the SLRGs.

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