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Jobs Adverts - Meetings Adverts - Special Announcements

From the Editor

The Active Galaxies Newsletter is produced monthly. The deadline for contributions is the last friday 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.

Rob Beswick

The Double-Peaked galaxy 3C390.3 - An additional broad-line region component associated with the jet?

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Analysis of UV and optical spectra of the radio galaxy 3C 390.3 shows that the observed line ratios for the broad components of lines CIV/Lα, Lα/Hβ and Hα/Hβ can be explained best by two system of clouds (two components to the BLR). One BLR component has an electron density 10^{10-12}cm^{-3} and is located in the equatorial plane at the distance ≈20 days from the center. This disk-like region emits predominantly low-ionization lines (including Hβ and Hα). The second BLR corresponds to the region with somewhat lower (10^{8-9}cm $^{-3}$), located out of the equatorial plane in the direction of radio-jet. Gas in this region could extend out to a distance of ≈ 40-80 days from the center. This region emits the high-ionization CIV line, a significant part (≈60%) of Lα and far wings of the Balmer lines.

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Suzaku Observations of near-relativistic outflows in the BAL quasar APM 08279+5255.

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We present results from three *S*uzaku observations of the $z = 3.91$ gravitationally lensed broad absorption line quasar APM 08279+5255. We detect strong and broad absorption at rest-frame energies of < 2 keV (low-energy) and 7–12 keV (high-energy). The detection of these features confirms the results of previous long-exposure (80–90 ks) *C*handra and *XMM-Newton* observations. The low and high-energy absorption is detected in both the back-illuminated (BI) and front-illuminated (FI) *S*uzaku XIS spectra (with an F-test significance of $> 99\%$). We interpret the low-energy absorption as arising from a low ionization absorber with log $N_{\rm H} \sim 23$ and the high-energy absorption as due to lines arising from highly ionized ($2.75 < \log \xi < 4.0$; where ξ is the ionization parameter) iron in a near-relativistic outflowing wind. Assuming this interpretation we find that the velocities in the outflow range between $0.1c$ and $0.6c$. We constrain the angle between the outflow direction of the X-ray absorber and our line of sight to be $< 36^\circ$. We also detect likely variability of the absorption lines (at the $> 99.9\%$ and $>98\%$ significance levels in the FI and BI spectra, respectively) with a rest-frame time scale of ~ 1 month. Assuming that the detected high-energy absorption features arise from Fe XXV, we estimate that the fraction of the total bolometric energy injected over the quasar's lifetime into the intergalactic medium in the form of kinetic energy to be $> 10\%$.

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Intranight polarization variability in radio-loud and radio-quiet AGN

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Intranight polarization variability in AGN has not been studied extensively so far. Studying the variability in polarization makes it possibly to distinguish between different emission mechanisms. Thus it can help answering the question if intranight variability in radio-loud and radio-quiet AGN is of the same or of fundamentally different origin. In this paper we investigate intranight polarization variability in AGN. Our sample consists of 28 AGN at low to moderate redshifts ($0.048 \leq z \leq 1.036$), 12 of which are radio-quiet quasars (RQQs) and 16 are radio-loud blazars. The subsample of blazars consists of eight flat-spectrum radio-quasars (FSRQs) and eight BL Lac objects. Each AGN was observed for a time span of ~ 4 h in the R band to measure polarization and variability. Using statistical methods, we determine duty cycles for polarized emission and polarization intranight variability. We find clear differences between the two samples. A majority of t he radio-loud AGN show moderate to high degrees of polarization, more than half of them also show variability in polarization. There seems to be a dividing line for polarization intranight variability at $P \sim 5$ per cent over which all objects vary in polarization. We did not find clear correlations between the strength of the variability and the redshift or degree of polarization. Only two out of 12 radio-quiet quasars show polarized emission, both at levels of $P < 1$ per cent. The lack of polarization intranight variability in radio-quiet AGN points towards accretion instabilities being the cause for intranight flux variability whereas the high duty cycle of polarization variability in radio-loud objects is more likely caused by instabilities in the jet or changes of physical conditions in the jet plasma. We were able to constrain the timescale of the detected variations to > 4 h. Further studies of intranight polarization variability will be necessary to reveal exact phys ical conditions behind this phenomenon

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PHL 1092 as a transient extreme X–ray weak quasar

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We report a dramatic variability event in the X–ray history of the Narrow–Line quasar PHL 1092 ($z = 0.396$). Our latest 2008 *XMM–Newton* observation reveals a flux drop of ~ 200 with respect to the previous observation performed about 4.5 years earlier, and a drop of ~ 135 with respect to its historical flux. Despite the huge X–ray variation, the UV flux remains constant producing a very significant steepening of the optical to X–ray slope $\alpha_{\rm ox}$ from -1.56 to -2.44, making PHL 1092 one of the most extreme X–ray weak quasars. The similarity in the soft X–ray spectral shape between the present and previous observations, together with the persistent UV flux and the lack of any dramatic change in the optical spectrum suggest that an absorption event is not likely to be the origin of the observed variation. If absorption is ruled out, the sudden X–ray weakness of PHL 1092 must be produced by a transient significant weakening or disruption of the X–ray emitting corona.

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Sing Signs of gas flows in the variable Balmer line profiles of the Seyfert galaxy uclei NGC 3227 and NGC 7469

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The spectral data on the Balmer line profiles obtained and compiled from the literature for the Seyfert galaxies NGC 3227 and NGC 7469 allow us to suppose that the profile variations are connected with three independent regions of different physical conditions.

1. Classical broad line region by the dimension of $\sim$ 4.5?10^{16} cm is ionized and excited by the central source radiation. The central source brightness variation in 1971-1972 led to the gas parameter variations 10$^9\,\mathrm{cm}^{-3} \geq$ $\mathrm{n}_e \geq 10^8\,\mathrm{cm}^{-3}$ and 2 10^4 K $\leq$ $\mathrm{T}_e \leq 410^4$K.

2. The profiles of the Balmer lines contain narrow components that kept their positions (radial velocities) over 25 and 17 years for the NGC 3227 and NGC 7469, respectively. These components are supposed to be caused by long-lived gas flows in the nuclei of the galaxies. Observational data obtained by Rubin and Ford allow us to argue that gas of the flows can be explained in the frame of the model of collision ionization and excitation of gas with self-absorption. It is dense and hot plasma: n$_e$=10^8 - 10^{12} cm^{-3} and T$_e$ = (1-2.5)10^4 K.

3. Broad blue bumps of radial velocity -4000 km/s - 5000 km/s were observed in the Hγ profile during several day flare twice in the NGC 3227 nucleus and ones in the NGC 7469. One can speculate that the flares are connected with short-lived ejections. The gas of the ejections is ionized and excited by collision processes and its n$_e$ $\sim$10^{14} cm^{-3}, T$_e$ $\sim$ 25 000 K.

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High-Redshift SDSS Quasars with Weak Emission Lines

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We identify a sample of 74 high-redshift quasars ($z > 3$) with weak emission lines from the Fifth Data Release of

the Sloan Digital Sky Survey and present infrared, optical, and radio observations of a subsample of four objects at $z > 4$. These weak emission-line quasars (WLQs) constitute a prominent tail of the Lyα+N v equivalent width distribution, and we compare them to quasars with more typical emission-line properties and to low-redshift AGNs with weak/absent emission lines, namely BL Lac objects. We find that WLQs exhibit hot ($T \sim 1000$ K) thermal dust emission and have rest-frame 0.1–5 μm SEDs that are quite similar to those of normal quasars. The variability, polarization, and radio properties of WLQs are also different from those of BL Lacs, making continuum boosting by a relativistic jet an unlikely physical interpretation. The most probable scenario for WLQs involves broad-line region properties that are physically distinct from those of normal quasars.

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Isotropic Luminosity Indicators in a Complete AGN Sample

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The [O iv] $\lambda 25.89$ μm line has been shown to be an accurate indicator of active galactic nucleus (AGN) intrinsic luminosity, in that it correlates well with hard (10–200 keV) X-ray emission. We present measurements of [O iv] for 89 Seyfert galaxies from the unbiased Revised Shapley-Ames (RSA) sample. The [O iv] luminosity distributions of obscured and unobscured Seyferts are indistinguishable, indicating that their intrinsic AGN luminosities are quite similar and that the RSA sample is well suited for tests of the unified model. In addition, we analyze several commonly used proxies for AGN luminosity, including [O iii] $\lambda 5007$ Å, 6 cm radio, and 2–10 keV X-ray emission. We find that the radio luminosity distributions of obscured and unobscured AGNs show no significant difference, indicating that radio luminosity is a useful isotropic luminosity indicator. However, the observed [O iii] and 2–10 keV luminosities are systematically smaller for obscured Seyferts, indicating that they are not emitted isotropically.

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Physical Conditions in the Inner Narrow Line Region of the Seyfert 2 Galaxy Markarian 573

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We have examined the physical conditions within a bright emission-line knot in the inner narrow-line region (NLR) of the Seyfert 2 galaxy Mrk 573 using optical spectra and photoionization models. The spectra were obtained with the *Hubble Space Telescope*/Space Telescope Imaging Spectrograph, through the $0''.2 \times 52''.0$ slit, at a position angle of -71.2°, with the G430L and G750M gratings. Comparing the spatial emission-line profiles, we found [Fe X] λ 6734 barely resolved, [O III] $\lambda 5007$ centrally peaked, but broader than [Fe X], and [O II] $\lambda 3727$ the most extended. Spectra of the central knot were extracted from a region $1''.1$ in extent, corresponding to the full-width at zero intensity in the cross-dispersion direction, of the knot. The spectra reveal that [Fe X] is broader in velocity width and blue-shifted compared with lines from less ionized species. Our estimate of the bolometric luminosity indicates that the active galactic nucleus (AGN) is radiating at or above its Eddington Luminosity, which is consistent with its identification as a hidden Narrow-Line Seyfert 1. We were able to successfully match the observed emission line ratios with a three-component photoionization model. Two components, one to account for the [O III] emission and another in which the [Fe X] arises, are directly ionized by the AGN, while [O II] forms in a third component, which is ionized by a heavily absorbed continuum. Based

on our assumed ionizing continuum and the model parameters, we determined that the two directly-ionized components are $\sim$ 55 pc from the AGN. We have found similar radial distances for the central knots in the Seyfert 2 galaxies Mrk 3 and NGC 1068, but much smaller radial distances for the inner NLR in the Seyfert 1 galaxies NGC 4151 and NGC 5548. Although in general agreement with the unified model, these results suggest that the obscuring material in Seyfert galaxies extends out to at least tens of parsecs from the AGN.

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AGN with strong forbidden high-ionisation lines selected from the Sloan Digital Sky Survey

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We have defined a sample of 63 AGN with strong forbidden high-ionisation line (FHIL) emission. These lines, with ionisation potentials $\gtrsim$100 eV, respond to a portion of the spectrum that is often difficult to observe directly, thereby providing constraints on the extreme UV–soft X-ray continuum. The sources are selected from the Sloan Digital Sky Survey (SDSS) on the basis of their [Fe x]λ6374Å emission, yielding one of the largest and the most homogeneous sample of FHIL-emitting galaxies. We fit a sequence of models to both FHILs ([Fe xi], [Fe x] and [Fe vii]) and lower-ionisation emission lines ([O iii], [O i], Hα, [N ii], [S ii]) in the SDSS spectra. These data are combined with X-ray measurements from the *Rosat* satellite, which are available for half of the sample. The correlations between these parameters are discussed for both the overall sample and subsets defined by spectroscopic classifications. The primary results are evidence that: (1) the [Fe x] and [Fe xi] lines are photoionised and their strength is proportional to the continuum flux around 250 eV; (2) the FHIL-emitting clouds form a stratified outflow in which the [Fe x] and [Fe xi] source regions extend sufficiently close to the BLR that they are partially obscured in Seyfert 2s whereas the [Fe vii] source region is more extended and is unaffected by obscuration; (3) narrow-lined Seyfert 1s (NLS1s) tend to have the strongest [Fe x] flux (relative to lower-ionisation lines); and (4) the most extreme [Fe x] ratios (such as [Fe x]/[O iii] or [Fe x]/[Fe vii]) are found in the NLS1s with the narrowest broad lines and appear to be an optical-band indication of objects with strong X-ray soft excesses.

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Radio constraints on the volume filling factors of AGN winds

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The calculation of mass outflow rates of AGN winds is of great importance in understanding the role that such winds play in AGN-galaxy feedback processes. The mass outflow rates are, however, difficult to estimate since the volume filling factors of the winds are unknown. In this paper, we use constraints imposed by the observed radio emission to obtain upper limits to the volume filling factors of wind components in certain nearby AGN. We do this by predicting the 1.4 GHz radio flux densities emitted by those components, assuming a uniform wind, and then comparing these with the observed flux densities for each AGN at this frequency. We find that the upper limits to the volume filling factors are in the range 10^{-4}–0.5.

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The active nuclei of $z < 1.0$ 3CRR radio sources

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We combine *Chandra* and *XMM-Newton* X-ray data from our previous papers with new X-ray observations and with *Spitzer* mid-infrared data in order to study the nature of the nuclei of radio galaxies and radio-loud quasars with $z < 1.0$ from the 3CRR sample. The significant increase in sample size over our previous work, the reduction of bias in the sample as a result of new observations, and the availability of more mid-infrared data allow us to show conclusively that almost all objects classed as low-excitation radio galaxies in optical spectroscopic studies lack a radiatively efficient active nucleus. We show that the distribution of absorbing columns in the narrow-line radio galaxies differs from the population of X-ray-selected radio-quiet type-2 quasars and from that in local Seyfert 2s. We comment on the current evidence for the nature of the soft X-ray component in radio-galaxy nuclear spectra, concluding that a jet origin for this component is very hard to evade. Finally, we discuss the recently discovered 'fundamental plane' of black hole activity, showing that care must be taken when placing radio-loud AGN on such diagnostic diagrams.

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Astrometric Redshifts for Quasars

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The wavelength dependence of atmospheric refraction causes differential chromatic refraction (DCR), whereby objects imaged at different optical/UV wavelengths are observed at slightly different positions in the plane of the detector. Strong spectral features induce changes in the effective wavelengths of broad-band filters that are capable of producing significant positional offsets with respect to standard DCR corrections. We examine such offsets for broad-emission-line (type 1) quasars from the Sloan Digital Sky Survey (SDSS) spanning $0 < z < 5$ and an airmass range of 1.0 to 1.8. These offsets are in good agreement with those predicted by convolving a composite quasar spectrum with the SDSS bandpasses as a function of redshift and airmass. This astrometric information can be used to break degeneracies in photometric redshifts of quasars (or other emission-line sources) and, for extreme cases, may be suitable for determining "astrometric redshifts". On the SDSS's southern equatorial stripe, where it is possible to average many multi-epoch measurements, more than 60% of quasars have emission-line-induced astrometric offsets larger than the SDSS's relative astrometric errors of 25-35 mas. Folding these astrometric offsets into photometric redshift estimates yields an improvement of 9% within $\Delta z \pm 0.1$. Future multi-epoch synoptic surveys such as LSST and Pan-STARRS could benefit from intentionally making ~ 10 observations at relatively high airmass ($\mathrm{AM} \sim 1.4$) in order to improve their photometric redshifts for quasars.

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Mass Functions of the Active Black Holes in Distant Quasars from the Large Bright Quasar Survey, the Bright Quasar Survey, and the Color-Selected Sample of the SDSS Fall Equatorial Stripe.

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We present mass functions of distant actively accreting supermassive black holes residing in luminous quasars discovered in the Large Bright Quasar Survey (LBQS), the Bright Quasar Survey (BQS), and the Fall Equatorial Stripe of the Sloan Digital Sky Survey (SDSS). The quasars cover a wide range of redshifts from the local universe to $z = 5$ and were subject to different selection criteria and flux density limits. This makes these samples complementary and can help us gain additional insight on the true underlying black hole mass distribution free from selection effects and mass estimation errors through future studies. By comparing these quasar samples, we see evidence that the active black hole population at redshift four is somewhat different than that at lower redshifts, including that in the nearby universe. In particular, there is a sharp increase in the space density of the detected active black holes ($M_{\rm BH} \gtrsim 10^8 M_\odot$) between redshifts $\sim$4 and $\sim$2.5. Also, the mass function of the SDSS quasars at $3.6 \leq z \leq 5$ has a somewhat flatter high mass-end slope of $\beta = -1.75 \pm 0.56$, compared to the mass functions based on quasars below z of 3 (BQS and LBQS quasars), which display typical slopes of $\beta \approx -3.3$; the latter are consistent with the mass functions at similar redshifts based on the SDSS Data Release 3 quasar catalog presented by Vestergaard et al. We see clear evidence of cosmic downsizing in the comoving space density distribution of active black holes in the LBQS sample alone. In forthcoming papers, further analysis, comparison, and discussion of these mass functions will be made with other existing black hole mass functions, notably that based on the SDSS DR3 quasar catalog. We present the relationships used to estimate the black hole mass based on the Mg II emission line; the relations are calibrated to the Hβ and C IV relations by means of several thousand high quality SDSS spectra. Mass estimates of the individual black holes of these samples are also presented.

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Black-hole masses of distant quasars

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A brief overview of the methods commonly used to determine or estimate the black hole mass in quiescent or active galaxies is presented and it is argued that the use of mass-scaling relations is both a reliable and the preferred method to apply to large samples of distant quasars. The method uses spectroscopic measurements of a broad emission-line width and continuum luminosity and currently has a statistical 1 sigma uncertainty in the absolute mass values of about a factor of 4. Potentially, this accuracy can be improved in the future. When applied to large samples of distant quasars it is evident that the black hole masses are very large, of order 1 to 10 billion solar masses, even at the highest redshifts of 4 to 6. The black holes must build up their mass very fast in the early universe. Yet they do not grow much larger than that: a maximum mass of about 10 billion solar masses is also observed. Preliminary mass functions of active black holes are presented for several quasar samples, including the Sloan Digital Sky Survey. Finally, common concerns related to the application of the mass scaling relations, especially for high redshift quasars, are briefly discussed.

Invited contribution to the 2007 Spring Symposium on "Black Holes" at the Space Telescope Science Institute. The proceedings, published by Cambridge University Press, are in press.

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