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Abstracts - Thesis Abstracts - Jobs - Meetings

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.

Rob Beswick

Abstracts of recently accepted papers

Super-Eddington accretion rates in Narrow Line Seyfert 1 galaxies

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We use the BH masses deduced from the empirical relation of Kaspi et al. (2000) between the size of the Broad Line Region (BLR) of Active Galactic Nuclei (AGN) and the optical luminosity, to compute their accretion rate in four samples of AGN, assuming that the optical luminosity is provided by the accretion disc. We show that Narrow Line Seyfert Galaxies 1 (NLS1s) accrete at super-Eddington rates, while their luminosity stays of the order of the Eddington limit. We take into account the possibility of a non-viscous energy release inversely proportional to the square of the distance in the gravitationally unstable region of the disc emitting a fraction of the optical luminosity. It leads to a smaller accretion rate and to a redder continuum than a standard disc, which agrees better with the observations. The observed bolometric luminosities appear to saturate at a few times the Eddington luminosity for super-Eddington accretion rates, as predicted by slim disc models. They favor a Kerr BH rather than a Schwarzshild one. Even when the accretion rate is super-Eddington, it stays always of the order of a few $M_\odot$/yr, irrespective of the BH mass, indicating that the growing of the BH is mass supply limited and therefore regulated by an exterior mechanism, and not Eddington limited. The mass of the BH increases by one order of magnitude in a few 10^7 years, a time smaller than that necessary for changing the bulge mass. This is in agreement with recent claims that the BHs of NLS1s do not follow the same black hole - bulge relation as other galaxies. Since they represent about 10% of AGN up to a redshift of 0.5, these "super-active" phases should play an important role in shaping the mass function of local BHs. We finally discuss the possibility that the masses could be systematically underestimated due to an inclination effect, and we conclude that it could indeed be the case, and that the accretion rates could thus be strongly overestimated in a small proportion of objects, possibly explaining the existence of apparently extremely high accretors.

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Preprint available at http://xxx.lanl.gov/abs/astro-ph/0407181

Chandra Observations of the NLS1 RX J2217.9–5941

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We report the results of two Chandra ACIS-S observations from February and August 2003 of the highly X-ray variable Narrow-Line Seyfert 1 galaxy RX J2217.9–5941. Observations spanning the time from the ROSAT All Sky Survey (RASS) through an ASCA observation in 1998 indicate apparently monotonically decreasing flux by a factor of 30. The Chandra observations reveal increased emission over that seen in ASCA, supporting a persistent variability rather than an X-ray outburst event. However, the cause of the strong X-ray variability remains unclear. Our Chandra observations confirm the steep soft X-ray spectrum in the 0.2-2.0 keV band found during the ROSAT All-Sky Survey observation ($\alpha_{\rm X}$=2.7). The spectral shape of the source appears to be variable with the spectrum becoming softer when the source becomes fainter. Best fitting models to the data include an absorbed broken power law, a blackbody plus power law, and a power law with partial covering absorption. The latter model suggests a variable partial-covering absorber in the line of sight which can explain in part the variability seen in RX J2217.9–5941. We suggest that there might be a population of Narrow Line Seyfert 1 galaxies which are at least at times highly absorbed.

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preprint available at http://arxiv.org/abs/astro-ph/0406068

Black Hole Masses of High-Redshift Quasars

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Black-hole masses of distant quasars cannot be measured directly, but can be estimated to within a factor 3 to 5 using scaling relationships involving the quasar luminosity and broad-line width. Why such relationships are reasonable is summarized. The results of applying scaling relationships to data of quasars at a range of redshifts ($z \leq 6.3$) are presented. Luminous quasars typically have masses $\sim 10^9 M_\odot$ even at the highest redshifts. The fact that such massive black holes appear as early as at $z \approx 6$ indicate that black holes form very early or build up mass very fast.

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Dust Reddening in SDSS Quasars

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We explore the form of extragalactic reddening toward quasars using a sample of 9566 quasars with redshifts $0 < z < 2.2$, and accurate optical colors from the Sloan Digital Sky Survey (SDSS). We confirm that dust reddening is the primary explanation for the red "tail" of the color distribution of SDSS quasars. Our fitting to 5-band photometry normalized by the modal quasar color as a function of redshift shows that this "tail" is well described by SMC-like reddening but not by LMC-like, Galactic, or Gaskell et al. (2004) reddening. Extension to longer wavelengths using a subset of 1886 SDSS-2MASS matches confirms these results at high significance. We carry out Monte-Carlo simulations that match the observed distribution of quasar spectral energy distributions using a Lorentzian dust reddening distribution; 2% of quasars selected by the main SDSS targeting algorithm (i.e., which are not extincted out of the sample) have $E_{B-V} > 0.1$; less than 1% have $E_{B-V} > 0.2$, where the extinction is relative to quasars with modal colors. Reddening is uncorrelated with the presence of intervening narrow-line absorption systems, but reddened quasars are much more likely to show narrow absorption at the redshift of the quasar than are unreddened quasars. Thus the reddening towards quasars is dominated by SMC-like dust at the quasar redshift.

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XMM-Newton observation of the Seyfert 1.8 ESO 113-G010: discovery of a highly redshifted iron line at 5.4 keV

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We present a spectral analysis of the Seyfert 1.8 ESO 113-G010 observed with *XMM-Newton* for 4 ks. The spectrum shows a soft excess below 0.7 keV and more interestingly a narrow emission Gaussian line at 5.4 keV (in its rest-frame), most probably originating from a redshifted iron Kα line. No significant line at or above 6.4 keV is found contrary to other objects showing redshifted lines, ruling out a strong blue-wing to the line profile. The line is detected at 99% confidence, from performing Monte Carlo simulations which fully account for the range of energies where a narrow iron line is likely to occur. The energy of the line could indicate emission from relativistic (0.17–0.23 c) ejected matter moving away from the observer, as proposed for Mrk 766 by Turner et al. (2004). Alternatively, the emission from a narrow annulus at the surface of the accretion disk is unlikely due to the very small inclination angle (i.e. less than 10°) required to explain the narrow, redshifted line in this intermediate Seyfert galaxy. However emission from a small, localized hot-spot on the disk, occurring within a fraction of a complete disk orbit, could also explain the redshifted line. This scenario would be directly testable in a longer observation, as one would see significant variations in the energy and intensity of the line within an orbital timescale.

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Central Masses and Broad-Line Region Sizes of Active Galactic Nuclei. II. A Homogeneous Analysis of a Large Reverberation-Mapping Database

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We present improved black hole masses for 35 active galactic nuclei (AGNs) based on a complete and consistent reanalysis of broad emission-line reverberation-mapping data. From objects with multiple line measurements, we find that the highest precision measure of the virial product $c\tau\Delta V^2/G$, where τ is the emission-line lag relative to continuum variations and ΔV is the emission-line width, is obtained by using the cross-correlation function centroid (as opposed to the cross-correlation function peak) for the time delay and the line dispersion (as opposed to full width half maximum) for the line width and by measuring the line width in the *variable* part of the spectrum. Accurate line-width measurement depends critically on avoiding contaminating features, in particular the narrow components of the emission lines. We find that the precision (or random component of the error) of reverberation-based black hole mass measurements is typically around 30%, comparable to the precision attained in measurement of black hole masses in quiescent galaxies by gas or stellar dynamical methods. Based on results presented in

a companion paper by Onken et al., we provide a zero-point calibration for the reverberation-based black hole mass scale by using the relationship between black hole mass and host-galaxy bulge velocity dispersion. The scatter around this relationship implies that the typical systematic uncertainties in reverberation-based black hole masses are smaller than a factor of three. We present a preliminary version of a mass–luminosity relationship that is much better defined than any previous attempt. Scatter about the mass–luminosity relationship for these AGNs appears to be real and could be correlated with either Eddington ratio or object inclination.

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X-ray Surveys and Wide-Field Optical/Near-Infrared Imaging with the Joint Dark Energy Mission

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I briefly describe a few important scientific issues that could be addressed effectively via the combination of data from *JDEM* and X-ray missions. The topics covered are largely focused on active galactic nuclei (AGN) and include (1) the selection of AGN via X-ray emission and optical variability, (2) nuclear outbursts in galaxies due to transient fueling of their supermassive black holes, (3) moderate-luminosity AGN at high redshift ($z > 4$) found via application of "dropout" techniques to X-ray sources, and (4) the host-galaxy morphologies of X-ray selected AGN. I also describe the substantial challenges to obtaining wide-field X-ray data with sufficient sensitivity to complement *JDEM* properly.

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The Unusual Tidal Dwarf Candidate in the Merger System NGC 3227/6: Star Formation in a Tidal Shock?

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We report the discovery of active star formation in the HI cloud associated with the interacting Seyfert system NGC 3227/NGC 3226 that was originally identified as a candidate tidal dwarf galaxy (TDG) by Mundell et al. and that we name J1023+1952. We present the results of broad-band BRIJHK and ultraviolet imaging that show the HI cloud is associated with massive on-going star formation seen as a cluster of blue knots ($M_B <$ -15.5 mag) surrounded by a diffuse ultraviolet halo and co-spatial with a ridge of high column density neutral hydrogen its southern half. We also detect Hα emission from the knots with a flux density corresponding to a star-formation rate of SFR $\sim$0.011 $M_\odot$ yr^{-1}. Although J1023+1952 spatially overlaps the edge of the disk of NGC 3227, it has a mean HI velocity 150 km/s higher than that of NGC 3227; comparison of ionized and neutral gas kinematics in the star-forming region show closely matched velocities, providing strong evidence that the knots are embedded in J1023+1952 and do not merely lie behind in the disk of NGC 3227, thus confirming J1023+1952 as a gas-rich dwarf galaxy. We discuss two scenarios for the origin of J1023+1952; as a third, pre-existing dwarf galaxy involved in the intera ction with NGC 3227 and NGC 3226, or a newly-forming dwarf galaxy condensing out of the tidal debris removed from the gaseous disk of NGC 3227. Given the lack of a detectable old stellar population, a tidal origin is more likely. If J1023+1952 is a bound object forming from returning gaseous tidal tail mate rial, we infer a dynamically young age similar to its star-formation age, and suggests it is in the ear liest stages of TDG evolution. Whatever the origin of J1023+1952 we suggest that its star formation is shock-triggered by collapsing tidal debris. (Abridged)

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Supermassive Black Holes in Active Galactic Nuclei. II. Calibration of the $\mathbf{M_{BH}}$–$\boldsymbol{\sigma_*}$ Relationship for AGNs

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We calibrate reverberation-based black hole masses in active galactic nuclei (AGNs) by using the correlation between black hole mass, $M_{\rm BH}$, and bulge/spheroid stellar velocity dispersion, σ_*. We use new measurements of σ_* for 6 AGNs and published velocity dispersions for 10 others, in conjunction with improved reverberation mapping results, to determine the scaling factor required to bring reverberation-based black hole masses into agreement with the quiescent galaxy $M_{\rm BH}$–σ_* relationship. The scatter in the AGN BH masses is found to be less than a factor of 3. The current observational uncertainties preclude use of the scaling factor to discriminate between broad-line region models.

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High resolution X-ray spectra of quasars

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Past X-ray observations by *ASCA* suggest that warm absorbers (O VII and O VIII edges) are apparently rare in high luminosity AGNs (quasars) while they are more common in low luminosity AGNs (Seyferts). However, this could be a selection effect if high luminosity AGNs have mostly narrow absorption lines (with no strong bound free edges), which escaped detection by the low resolution of *ASCA*. To check this hypothesis we are studying the high-resolution X-ray spectra of quasars from grating spectrometers on board *Chandra* and *XMM-Newton* in search for absorption lines. In this contribution we present spectra of three quasars. The spectra show narrow (several hundred km s^{-1}) absorption and emission X-ray lines from H-like and He-like ions of O, Ne, Mg, and other abundant elements. We also detect absorption from iron L-shell lines and iron M-shell unresolved transition array. We present the analysis of MR2251-178 where we find that at least two, and probably three, distinct warm absorbers are needed to explain the high resolution spectrum of this object. We re-analyze the high-resolution X-ray spectrum of PG 1211+143 and suggest that an outflow velocity of $\sim$ 3000 km s^{-1} provides an adequate explanation to these data. We also present preliminary results form the *Chandra*/HETGS observation of the quasar 4C74.26.

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Evidence for X-ray Obscuration in Type II Quasar Candidates from the Sloan Digital Sky Survey

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Recently, Zakamska et al. (2003) selected 291 high-ionization narrow emission-line AGN in the redshift range 0.3–0.83 from the Sloan Digital Sky Survey spectroscopic data. The sample includes both Seyfert II galaxies and their higher luminosity "cousins", Type II quasar candidates. Here we present the results on the X-ray properties of 17 of these objects for which archival X-ray data (*ROSAT* and XMM-*Newton*) are available. Three sources have been significantly ($\geq 6\sigma$) detected, one being the most radio-loud source of the sample; its X-ray emission, possibly enhanced by jet emission, is consistent with the absence of absorption. Another source has a $\approx 6\sigma$ detection in the *ROSAT* All-Sky Survey, possibly complex radio structure, and no evidence for strong X-ray absorption. For the third X-ray detection, the XMM-*Newton* spectrum indicates a column

density of $N_{\rm H} = 1.26^{+0.75}_{-0.51} \times 10^{22}$ cm^{-2}; this result, coupled with the 2–10 keV luminosity of $\approx 4\times10^{44}$ erg s^{-1}, makes this source a genuine Type II quasar. Using the [O III]λ5007 line luminosities, we estimated the intrinsic X-ray power of the AGN and found that ≥ 47 per cent of the observed sample shows indications of X-ray absorption, with column densities $\geq 10^{22}$ cm^{-2}. This provides further evidence that a considerable fraction are obscured quasars. Support to our conclusions also comes from the recent analysis of RASS data performed by Zakamska et al. (2004), who found five additional lower significance ($\approx 2.1\sigma - 3.6\sigma$) X-ray matches.

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Reverberation Mapping of Active Galactic Nuclei

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Reverberation mapping is a proven technique that is used to measure the size of the broad emission-line region and central black hole mass in active galactic nuclei. More ambitious reverberation mapping programs that are well within the capabilities of *Hubble Space Telescope* could allow us to determine the nature and flow of line-emitting gas in active nuclei and to assess accurately the systematic uncertainties in reverberation-based black hole mass measurements.

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The role of interactions

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Interactions between galaxies are suggested to be a mechanism responsible for feeding Active Galactic Nuclei (AGN). Theoretical models show that interactions are an efficient way to drive gas from the galaxy to the nucleus, however, the observational evidence on this subject is controversial. Here we review results in this field, discuss possible limitations of previous studies and the importance of dealing with selection effects. We also show that there is no significant difference in the percentage of low luminosity AGN and normal galaxies with companions, and discuss possible interpretations of this result.

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The Broad-Line Region in Active Galactic Nuclei

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We review the basic observed and inferred properties of the broad emission-line region in AGNs, as well as the basics of the reverberation-mapping technique that can be used to determine the size and structure of the region. We argue that the current best evidence points to a multi-component line-emitting region, with a disk-like structure, possibly an extension of the accretion disk itself, and a disk wind being strong candidates for the origin of the broad-line emission.

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A study of the 15μm quasars in the ELAIS *N1* and *N2* fields

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This paper discusses properties of the European Large Area *ISO* Survey 15μm quasars and tries to establish a robust method of quasar selection for future use within the Spitzer Wide-Area Infrared Extragalactic Survey (SWIRE) framework. The importance of good quality ground-based optical data is stressed, both for the candidates selection and for the photometric redshift s estimates. Colour-colour plots and template fitting are used for these purposes. The properties of the 15μm quasars sample are studied, including variability and black hole masses and compared to the properties of other quasars that lie within the same fields but have no mid-infrared counterparts. The two subsamples do not present substantial differences and are believed to come from the same parent population.

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