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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

XMM-Newton Spectroscopy of the Highly Polarized and Luminous Broad Absorption Line Quasar CSO 755

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We present the results from *XMM-Newton* observations of the highly optically polarized broad absorption line quasar (BALQSO) CSO 755. By analyzing its X-ray spectrum with a total of $\sim$3000 photons we find that this source has an X-ray continuum of ‘typical’ radio-quiet quasars, with a photon index of Γ=$1.83^{+0.07}_{-0.06}$, and a rather flat (X-ray bright) intrinsic optical-to-X-ray spectral slope of $\alpha_{\rm ox}$=-1.51. The source shows evidence for intrinsic absorption, and fitting the spectrum with a neutral-absorption model gives a column density of $N_{\rm H}$$\sim$$1.2\times10^{22}$ cm^{-2}; this is among the lowest X-ray columns measured for BALQSOs. We do not detect, with high significance, any other absorption features in the X-ray spectrum. Upper limits we place on the rest-frame equivalent width of a neutral (ionized) Fe Kα line, $\leq$180 eV ($\leq$120 eV), and on the Compton-reflection component parameter, $R\leq$0.2, suggest that most of the X-rays from the source are directly observed rather than being scattered or reflected; this is also supported by the relatively flat intrinsic $\alpha_{\rm ox}$ we measure. The possibility that most of the X-ray flux is scattered due to the high level of UV–optical polarization is ruled out. Considering data for 46 BALQSOs from the literature, including CSO 755, we have found that the UV–optical continuum polarization level of BALQSOs is not correlated with any of their X-ray properties. A lack of significant short- and long-term X-ray flux variations in the source may be attributed to a large black-hole mass in CSO 755. We note that another luminous BALQSO, PG 2112+059, has both similar shallow C IV BALs and moderate X-ray absorption.

Accepted by The Astronomical Journal

E-mail contact: ohad@astro.psu.edu
preprint available at http://arxiv.org/abs/astro-ph/0509146

The Knotty Question of the Jet of PKS B1421-490

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We report the discovery of unusually strong optical and X-ray emission associated with a knot in the radio jet of PKS B1421-490. The knot is the brightest feature observed beyond the radio band, with knot/core flux ratios ∼300 and 3.7 at optical and X-ray frequencies. We interpret the extreme optical output of the knot as synchrotron emission. The nature of the X-ray emission is unclear. We consider a second synchrotron component, inverse Compton emission from a relativistic, decelerating jet, and the possibility that this feature is a chance superposition of an unusual BL Lac object.

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preprint available at http://arxiv.org/abs/astro-ph/0509205,
higher-resolution preprint and related materials available from http://space.mit.edu/home/jonathan/jets/ .

INTEGRAL Observations of AGN in the Galactic Plane

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We present results on approximately one year of *INTEGRAL* observations of six AGN detected during the regular scans of the Galactic Plane. The sample is composed by five Seyfert 2 objects (MCG –05–23–16, NGC 4945, the Circinus galaxy, NGC 6300, ESO 103–G35) and the radio galaxy Centaurus A. The continuum emission of each of these sources is well represented by a highly absorbed ($N_{\rm H} > 10^{22}\,{\rm cm}^{-2}$) power law, with average spectral index $\Gamma = 1.9 \pm 0.3$. A high energy exponential cut-off at $E_c \sim 50\,{\rm keV}$ is required to fit the spectrum of the Circinus galaxy, whereas a lower limit of 130 keV has been found for NGC 4945 and no cut-off has been detected for NGC 6300 in the energy range covered by these *INTEGRAL* data. The flux of Centaurus A was found to vary by a factor of ~ 2 in 10 months, showing a spectral change between the high and low state, which can be modelled equally well by a change in the absorption ($N_{\rm H}$ from 17 to $33 \times 10^{22}\,{\rm cm}^{-2}$) or by the presence of a cut-off at $\geq 120\,{\rm keV}$ in the low state spectrum. A comparison with recently reprocessed *BeppoSAX*/PDS data shows a general agreement with *INTEGRAL* results. The high energy cut-off in the hard X-ray spectra appears to be a common but not universal characteristic of Seyfert 2 and to span a wide range of energies.

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Type I ULIRGs: Transition Stage from ULIRGs to QSOs

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We examine whether the ultraluminous infrared galaxies that contain a type I Seyfert nucleus (a type I ULIRG) are in the transition stage from ULIRGs to quasi-stellar objects (QSOs). To inspect this issue, we compare the black hole (BH) mass, the bulge lu minosity and the far infrared luminosity among type I ULIRGs, QSOs and elliptical galaxies. As a result, we find the following results; (1) The type I ULIRGs have systematically smaller BH masses in spite of the comparable bulge luminosity relative to QSO s and elliptical galaxies. (2) The far-infrared luminosity of most type I ULIRGs is larger than the Eddington luminosity. We show that above results do not change significantly for 3 type I ULIRGs that we can estimate the visual extinction from the column density. Also, for all 8 type I ULIRGs, we investigate the effect of uncertainties of BH mass measurments and our sample bias, so that it turns out that our results do not alter even if we consider above two effects. In addition, Anabuki (2004) revealed that their X-ray properties are similar to those of the narrow line Seyfert 1 galaxies. These would indicate that active galactic nuclei (AGNs) with a high mass accretion rate exist in the type I ULIRGs. Based on all of these findings, we conclude that it would be a natural interpretation that type I ULIRGs are the early phase of BH growth, namely the missing link between ULIRGs and QSOs. Moreover, by comparing our results with a theoretical model of a co evolution scenario of a QSO BH and a galactic bulge, we show clearly that this explanation would be valid.

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The High-Velocity Outflow of PG 1211+143 May Not be That Fast

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We analyze the X-ray spectrum of the quasar PG 1211+143 observed with the CCD and grating spectrometers on board *XMM-Newton*. Using an ion by ion fitting model we find an outflow component of about 3000 $\mathrm{km\,s^{-1}}$ that includes absorption lines of K-shell and L-shell ions of the astrophysically abundant elements. We also identify and include in our model broad (FWHM $= 6000\,\mathrm{km\,s^{-1}}$) emission lines from H-like ions of C, N, O, and Ne, and He-like ions of O, Ne, and Mg. The outflow velocity we find is an alternative interpretation of the data and is in contrast with the ultra high velocity of ~ 24000 $\mathrm{km\,s^{-1}}$ reported previously for this object. Nevertheless, we can not completely rule out the presence of a high velocity component due to the poor signal-to-noise ratio of the data.

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Hybrid Morphology Radio Sources from FIRST survey

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The so-called HYbrid MOrphology Radio Sources (HYMORS) are a class of objects that appear to have a mixed Fanaroff-Riley (FR) morphology in a single object i.e. a HYMORS has an FR I-type lobe on one side of its nucleus and an FR II-type lobe on the other side. Because of this unique feature and given that the origin of the FR morphological dichotomy is still unclear, HYMORS may possibly play a crucial role in our understanding of the FR-dichotomy. The number of known HYMORS is quite small – Gopal-Krishna & Wiita (2000) established a sample of six HYMORS by means of a literature survey. With the aim to increase that number, a few areas of the sky covered by the VLA FIRST survey were inspected and based upon the morphology shown in the FIRST images a sample of 21 HYMORS candidates was selected. They were observed using the

VLA in B-conf. at 4.9 GHz. Three objects from the initial sample turned out to be actual HYMORS and two others very likely to fulfill the criteria. These five were subsequently re-observed with the VLA in A-conf. at 1.4 GHz. Our results provide strong support to the findings of Gopal-Krishna & Wiita (2000), namely that there are two different kinds of jets in HYMORS and, consequently, the existence of FR-dichotomy as a whole is difficult to reconcile with the class of explanations that posit fundamental differences in the central engine.

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Seyfert Galaxies and the Hard X-ray Background: Artificial *Chandra* Observations of $z = 0.3$ Active Galaxies

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Deep X-ray surveys have resolved much of the X-ray background radiation below 2 keV into discrete sources, but the background above 8 keV remains largely unresolved. The obscured (type 2) Active Galactic Nuclei (AGNs) that are expected to dominate the hard X-ray background have not yet been detected in sufficient numbers to account for the observed background flux. However, deep X-ray surveys have revealed large numbers of faint quiescent and starburst galaxies at moderate redshifts. In hopes of recovering the missing AGN population, it has been suggested that the defining optical spectral features of low-luminosity Seyfert nuclei at large distances may be overwhelmed by their host galaxies, causing them to appear optically quiescent in deep surveys. We test this possibility by artificially redshifting a sample of 23 nearby, well-studied active galaxies to $z = 0.3$, testing them for X-ray AGN signatures and comparing them to the objects detected in deep X-ray surveys. We find that these redshifted galaxies have properties consistent with the deep field "normal" and "optically bright, X-ray faint" (OBXF) galaxy populations, supporting the hypothesis that the numbers of AGNs in deep X-ray surveys are being underestimated, and suggesting that OBXFs should not be ruled out as candidate AGN hosts that could contribute to the hard X-ray background source population.

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preprint available at http://arxiv.org/abs/astro-ph/0509702

When less is more: Are radio galaxies below the Fanaroff-Riley break more polarized on parsec scales ?

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We present images showing the first detections of polarization on parsec scales in the nuclei of four Fanaroff-Riley type I (low-luminosity) radio galaxies. Observations with Very Long Baseline Interferometry at λ 3.6cm reveal the presence of ordered magnetic fields within $\sim$1650 Schwarzchild radii of the putative central supermassive black hole. The relatively high fractional polarization in the pc-scale jets of these galaxies is consistent with the standard scheme unifying low-luminosity radio galaxies with BL Lac objects. This result also suggests that these radio galaxies lack the obscuring tori that apparently depolarize the nuclear emission in the more powerful FRII radio galaxies, and that their supermassive blackholes are poorly fed and/or inefficient radiators.

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X-ray emission of a sample of LINER Galaxies

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We report the results from an homogeneous analysis of the X-ray (ACIS-S/Chandra) data available for a sample of 52 LINER galaxies. The X-ray morphology has been classified attending to their nuclear compactness in the hard band (4.5-8.0 keV), into 2 categories: AGN-like nuclei (with a clearly identified unresolved nuclear source) and Starburst-like nuclei (without a clear nuclear source). 60% of the total sample are classified as AGNs, with a median luminosity of L_X(2.0-10.0 keV)=2.5×10^40 erg s^{-1}, which is an order of magnitud brighter than that for SB-like nuclei. The spectral fitting allows to conclude that most of the objects need a non-negligible thermal contribution. When no spectral fitting can be performed (low signal-to-noise ratio), the Color-Color diagrams allow us to compute physical parameters such as density column, temperature of the thermal model or spectral index and therefore to analyze the origin of the X-ray emission. All X-ray morphology, spectral fitting and Color-Color diagrams allow conclude that a high percentage of LINER galaxies host AGN nuclei.

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Spatially-Resolved Narrow Line Region Kinematics in Active Galactic Nuclei

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We have analyzed *Hubble Space Telescope* spectroscopy of 24 nearby Active Galactic Nuclei (AGNs) to investigate spatially-resolved gas kinematics in the Narrow Line Region (NLR). These observations effectively isolate the nuclear line profiles on less than 100 parsec scales and are used to investigate the origin of the substantial scatter between the widths of strong NLR lines and the stellar velocity dispersion σ_* of the host galaxy, a quantity which relates with substantially less scatter to the mass of the central, supermassive black hole, and more generally characterize variations in the NLR velocity field with radius. We find that line widths measured with STIS at a range of spatial scales systematically underestimate both σ_* and the line width measured from ground-based observations, although they do have comparably large scatter to the relation between ground-based NLR line width and σ_*. There are no obvious trends in the residuals when compared with a range of host galaxy and nuclear properties. The widths and asymmetries of [OIII] $\lambda5007$ and [SII] $\lambda\lambda6716, 6731$ as a function of radius exhibit a wide range of behavior. Some of the most common phenomena are substantial width increases from the STIS to the large-scale, ground-based aperture and almost no change in line profile between the unresolved nuclear spectrum and ground-based measurements. We identify asymmetries in a surprisingly large fraction of low-ionization [SII] line profiles and several examples of substantial red asymmetries in both [OIII] and [SII]. These results underscore the complexity of the circumnuclear material that constitutes the NLR and suggests that the scatter in the NLR width and σ_* correlation can not be substantially reduced with a simple set of empirical relations.

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Thesis

Measurement of Black Hole Masses in Active Galactic Nuclei

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Ph.D dissertation directed by: Bradley M. Peterson

Ph.D degree awarded: August 2005

We investigate the calibration and application of reverberation mapping techniques for determining black hole (BH) masses in active galactic nuclei (AGNs). We present revised BH mass determinations for several AGNs based on the use of updated methodologies with archival data, demonstrating significant reductions in the sizes of the BH mass uncertainties. Moreover, the study of the Seyfert 1 galaxy, NGC 3783, shows that the gas in the broad-line region of this AGN obeys the virial theorem.

We use measurements of stellar velocity dispersions, σ_*, in AGNs and the assumption that AGNs follow the same relation between BH mass and σ_* as quiescent galaxies to provide the first empirical calibration for reverberation-based BH masses. We also attempt to determine an independent calibration of these masses by studying the reverberation-mapped AGN, NGC 4151, with ground- and space-based observations, and by trying to constrain the BH mass through modeling of the galaxy's stellar dynamics.

We estimate the BH masses and bolometric luminosities in ~ 400 AGNs selected from the multi-wavelength AGN and Galaxy Evolution Survey (AGES), where the BH masses are calculated from scaling relationships that have grown out of reverberation mapping. We find the distribution of Eddington ratios at fixed luminosity to be sharply peaked around a value of 1/3, with a dispersion of just 0.3 dex. The distribution of Eddington ratios at fixed mass looks to be similarly narrow, and we are able to confirm a drop in the underlying distribution at low Eddington ratios for certain combinations of redshift and BH mass—all previous studies in these redshift-mass bins are affected by selection effects at low Eddington ratio (as are the AGES data in lower mass or higher redshift bins). The dominance of AGN accretion at rates relatively close to the Eddington limit has important implications for the growth of BHs and the joint evolution of BHs and their host galaxies.

Jobs

PhD Opening at Landessternwarte Heidelberg, Germany

The H.E.S.S. team at Landessternwarte Heidelberg offers a post-graduate research position. Topic of research is the measurement of gamma-ray spectra from active galactic nuclei with H.E.S.S. to characterize the cosmic extragalactic background light.

The project aims at a measurement of the diffuse extragalactic background radiation field in the mid-infrared regime, using the influence of this radiation field on measured TeV gamma-ray spectra of AGN at different redshifts. Because of gamma-gamma-absorption, the measured gamma-ray spectra of TeV blazars are modified compared to their source spectra. For single sources, modelling of the unabsorbed TeV source spectra is possible, using simultaneous multi-wavelength data, especially in the X-ray domain. This allows to estimate the infrared photon field up to the given redshift of the source. The model predictions may possibly be affected by uncertainties; however, with several sources at different redshifts, the common influence of the infrared background will emerge. So far, only a handful of TeV AGN spectra have been obtained with existing instruments. With H.E.S.S. the necessary increase in sensitivity in the required energy range (100 GeV - 10 TeV) has been achieved to sufficiently increase the number of detected TeV blazar spectra.

The position carries remuneration according to the German civil service pay scale (BAT IIa/2) and will be available from November 2005 on. Candidates should have completed the equivalent of a German masters degree (Diplom) in Physics, qualifying them to gain admission to the Ph.D. programme of the University of Heidelberg. Some experience with data analysis techniques as used either in high energy gamma ray astronomy or in X-ray astronomy is advantageous but not mandatory.

The position offers the possibility to obtain a Ph.D. degree at the Landessternwarte Koenigstuhl, University of Heidelberg. Our team is involved in the "International Max-Planck Research School for Astronomy & Cosmic Physics", the special research centre (SFB) 439 (Galaxies in the early universe), the H.E.S.S. experiment, the LBT (Large Binocular Telescope) collaboration, and several European network projects.

Applications should include a short CV and the name of a person who could provide a letter of reference. The review of applications will start end of October, and will be continued until the position is filled. Material should be sent to:

Prof. Stefan Wagner or Dr. Gerd Puehlhofer

via E-mail

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or as letter to

Landessternwarte Heidelberg, Koenigstuhl 12, D-69117 Heidelberg

Further information concerning the research group can be found at
http://www.lsw.uni-heidelberg.de/projects/hess/hess.phtml

The Active Galaxies Newsletter is available on the World Wide Web. You can access it via the University of Manchester home page :- http://www.ast.man.ac.uk/∼rb/agn/
If you move or your e-mail address changes, please send the editor your new address. If the Newsletter repeatedly bounces back from an address then that address is deleted from the mailing list.