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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.

Wishing everyone a Seasons Greetings and Happy New Year.
Rob Beswick

Abstracts of recently accepted papers

The origin of optical emission from super–Eddington accreting Active Galactic Nuclei: the case of Ton S 180

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Self-gravitating accretion discs have only been studied in a few nearby objects using maser spots at the parsec-scale. We find a new spectral window for observing the self-gravitating accretion disc in super-Eddington accreting Active Galactic Nuclei (AGNs). This window is determined by calculating the outermost radius ($r_{\rm sg}$) of a non self-gravitating disc and the corresponding emission wavelength ($\lambda_{\rm sg}$) as a function of various disc parameters. We find that $\lambda_{\rm sg}$ reaches ~ 4000Å for $\alpha = 0.1$, when $\dot{M} \gtrsim 70\,(M_{\rm BH}/10^7 M_\odot)^{-1}\, L_{\rm Edd}/c^2$ (where α, $\dot{M}$, $M_{\rm BH}$ and $L_{\rm Edd}$ are, respectively, the viscosity parameter, gas accretion rate onto the central black hole (BH), the BH mass and the Eddington luminosity). Moreover, $\lambda_{\rm sg}$ is as small as ~ 1500Å for $\alpha = 0.001$, which is the smallest α case in this study. Therefore, the window for observing the self-gravitating part of an AGN accretion disc is from $\sim 2\mu$m to $\lambda_{\rm sg}$. Incidentally, $r_{\rm sg}$ can be less than the photon trapping radius for $\dot{M} \gtrsim 10^{3.3}\, L_{\rm Edd}/c^2$. Namely, a self-gravitating, optically-thick, advection-dominated accretion disc is expected to appear in the extremely high accretion rate regime.

Next, we demonstrate that the Mid-Infrared to X-ray spectrum of a bright, well-studied Narrow-Line Seyfert 1 galaxy, Ton S 180, is indeed well fitted by the spectrum arising from the following three components: an inner slim disc (with a corona), an outer, self-gravitating non-Keplerian disc and a dusty torus. The total mass, BH mass plus the entire disc mass, is found to be about $(1.4 - 8.0)M_{\rm BH}$. If the surface density varies with radius r in proportion to $r^{-0.6}$, the total mass is consistent with the central mass estimated by Hβ and [O III] widths.

Accepted for publication in Astronomy and Astrophysics

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Radio Identification of the X-ray Jet in the z=4.3 Quasar GB 1508+5714

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The recent discovery of an X-ray jet in the z=4.3 quasar GB 1508+5714 by Yuan et al. (astro-ph/0309318) and Siemiginowska et al. (astro-ph/0310241) prompted a search for its radio counterpart. Here, we report the successful discovery of faint radio emission from the jet at 1.4 GHz using archival VLA data. The X-ray emission is best interpreted as inverse Compton (IC) emission off the CMB as discussed by the previous investigators. In this scenario, its high X-ray to radio monochromatic luminosity ratio, compared to previously detected IC/CMB X-ray jets at lower redshift, is a natural consequence of its high redshift.

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E-mail contact: ccheung@brandeis.edu, preprint available at http://arXiv.org/abs/astro-ph/0310733

Dramatic X-ray Spectral Variability of the Broad Absorption Line Quasar PG 2112+059

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With a 1999 *ASCA* observation, PG 2112+059 became notable as the first Broad Absorption Line (BAL) quasar found to exhibit a typical radio-quiet quasar X-ray continuum underlying a large amount of intrinsic absorption. We present a recent *Chandra* ACIS-S3 observation of PG 2112+059 that demonstrates remarkable spectral and luminosity variability since that time. In addition to a decrease in the continuum normalization by a factor of ~ 3.5, the absorption column density has apparently increased substantially, and a strong feature in the Fe Kα region has appeared. Concurrent *HST* STIS data compared with archival *HST* data from earlier epochs show evidence for variability of the continuum (up to a factor of ~ 1.7 in the ultraviolet), and in some absorption features of the C IVλ1549 BAL since 1992; however, the O VI BAL structure is consistent with a 1995 observation. We also present evidence for Lyβ–O VIλ1037.62 and Lyα–N Vλ1242.80 line-locked absorption systems, supporting the assumption that ultraviolet line pressure is driving the BAL outflow. Whereas ultraviolet BALs typically exhibit only modest equivalent-width variability over timescales of years, the dramatic X-ray variability of PG 2112+059 suggests that X-ray spectral variability studies of BAL quasars have great potential for probing the physics of quasar winds.

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E-mail contact: sgall@astro.ucla.edu, preprint available at http://xxx.lanl.gov/abs/astro-ph/0311401

Spin orientation of supermassive black holes in active galaxies

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Accretion of gas onto a central supermassive black hole is generally accepted to be the source of the emitted energy in active galactic nuclei. The broad emission lines we observe in their optical spectra are probably formed in the wind of an accretion disk at distances of light days to light years from the central black hole. The variable fraction of the emission lines originates at typical distances of only 1 to 50 light days from the central supermassive black hole. We derived a central black hole mass of $M_{\mathrm{orbital}} = 1.8 \pm 0.4 \times 10^7 M_\odot$ in the Seyfert galaxy Mrk 110 assuming the broad emission lines are generated in gas clouds orbiting within an accretion disk. This figure depends on the inclination angle of the accretion disk. Here we report on the detection of gravitational redshifted emission in the variable fraction of the broad emission lines. We derive a central black hole mass of $M_{\mathrm{grav}} = 14.0 \pm 3.0 \times 10^7 M_\odot$. These measurements are independent on the orientation of the accretion disk. The comparison of both black hole mass estimates allows to determine the projection of the central accretion disk angle i to 21 ± 5 deg. in Mrk 110 and therefore the orientation of the spin axis of the central black hole.

In press in A&A Letters
E-mail contact: wkollat@uni-sw.gwdg.de, preprint available at astro-ph/0311283

The Effects of Low-Temperature Dielectronic Recombination on the Relative Populations of the Fe M-Shell States

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We examine the effects of low-temperature, or $\Delta n = 0$, dielectronic recombination (DR) on the ionization balance of the Fe M-Shell (Fe IX through Fe XVI). Since $\Delta n = 0$ rates are not available for these ions, we have derived estimates based on the existing rates for the first four ionization states of the CNO sequence and newly calculated rates for L-shell ions of 3rd row elements and Fe. For a range of ionization parameter and column density applicable to the intrinsic absorbers detected in *ASCA*, *Chandra*, and *XMM-Newton* observations of Seyfert galaxies, we generated two grids of photoionization models, with and without DR. The results show that the ionization parameter at which the population of an Fe M-shell ion peaks can increase in some cases by factor > 2 when these rates are included. More importantly, there are dramatic changes in the range in ionization parameter over which individual M-shell ions contain significant fractions of the total Fe (e.g. $> 10\%$) in the plasma. These results may explain the mismatch between the range of Fe ionization states detected in the X-ray spectra of Seyferts, identified by the energies of the M-Shell Unresolved Transition Array, and those predicted by photoionization models of the X-ray absorbers that reproduce lines of second and third row elements. The results suggest that care should be taken in using 3rd and 4th row ions to constrain the physical conditions in photoionized X-ray plasmas until accurate DR rates are available. This underscores the importance of atomic physics in interpreting astronomical spectroscopy.

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The Spectral Energy Distribution and Emission-Line properties of the NLS1 Galaxy Arakelian 564

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We present the intrinsic spectral energy distribution (SED) of the Narrow-Line Seyfert 1 galaxy (NLS1) Arakelian 564, constructed with contemporaneous data obtained during a multi-wavelength, multi-satellite observing campaign in 2000 and 2001. We compare this SED with that of the NLS1 Ton S180 and with those obtained for Broad-Line Seyfert 1s to infer how the relative accretion rates vary among the Seyfert 1 population. Although the peak of the SED is not well constrained, in our parameterization most of the energy of this object is emitted in the 10–100 eV regime, constituting roughly half of the emitted energy in the optical/X-ray ranges. This is consistent with a primary spectral component peaking in the extreme UV/soft X-ray band, and with disk–corona models, hence high accretion rates. Indeed, we estimate that $\dot{m} \approx 1$.

We also address the issue of the energy budget in this source by examining the emission lines observed in its spectrum, and we constrain the physical properties of the line-emitting gas through photoionization modeling. The available data suggest that the line-emitting gas is characterized by $\log n \approx 11$ and $\log U \approx 0$, and is stratified around $\log U \approx 0$. Our estimate of the radius of the Hβ-emitting region $R_{\rm BLR}^{\rm H\beta} \approx 10 \pm 2$ lt-days is consistent with the $R_{\rm BLR}^{\rm H\beta}$–luminosity relationships found for Sy1 galaxies, which indicates that the narrowness of the emission lines in this NLS1 is not due to the Broad-Line Region being relatively further away from the central mass than in BLS1s of comparable luminosity. We also find evidence for super-solar metallicity in this NLS1. We show that the emission lines are not good diagnostics for the underlying SEDs and that the absorption line studies offer a far more powerful tool to determine the ionizing continuum of AGNs, especially if comparing the lower- and higher-ionization lines.

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preprint available at http://it.arXiv.org/abs/astro-ph/0311206

A bias in optical observations of high redshift luminous infrared galaxies

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We present evidence for the dramatically different morphology between the rest frame UV and 7μm mid-IR emission of VV 114 and Arp 299, two nearby (z$\sim$0) violently interacting infrared luminous galaxies (LIRGs). Nearly all LIRGs are interacting systems and it is currently accepted that they dominate the IR emission at z>1. Luminous IR galaxies located at z=1–2 could easily be detected as unresolved sources in deep optical/near-IR ground based surveys, as well as in upcoming 24μm surveys with the Space Infrared Telescope Facility. We demonstrate that the spatial resolution of these surveys will result in blending of the emission from unresolved interacting components. An increased scatter will thus be introduced in the observed optical to mid-IR colors of these galaxies, leading to a systematic underestimation of their dust content.

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preprint available at http://arxiv.org/abs/astro-ph/0311632

Dust enshrouded star-forming activity in Arp 299

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We present mid-infrared spectro-imaging ($5 - 16\,\mu$m) observations of the infrared luminous interacting system Arp 299 (= Mrk 171 = IC 694+NGC 3690) obtained with the ISOCAM instrument aboard ISO. Our observations show that nearly 40 % of the total emission at 7 and 15 μm is diffuse, originating from the interacting disks of the galaxies. Moreover, they indicate the presence of large amounts of hot dust in the main infrared sources of the system and large extinctions toward the nuclei. While the observed spectra have an overall similar shape, mainly composed of Unidentified Infrared Bands (UIB) in the short wavelength domain, a strong continuum at $\sim 13\,\mu$m and a deep silicate absorption band at $10\,\mu$m, their differences reveal the varying physical conditions of each component. For each source, the spectral energy distribution (SED) can be reproduced by a linear combination of a UIB "canonical" spectral template and a hot dust continuum due to a $230 - 300\,$K black body, after independently applying an extinction correction to both of them. We find that the UIB extinction does not vary much throughout the system ($A_V > 5\,$mag) suggesting that most UIBs originate from less enshrouded regions. IC 694 appears to dominate the infrared emission of the system and our observations support the interpretation of a deeply embedded nuclear starburst located behind an absorption of about 40 magnitudes. The central region of NGC 3690 displays a hard radiation field characterized by a [NeIII]/[NeII] ratio ≥ 1.8. It also hosts a strong continuum from 5 to $16\,\mu$m which can be explained as thermal emission from a deeply embedded ($A_V \sim 60\,$mag) compact source, consistent with the mid-infrared signature of an active galactic nucleus (AGN), and in agreement with recent X-ray findings.

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Rest-frame optical continua of $L \sim L^*$, $z > 3$ quasars: probing the faint end of the high z quasar luminosity function

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Near-IR photometry for 20 radio-loud $z > 3$ quasars, 16 of which are radio-selected, are presented. These data sample the rest-frame optical/UV continuum, which is commonly interpreted as emission from an accretion disk. In a previous study, we compared the rest-frame optical/UV continuum shapes of 15 optically bright (V< 17.5) $z > 3$ quasars with those of 27 low redshift ($z \sim 0.1$) ones that were matched to the high redshift sample in *evolved* luminosity (i.e. having luminosities ranging from 1-7 times the characteristic luminosity, L^*, where $L^* \sim (1+z)^{\sim 3}$) to look for signs of evolution in the central engines. We found the continuum shapes at $z \sim 0.1$ and $z > 3$ similar, consistent with no significant change in the ratio $\dot{m}$/M, where $\dot{m}$ is the accretion rate with respect to the Eddington rate and M is the black hole mass. This study expands our earlier high redshift sample to lower luminosity, away from extreme objects and towards a luminosity overlap with lower redshift samples. The distribution of rest-frame optical/UV continuum shapes for this fainter sample is broader, extending further to the red than that of the brighter $z > 3$ one. Three quasars from this fainter sample, two radio-selected and one optically-selected, have optical continuum slopes $\alpha < -1$ ($F_\nu \sim \nu^\alpha$). The optically-selected one, LBQS0056+0125, appears to be reddened by dust along the line of sight or in the host galaxy, whereas the radio-selected ones, PKS2215+02 and TXS2358+189, could derive their red continua from the contribution of a relatively strong synchrotron component to the rest-frame optical. These objects may represent a bridge to a population of very red high redshift quasars to which ongoing or future near-IR, optical and deep X-ray surveys will be sensitive.

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preprint available at http://cul.arxiv.org/abs/astro-ph/0311239

Jobs

Postdoctoral Fellowship - AGN Jet Physics

Joint Center for Astrophysics, University of Maryland, Baltimore County, USA
Application deadline: December 31, 2003

The Joint Center for Astrophysics at the University of Maryland, Baltimore County, invites applications for a Postdoctoral Fellow position beginning in 2004. The successful applicant will work with Dr. Eric Perlman and collaborators on multi-waveband observations of AGN jets. Research work will include the reduction of data from the HST, Chandra, and the VLA, modeling of jet physics, as well as preparation of observing proposals and the implementation of observing programs.

The candidate should have experience with X-ray, optical and/or astronomical data analysis methods and analysis packages (e.g.,IRAF/PyRAF, FTOOLS, CIAO, XSPEC, AIPS), and should be proficient in scientific programming. The position requires a Ph.D. in Astronomy, Physics or a closely related field. The initial appointment will be for one year, with renewal for up to two more years possible subject to funding.

For full consideration completed applications should be received before **December 31, 2003**, although applications will be reviewed until the position is filled. Applicants should submit their CV, bibliography, statement of research interests, and the names and contact information for three references to:

Joint Center for Astrophysics
Physics Department
University of Maryland, Baltimore County
1000 Hilltop Circle
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Inquiries should be addressed to Dr. Eric Perlman at perlman@jca.umbc.edu or 410-455-1982. Information about the Joint Center for Astrophysics, a collaboration between UMBC and NASA's Goddard Space Flight Center, can be found at http://jca.umbc.edu. UMBC is an AA/EOE.

Note from editor:

Considering the closing date for this post, this advert will be run in the October, November & December issues of the newsletter (RJB).

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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.